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JRC SCIENCE FOR POLICY REPORT

2035

Paths towards a sustainable EU economy

Sustainable transitions and the potential of eco-innovation for jobs and economic development in EU eco-industries 2035

Foresight Series

Laurent Bontoux
Daniel Bengtsson

2015

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page 11, © Doug Ellis, *Eco Programs and Sustainability at Esalen*, 2012. Source: Dharma Communications

Abstract
In view of the many current unsustainable resources use and environmental degradation trends, ensuring future success requires reducing the negative emissions and environmental impacts of economic activities, decreasing resources use to get back into the range of natural sustainability while creating new opportunities for people to make a decent living. This foresight study aimed at developing long-term visions for eco-industries (Horizon 2035), identifying relevant trends and drivers, highlighting implications for EU policies and describing realistic and desirable possible futures. A systemic approach to eco-industries was taken by defining them as a stream of business activities across and within the entire industrial segment of society encompassing "Green industries" (environmental industries), "Industries greening"(other industries adopting eco-innovations) and "Eco-innovative solution providers" (R&D, new business models, organisational/social innovation, integrators). The study followed a classic foresight approach to develop four scenarios (Multiple Connected Initiatives, Shared Circular Strategies, Compact Green Innovation and Local Self-Reliance). For each scenario, an imaginary eco-industries landscape was built allowing for a systemic understanding of the alternative worlds and for the identification of four sets of policy recommendations to promote sustainability. The scenarios were constructed around societal values (varying between individualistic and collaborative) and the fiscal framework (varying between traditional and strongly supporting sustainability. They took into account a set of likely megatrends: world population reaching 8.6 billion, a global consuming class having increased by 4 billion people, the first generation of "digital natives" in power, global warming having already reached 2°C (with the accompanying consequences) and increasing urbanisation. All this would happen in a context of continuing technological development (ICT, biotechnologies, materials, mobile technologies, sensors…) that will lead to a hyper-connected world. In order to help communicate the scenarios, four characters (Clement, Sophia, Leo and Leila) were created. They were given life in four narratives corresponding to the four scenarios. Each character is most successful in a different scenario. The robust intellectual framework created by these four scenarios has proven its worth as a platform to engage in systemic reflections with a very wide range of people. To reach an even wider range of stakeholders and improve usefulness for policy making a serious game, the JRC Scenario Exploration System, was developed.

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PREFACE

This foresight study was carried out on the request of Dominique Ristori, Director-General of the JRC at that time. While the original request focused on the traditional environmental industries, it soon became obvious that the field needed a more systemic approach which took some time to design. Clearly, the issue was about understanding what possible transitions the EU could take towards a more sustainable future, while avoiding the danger of embarking on an exercise to reinvent the world. We had to be pragmatic in order to be able to provide meaningful advice for EU policy-making.

Next came the double challenge of identifying suitable participants and convincing enough of them to take part in such an unconventional exercise. The context must have been appropriate and the subject timely since almost half of those contacted (several with demanding responsibilities) made themselves available to embark on the 'adventure'.

After the first workshop, there was a certain suspense about who would come back and spend two days with us four more times (!) to bring the study to a fitting conclusion. As it turned out, most did, and for the whole adventure! While all the participants were very familiar with sustainable development, the most consistent feedback received after each workshop was that they felt that they were learning – learning about something that currently does not exist: the future! This shows just how extraordinary and potentially useful a foresight process can be for shedding light on strategic or policy decisions. Our one regret is that we were not able to count high-level EU policy-makers in our ranks, even though Judith Merkies, a Member of the European Parliament, addressed the last workshop.

We hope that this report will be perceived by all those who participated as a faithful rendition of the work performed and that it can help those interested in the future of the EU to broaden their horizons.

In conclusion, I would like to thank very warmly all those who were part of the study and all the extraordinary people who came to explain new trends, views and business models to inspire, illustrate and give a reality check to our scenarios.

L. BONTOUX
July 2015

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1. ACKNOWLEDGEMENTS

The authors would like to thank the various external and European Commission experts who dedicated their time and effort to this venture. Without them, this study would not have been possible (please see the full list in Annex 2).

Nick Payne, who helped us with the narratives, visualisation and animation during the fourth workshop, as well as graphic support during the last workshop, deserves a special thank you. He helped us bring the scenarios to life and stimulate the experts' imagination.

The authors also wish to acknowledge and thank the JRC staff who provided very valuable support at key moments of the study. Johanna Trieb, Tine van Criekinge and Vincent Viaud demonstrated their creative talent when it came to writing the narratives. Along with Elisa Boelman, Peter Churchill, Peter de Smedt, Ioana Profir, Helena Ruiz Fabra and Fabiana Scapolo, they were also essential for the running of successful workshops and helped us harvest the many rich discussions we held with the experts.

Pictures 1 to 12 are illustrations by Nick Payne, graphic facilitator, Brussels (Belgium). They were used to animate the fourth and fifth workshops.

2. KEY ISSUES RAISED BY THE STUDY

The five study workshops created numerous opportunities for the experts to share experiences, discuss and brainstorm from multiple perspectives. Along the way, a number of key ideas emerged from the discussions:

Societal values are essential drivers of change

- The discussions quickly identified societal values as key elements to be taken into account in any discussions about the future. Today, the collaborative or individualistic nature of European societies differs across regions and sometimes overlaps, although this may change – education and framework conditions can make them evolve.

Green taxation can be a potent driver

- As demonstrated by the choice of the experts to use the fiscal framework as one of the two dimensions for constructing the scenario logic, shifting to green taxation is also a very powerful way to accelerate the transition to a sustainable economy, whatever the starting point. Such a shift would have a systemic impact, facilitating the introduction of new business models and having a potentially very favourable impact on employment in Europe, including for those most vulnerable.

Policy matters

- Regulatory (un)certainty and the focus of policy initiatives can be game changers; clear and steady policy directions can play a very important role in managing change and steering the evolution of society and the economy.

A changing world requires new forms of governance

- Current forms of governance were developed under circumstances prevalent decades ago. The rapid pace of societal and economic change coupled with very fast technological change requires an adaptation in governance models. The introduction of new, service-based business models also requires new types of governance. In many cases, leadership seems to have the potential to speed up transition. As older generations retire, the arrival of millennials in decision-making positions, with their internet-based habits, is also likely to usher important changes in modes of governance.

New metrics are needed

- Measuring growth in consumption, observing economic activity and monitoring financial indicators are no longer enough when managing a sustainable economy. Information is also needed on environmental and social aspects. This requires businesses to develop integrated reporting (i.e. more than financial accounts) and to develop an integrated view of life cycles (of products, of business units, etc.) and value chains.

We need new financial models and new ways to invest

- For a sustainable transition to be successful, investments and financial rewards must be coherent with the whole range of new metrics required by a sustainable economy. Externalities must be internalised.

Education is essential

- Education lies at the root of societal values, environmental awareness, innovative capacity and other fundamental factors shaping the future of society.

3. EXECUTIVE SUMMARY

Objective

The overall objective of this foresight study was to:
- Develop mid- to long-term visions for eco-industries (Horizon 2035);
- Identify relevant trends and drivers;
- Highlight the implications for EU policies and research;
- Describe realistic and desirable possible futures.

Scope

The study takes a systemic approach to eco-industries by **looking at those whose business objectives contribute to achieving greater sustainability and resource efficiency in the economy** – the enablers.

The definition and scope of this foresight study implies that the term 'eco-industries' does not refer to a specific group of industry sectors that are clearly identifiable but rather to a stream of business activities across and within the entire industrial segment of society, encompassing:
- **'Green industries'** – environmental industries;
- '**Industries greening**' – other industries adopting eco-innovations;
- '**Eco-innovative solution providers**' – R&D, new business models, organisational/social innovation, integrators.

Process

The study followed a classic foresight approach to scenario development based on an expert panel. Four scenarios and their corresponding narratives were developed. For each, an imaginary eco-industries landscape was created allowing for a systemic understanding of the alternative worlds to emerge. On that basis, and assuming that it would be desirable to push each scenario towards becoming even more sustainable, four sets of policy issues were identified.

Scenarios

The study built four scenarios for 2035 around two key drivers: societal values and the fiscal framework. Across the scenarios, the societal values vary between individualistic and collaborative, and the fiscal framework between being traditional or highly supportive of sustainability.

Initially, a set of key drivers and megatrends that will affect all scenarios was analysed. By 2035, the population of the world will probably reach 8.6 billion, with a stable ageing population in Europe but strong growth in Africa and parts of Asia. As the situation in emerging economies will also continue to improve, the global consuming class is expected to increase by 4 billion people, resulting in a strong demand for raw materials and energy. The first generation of "digital natives", with its new approach to social contacts and mastery of digital technologies, will be in power. Global warming could very well reach 2 °C, with the accompanying rise in sea level and damage to agriculture and infrastructures. Urbanisation will also continue unabated, leading to mega cities in the developing world and to more mid-sized cities in Europe. All this will happen in the context of continuing technological development (ICT, biotechnologies, materials, mobile technologies, sensors, etc.) that will lead to a hyperconnected world.

Scenario 1 (*Multiple Connected Initiatives*) depicts a rather flat and networked society. European society has shifted from competitive to more collaborative values. Informed and empowered citizens self-organise through globally connected local initiatives. Social networks play a key role in supporting direct democracy. The sense of collective identity extends to the global village, but co-operation within Europe remains predominant for addressing societal challenges. Disenchanted by centralised policy institutions and strongly connected by social media, a vibrant, informed and empowered civil society takes the lead in addressing societal, economic and environmental challenges. In this context, local authorities and Euro-regions raise their profile versus higher levels of government. They accompany this societal movement because they are often the first port of call for people engaged in initiatives to improve things they are confronted with locally. They provide platforms for people who want to collaborate but do not know how to. As a result, they start to engage through innovative policy-making and new funding mechanisms. Local authorities also make bridges between groups who are either not communicating or are in competition or disagreement.

Scenario 2 (*Shared Circular Strategies*) describes a world in which a strong collaborative ethos has emerged as a consequence of traumas created by catastrophic climate change. Society wants to survive. Solidarity mechanisms are strong and preoccupation with sustainability has generated a lot of social innovation that, in turn, has transformed European societies radically. In this top-down world, public authorities invest in large infrastructure projects for sustainable development. Integration of systems across society and the economy has made Europe very resource efficient. Industrial symbioses are the norm. Here, the local level is not so much a source of initiatives but more a level of implementation for grand, EU-wide plans. However, the overarching objectives are adapted to local specificities to fit well in the diverse European local contexts.

Scenario 3 (*Compact Green Innovation*) is mostly characterised by individualism, frugality, and technological development. It is driven by the market. Mechanisms of social solidarity weaken. As creative and dynamic hubs, European cities are at the heart of new societal trends. However, they follow sometimes diverse development paths. Many become the focal point of the regions surrounding them regardless of national borders. Diverse geo-climatic conditions, historical legacies and visions implemented by their managers create very different local dynamics. Some cities manage to create successful sustainable paths for development and are very attractive, whereas others fail to overcome adverse conditions and decline. The affluent manage to move to more successful cities, reinforcing negative trends in real estate prices in declining cities and price rises in the successful ones. This creates issues of social equity in a context in which centralised modes of governance become weaker.

Scenario 4 (*Local Self-Reliance*) describes an individualistic world in which governance at EU and national levels is weak and powerful interest groups have created niches of influence. This gives more room to local levels of government. As average income levels have fallen, social protection systems have been eroded and the middle class has shrunk. Under external pressures, macroeconomic governance has become more integrated at EU level. The erosion of social protection systems also chipped away at citizens' respect for the 'State'. People consider that they have to rely on themselves more, with the result that they feel they need government less. Inequalities increase and powerful ICT platforms make direct democracy (and self-help) increasingly attractive, keeping governments in check but giving a greater role to the levels of government that are perceived to be closer, such as city and regional authorities. These have their hands full with managing disputes between self-centred citizens who want to have it all their own way. Many people may have a global outlook on the state of the environment but they care more about their own well-being and their own immediate environment than their country, Europe or people further afield. It is a 'live and let live', pragmatic and flexible society in which private interests dominate.

Narratives

To help communicate the scenarios to a broad public, four characters (Clement, Sophia, Leo and Leila) were created in order to make each one most successful in a different scenario. These characters were then brought to life in four narratives corresponding to the four scenarios (see the introduction in the text box).

Back in the 1980s …

SOPHIA

… we were just kids. Clement lived in the terraced house over on Chestnut Street, Leonardo in the red-brick house near the park, and I was the girl from the apartment complex on the east side. Leila lived really far out but we were all in school together. Those were the days when we were learning and taking our first steps towards trying to make sense of the world.

Seen from today, the '80s were an exciting time. Industrialised countries' stock markets were setting new records. Acid rain and the ozone hole could be solved. Voices were talking of the emergence of China, and poor countries were still poor. Eastern Europe and the Middle East were unstable but little did we know how things would change! The fall of the Berlin Wall and the UN's creation of the IPCC in 1989 ushered in a new era.

The 1990s, our teenage years, started to bring out our true characters. This was obvious in the environmental science project during our last year of high school. Clement loved working with people and bringing them together! He pushed to elect a class committee to organise the collection of waste and old clothes from home. Paper, glass and metals could be recycled. Usable wood and plastic would be used to create art pieces and jewellery for our school art exhibition. We also repaired things and there was a prize for the most creative use of waste.

Leo's interests focused on technology. He invented an irrigation system for a school rooftop greenhouse built from waste. Food waste was composted for fertiliser. His system really mobilised teachers and parents. He also tried to build a clothes-recycling machine! I am sure Tekno, our science teacher, still remembers … his favourite jacket didn't survive!

Leila had an eye for business and luxury. To make some profit, she proposed that each month one class should sell leftover food from lunch at the school sports competitions. She sold sorted, used metal and glass to local recyclers. She also organised sales at the school art exhibition! Leila wanted to use the money for a cool class trip. Her concept was very "we did the work, we should benefit" … typical!

I wanted to tackle the problem from the core: reduce our consumption. Thanks to my image of 'best in class', the director trusted me with data on how much office and food supplies our school consumed. I implemented a new weekly calendar system where students filled out their lunch requests: we succeeded while giving the students a say. I loved the responsibility!

It was clear that we were taking different paths. The next millennia started with the burst of the dotcom bubble and the launch of the euro, followed in 2004 with a big bang EU enlargement. By that time, two of us had finished university and the other two had started professional life. Then came 2008 … financial crisis, credit crunch, bank bailouts … It was obvious that our school days were well and truly over.

SOPHIA
March 2015

Using the scenarios

The intellectual framework created by these four visions of alternative worlds has proved to be very robust during many discussions related to a wide range of topics. It has also proven its worth as a platform to engage in systemic reflections. To enable a wide audience to take advantage of this intellectual framework, a serious game called the JRC *Scenario Exploration System* was developed for two main purposes:

- **A general exploration of the scenarios**: this version is best played to create communication channels between stakeholders who would either not easily come into contact or pursue apparently diverging agendas, or to enlarge the mental horizon of the players, i.e. introduce them to systemic elements that challenge their usual frame of thinking;
- **The systemic exploration of a particular issue within alternative scenarios**: this can enrich strategic reflections or help future-proof the work on the issue in question.

The scenarios can also be used in strategic interactive workshops to go deeper in discussions on future sustainable development or to explore the possible future outlook of specific issues in a systemic fashion.

4. INTRODUCTION | A NEW ECONOMIC PARADIGM

The successful societies of the future will be built on economic, social and environmental sustainability. In view of the many current unsustainable uses of resources and trends in environmental degradation, ensuring future success requires reducing the negative environmental impacts of economic activities, decreasing greenhouse gas (GHG) and other emissions in a cost-effective way, decreasing the use of resources to get back within the range of sustainability (e.g. by using resources more intelligently) while creating new opportunities for people to make a decent living. New technologies, novel business models and new societal arrangements are likely to be paramount in making this evolution a success.

4.1 TOWARDS A SUSTAINABLE ECONOMY

The consumption-based economic model has been extraordinarily successful in delivering human prosperity and welfare to Western economies throughout the 20th century. In the last two decades, the success of emerging economies in emulating this development model has led to a sharp increase in the size of the global middle class with a high level of consumption. While this has brought about enormous economic and social benefits in developing countries, the scale of this consumption is such that global anthropogenic climate change is already having serious consequences and we are reaching the physical limits in the availability of natural resources. This trend has been reinforced by the strong growth of the world population over the last few decades, which the UN predicts will reach 8.2 billion by 2025 and 9 billion by 2050, compared to 7 billion today. This means that the current consumption-based model of economic development is no longer sustainable and must be adapted. Fortunately, we are (re-)discovering that well-being can be obtained from material 'use' (e.g. renting a drill or paying for lighting services) rather than material 'consumption' (e.g. buying a cheap drill to be used a few times and then discarded).

Many businesses have already woken up to the challenge and recognise the opportunities that more resource-efficient and low-carbon business models can bring. World-class environmental industries bring a significant contribution to both the EU environment and economy. In addition, businesses in the US, Japan and emerging economies in Asia are investing heavily and increasing their market shares in some key environmental technologies.

At the same time, there is growing awareness that ultimately it is the entire economy and society as a whole that must be "greened"[1]. Efforts both great and small are being made across the EU Member States, regions and cities to promote more sustainable practices.

[1] http://www.eea.europa.eu/articles/greening-the-entire-economy-not

Today, largely thanks to its policies and regulatory framework, the EU has started to decouple GDP growth from the consumption of natural resources. As made clear in several past policy documents[2] and current initiatives[3], the EU recognises the need for a long-term policy framework. As explained in its Sustainable Development Strategy, for the European Union: "Sustainable development means that the needs of the present generation should be met without compromising the ability of future generations to meet their own needs. It is an overarching objective of the European Union. […] It promotes a dynamic economy with full employment and a high level of education, health protection, social and territorial cohesion and environmental protection in a peaceful and secure world, respecting cultural diversity"[4].

At the same time, the EU aims to unleash the job creation potential of the green economy and other promising areas such as ICT and health. A long-term framework based on a shared vision can bring greater coherence to existing work and galvanise the research and innovation needed to engineer the transition to a low-carbon, resource-efficient economy. In view of the global scale of the sustainability challenges, the EU is particularly well placed to give policy the required long-term dimension.

This foresight study has been carried out at a time when radical shifts are already taking place. Long-established patterns (e.g. in climate, trade, etc.) are being disrupted and the relative economic and geopolitical position of all the major regions in the world is being transformed largely due to the rise of the so-called emerging economies.

At the same time, the financial crisis has created major constraints on investment in the EU and elsewhere. The State of the Environment Report 2015 (http://www.eea.europa.eu/soer) recently released by the European Environmental Agency, bears witness to the megatrends at the root of many of these shifts.

4.2 WHY A FORESIGHT STUDY?

Future-oriented thinking is vital for any forward planning or policy activity to be able to meet future challenges proactively. Foresight enhances such thinking by gathering anticipatory intelligence from a wide range of knowledge sources in a systematic way and linking it to today's decision-making. Foresight does not aim to predict the future, but rather it invites consideration of the future as something that can be created or shaped.

Foresight supports actors and stakeholders in actively shaping the future. Foresight methods (i.e. vision building, scenario building, Delphi, etc.) are used to structure the debate on possible futures to ensure the emergence of collective intelligence from all relevant stakeholders and experts. In addition, foresight methods help thinking beyond established pathways.

4.3 OBJECTIVES

The overall objective of this foresight study is to develop **2035 visions for paths towards a sustainable EU economy** by addressing the question: "How can eco-industries (and other parts of the economy) best contribute to meeting the EU's sustainability, resource efficiency, growth and jobs objectives?"

The study takes a systemic approach to the economic system by **looking at drivers of greater sustainability and resource efficiency that could enable a sustainable transition of industries as a whole.** Particular attention is paid to eco-industries for making the transition to a sustainable economy possible. The study addresses a number of themes that cut across all eco-industries: **resource efficiency**, the **integrating, networking and infrastructure effect of eco-industries**, and **demand and behaviour**. Furthermore, underlying dimensions, such as **technology, regulation, research and eco-innovation**, are addressed throughout the analysis.

By identifying key drivers of change, trends and opportunities, and developing possible scenarios linked to eco-industries, the study generated **recommendations for EU policies and research to establish the vision that policy-makers will choose for setting the EU economy on a path towards sustainable development.**

"Any useful idea about the future should appear to be ridiculous."

Prof. Jim Dator | Director, Hawaii Research Center for Futures Studies

[2] 2006 Renewed EU Sustainable Development Strategy, Europe 2020, Horizon 2020, EC Work Programme 2013, EU Energy Roadmap 2050, Resource Efficiency Roadmap

[3] Communications on resource efficiency, sustainable food, sustainable buildings, the circular economy, etc.

[4] 2006 Renewed EU Sustainable Development Strategy

5. METHODOLOGY

5.1 STUDY PLANNING

This foresight study started in the autumn of 2012 with a concept paper developed by the Joint Research Centre (See Annex 1).

Following that paper, a Steering Committee was set up (see Annex 2) with a three-fold mandate:

- To provide input on the concept paper, on the scope of the exercise and on the proposed approach;
- To help identify the need for expertise and experts to participate in the study; and
- To monitor progress of the study and provide guidance.

Subsequently, a number of experts were recruited to participate in the study (see Annex 2). They represented a wide range of stakeholders, such as industry, academia, the European Commission, NGOs, the world of consultancy, the Chinese Academy of Sciences, the financial sector, etc. This group of experts was called upon to participate in five scenario-building workshops, all of which were held in Brussels, Belgium.

A steering committee meeting was held before each workshop, and in-between each workshop, the JRC team both advanced on the outcome from the previous workshop, and prepared the content, structure and logic for the next one.

Table 1 presents the time line of the study.

STEP	DATES				
CONCEPT PAPER	Autumn 2012				
STEERING COMMITTEE MEETINGS	30/01/2013	11/06/2013	05/09/2013	03/12/2013	11/02/2014
EXPERT WORKSHOPS	7-18/04/2013	24-25/06/2013	8-19/09/2013	10-11/12/2013	19-20/03/2014
FINAL REPORT	October 2014				
DISSEMINATION	Autumn 2014 - Spring 2015				

Table 1: *Time line of the foresight study*

5.2 METHOD AND PROCESS

5.2.1 OVERALL METHODOLOGY

This foresight study followed a classic scenario-building methodology[5], using a mix of different foresight techniques that were:

- Participatory and creative;
- Multidisciplinary, based on the principle that current problems cannot be well understood if reduced to one dimension only;
- Geared at generating systemic understanding;
- Aimed at generating insights on the dynamics of change, future challenges and options.

5.2.2 FIRST WORKSHOP: 'FRAMING THE SYSTEM, IDENTIFYING DRIVERS'

This workshop had the following objectives:

1. Define the eco-industries system in the context of the overall industrial landscape;
2. Identify what agents of change will affect the eco-industries system between now and 2035.

As the participants in the study did not know each other, the first session focused on getting to know each other and on initiating a group feeling. The group was then asked to define the system to study ('eco-industries') in brainstorming

[5] http://forlearn.jrc.ec.europa.eu/guide/4_methodology/meth_scenario.htm

sessions alternating with plenary discussions and work in sub- groups. It quickly became clear that a narrow view of eco-industries would not allow for the development of a systemic reflection. Thus, eco-industries were considered as including all socio-economic activities that enable the transition to a green economy. Section 6.2.1 presents a more detailed account of the definition of eco-industries.

Another brainstorming in groups was then organised to understand what drivers, or agents of change, would impact these eco-industries. The STEEP (Society, Technology, Environment, Economy, Policy) approach, introduced using the Industrial Landscape Vision 2025 model created by the JRC foresight study on industrial standards, was used to develop this list of agents of change. The workshop concluded with a first vote to identify the drivers of change that were considered both most important *and* most uncertain. As most experts were not familiar with foresight exercises, this workshop was the first attempt to make the experts aware of the methodology which would be followed.

At the end of this workshop, clarifications were still needed regarding the concept of eco-industries. In addition, the first brainstorming on agents of change generated a range of items that was quite comprehensive but lacked coherence and consistency.

5.2.3 SECOND WORKSHOP: 'UNDERSTANDING IMPACTS, SELECTING SCENARIOS'

This workshop had the following objectives:

1. Finalise reflections on the system to be studied;
2. Determine the scenario logic

To address the points previously left open, this workshop opened with a new plenary discussion on the definition of eco-industries – and rapidly reached a conclusion. If we consider that this study is about charting possible paths towards a 'green economy', then eco-industries can be considered as the socio-economic activities making this transition possible. The UNEP definition of a green economy is:

"One that results in improved human well-being and social equity, while significantly reducing environmental risks and ecological scarcities."

In preparation for this workshop, the study team consolidated and harmonised the draft list of drivers of change that had been generated at the first workshop. This was used as the starting point of the process to identify a scenario logic. A new brainstorming and plenary discussion led to a revised list of drivers of change that appeared to the experts to be both comprehensive and coherent.

This list was then put to a new vote during which the experts initially identified the most important drivers. The most uncertain ones were then selected from among the top-ranking drivers.

In the ensuing plenary discussion, the group of experts reached the conclusion that *fiscal framework (high/low support of sustainability)* would form one axis of the scenario matrix, while *societal values (individualistic/collaborative)* would form the other (see section 5). Following that workshop, the JRC study team developed their first draft scenarios.

5.2.4 THIRD WORKSHOP: 'DEVELOPING THE SCENARIOS'

This workshop had the following objectives:

1. To flesh out the scenarios;
2. To identify and address policy questions.

To stimulate forward-looking reflection within the group, the study team illustrated the challenge by presenting examples of state-of-the-art technologies in both 1953 and 1983. During this workshop, world-café sessions were organised in which the experts worked systematically with each scenario on the basis of drafts prepared by the JRC study team. They were requested to take a critical look at the draft elements and to add substance to the general analytical descriptions of all scenarios. These in-depth discussions provided the basis for the study team to prepare updated drafts.

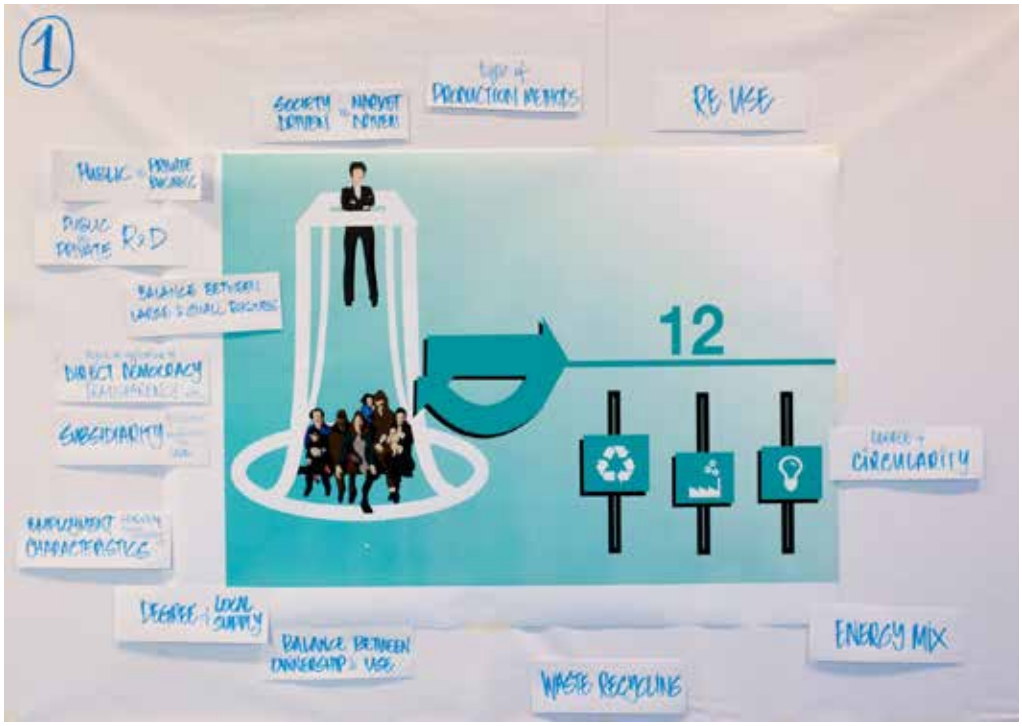
The end of the workshop was dedicated to making a first attempt to identify policy issues deemed relevant for each scenario by the experts (see detailed outcome in section 11).

5.2.5 FOURTH WORKSHOP: 'VALIDATING THE VISIONS, IDENTIFYING ACTIONS'

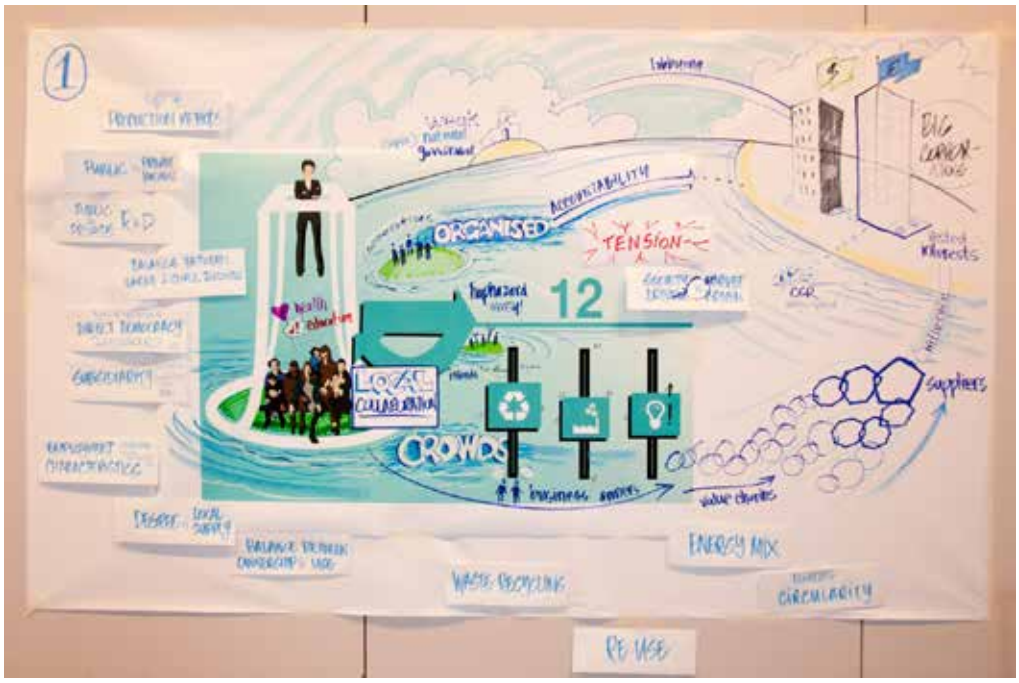
This workshop had the following objectives:

1. Full development of the scenarios and themes;
2. Identification of the main policy messages.

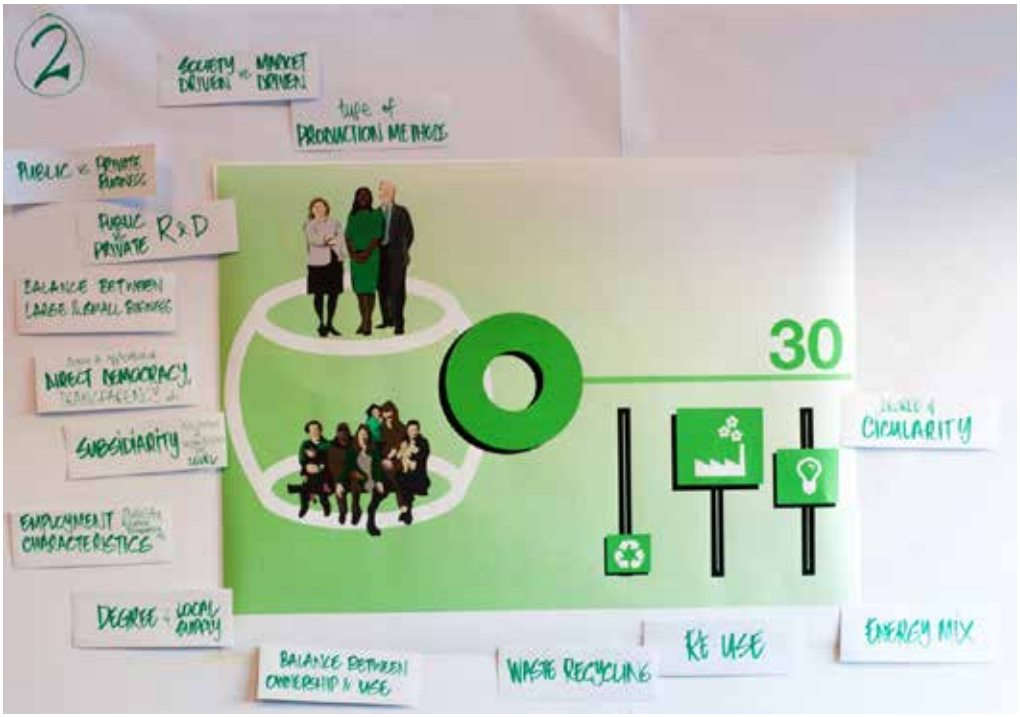
In this workshop, the four draft scenarios – which had been developed further by the JRC team using the content from workshop 3 – were presented to the experts. A coherency and completeness check to finalise the scenarios was carried out during the brainstorming world-café sessions. However, this time the experts were asked to develop in particular the specific consequences that each scenario would have on eco-industries. This work was animated using graphics. Pictures 1 to 8 show the drawings by the graphic artist Nick Payne at the beginning and end of the process.



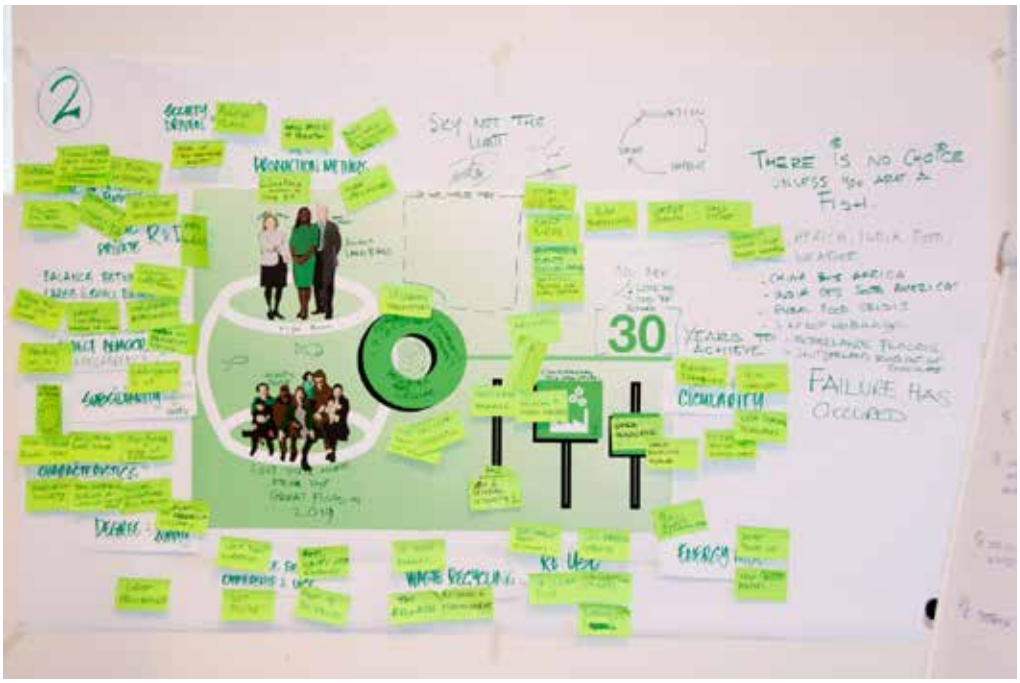
Picture 1: *Drawing illustrating the development of scenario 1 at the start of the process*



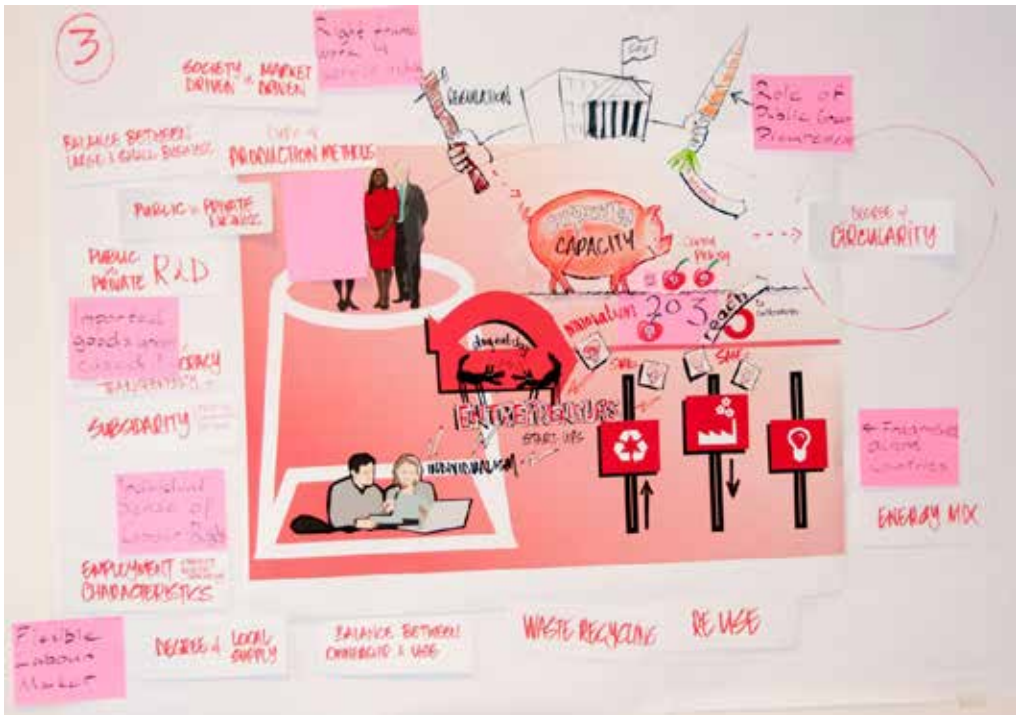
Picture 2: *Drawing illustrating scenario 1 at the end of the world-café*



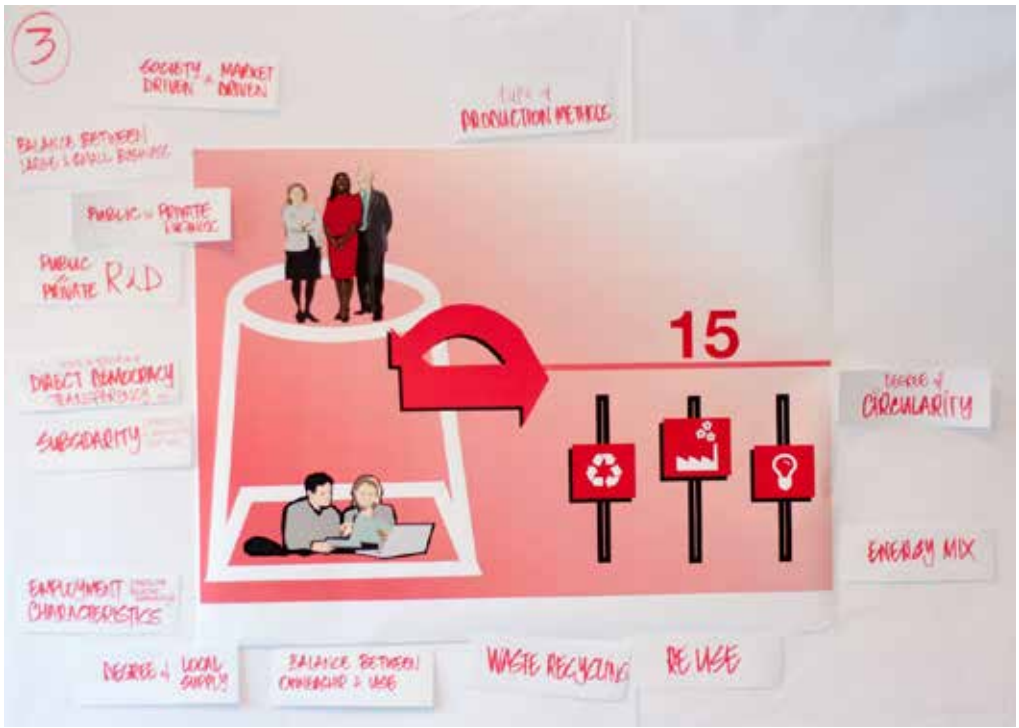
Picture 3: *Drawing illustrating the development of scenario 2 at the start of the process*



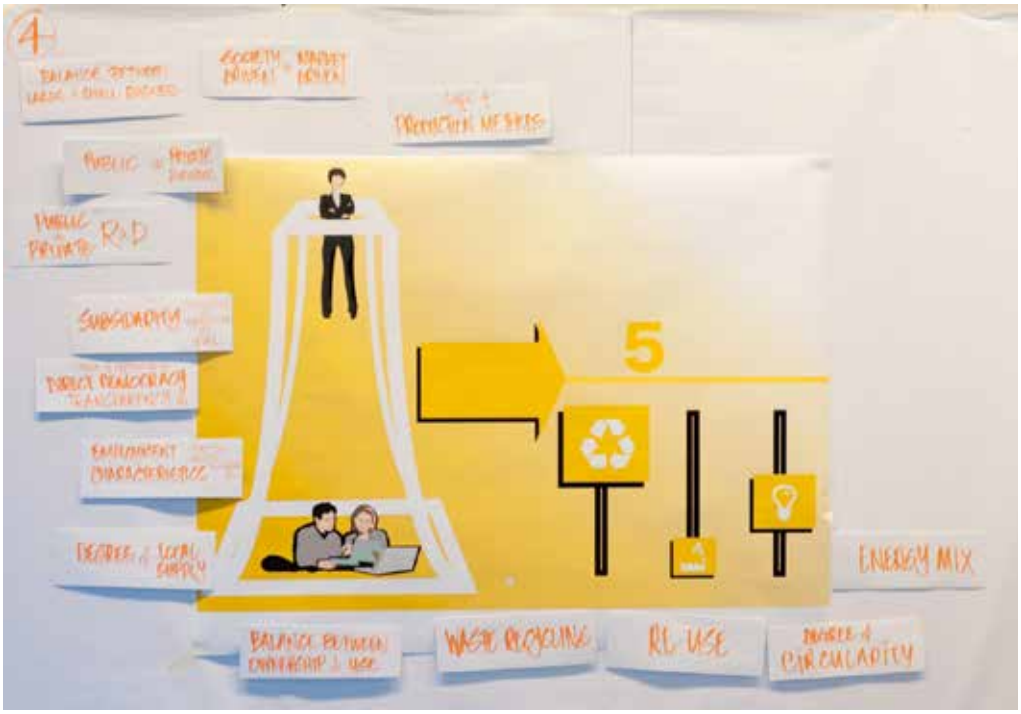
Picture 4: *Drawing illustrating scenario 2 at the end of the world-café*



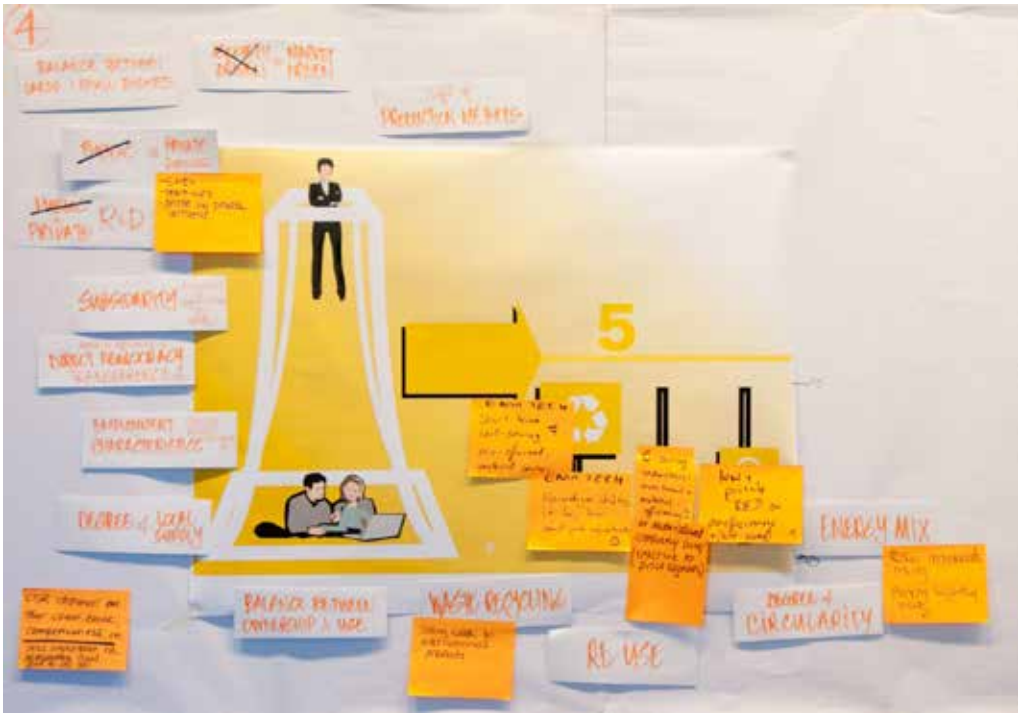
Picture 5: *Drawing illustrating the development of scenario 3 at the start of the process*



Picture 6: *Drawing illustrating scenario 3 at the end of the world-café*



Picture 7: *Drawing illustrating the development of scenario 4 at the start of the process*



Picture 8: *Drawing illustrating scenario 4 at the end of the world-café*

Finally, the experts were asked to identify all policies that could be used to push each scenario towards more sustainability (plenary brainstorming). Then four rounds of voting (one per scenario) were organised to rank the proposed policies by order of decreasing impact for each scenario. After that, the experts worked in brainstorming world-café sessions to develop the three most important policy issues according to a standard template (see detailed outcome in section 11).

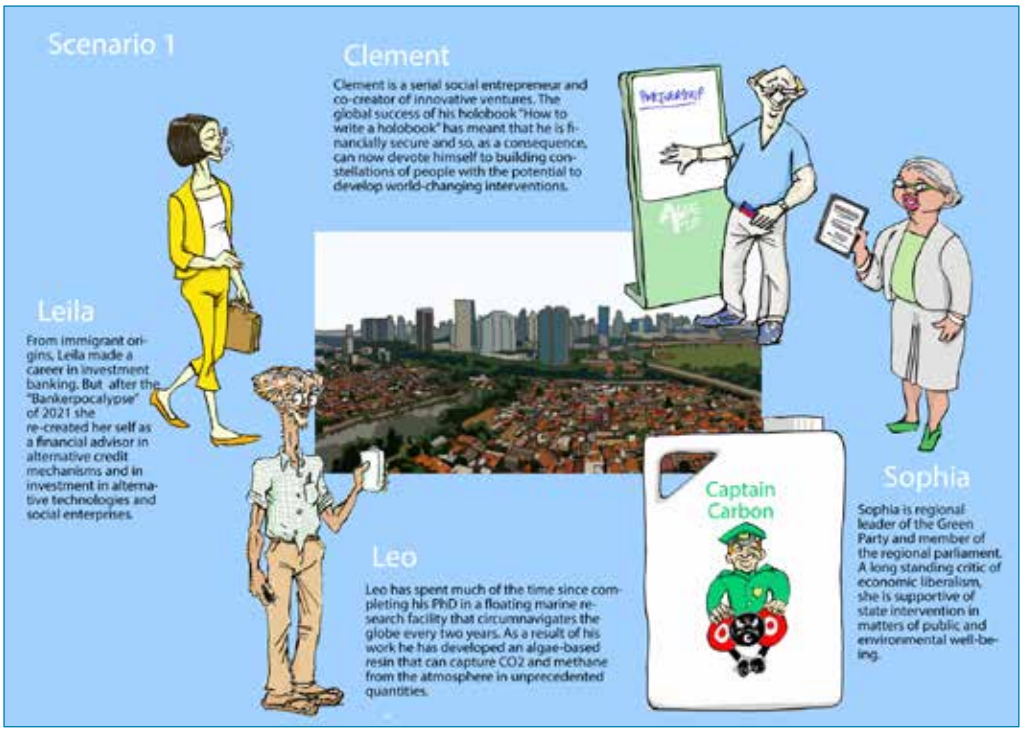
After this session, Bert van Son, founder of Mud Jeans, presented his company and its new business model: leasing clothes. Following this workshop, the JRC team developed narratives for all the scenarios to help bring the analytical descriptions to life.

5.2.6 FIFTH WORKSHOP: 'FINAL VALIDATION AND CONCLUSIONS'

This workshop had the following objectives:

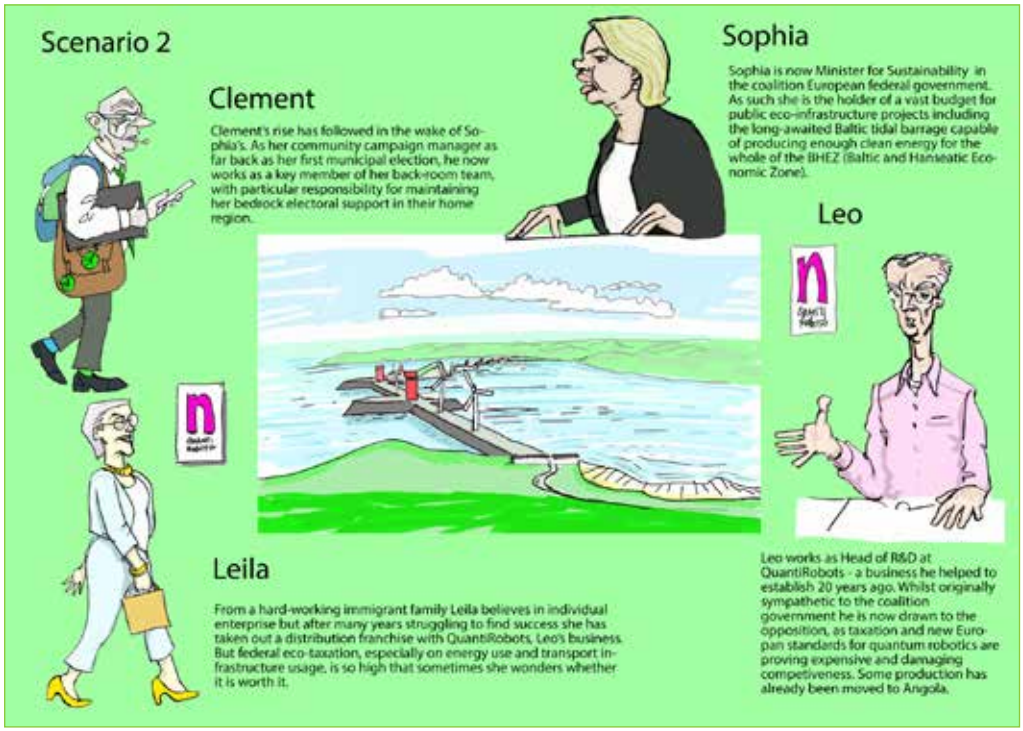
1. Final review and approval of scenarios and checking of scenario narratives;
2. Address further policy questions and main conclusions.

First, during a short plenary session, the study team presented the draft final scenarios to the experts for any last comments. The experts then gave the scenarios their approval. The four narratives were then presented (see pictures 9-12) and the experts were asked to give feedback during brainstorming world-café sessions. This resulted in a lot of high-quality input.

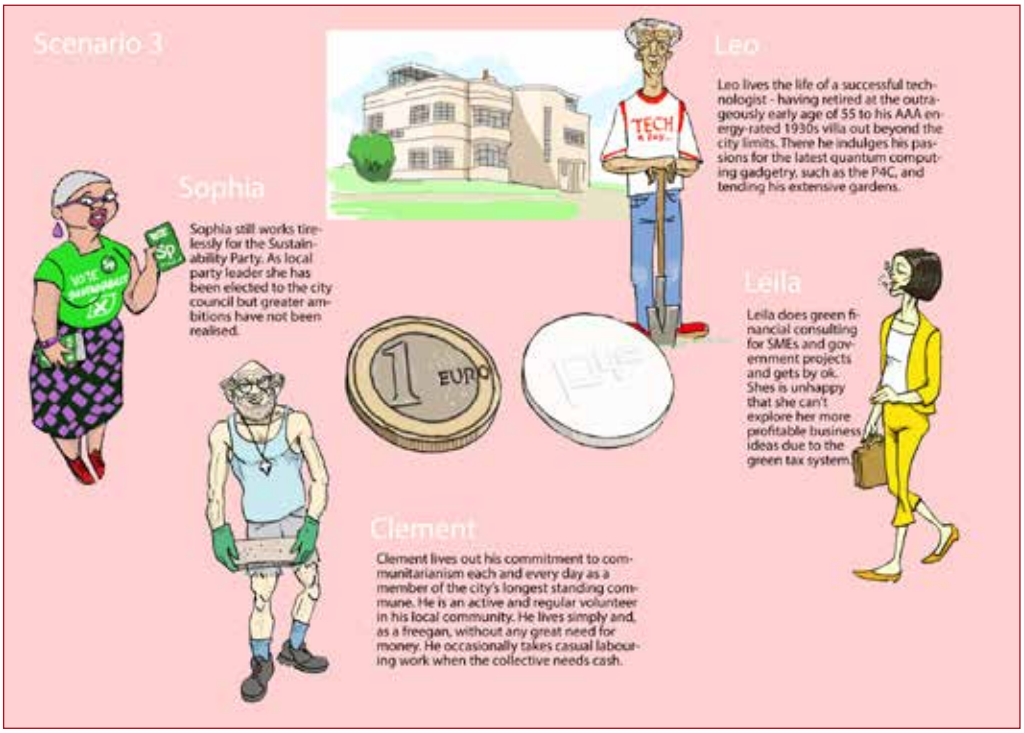


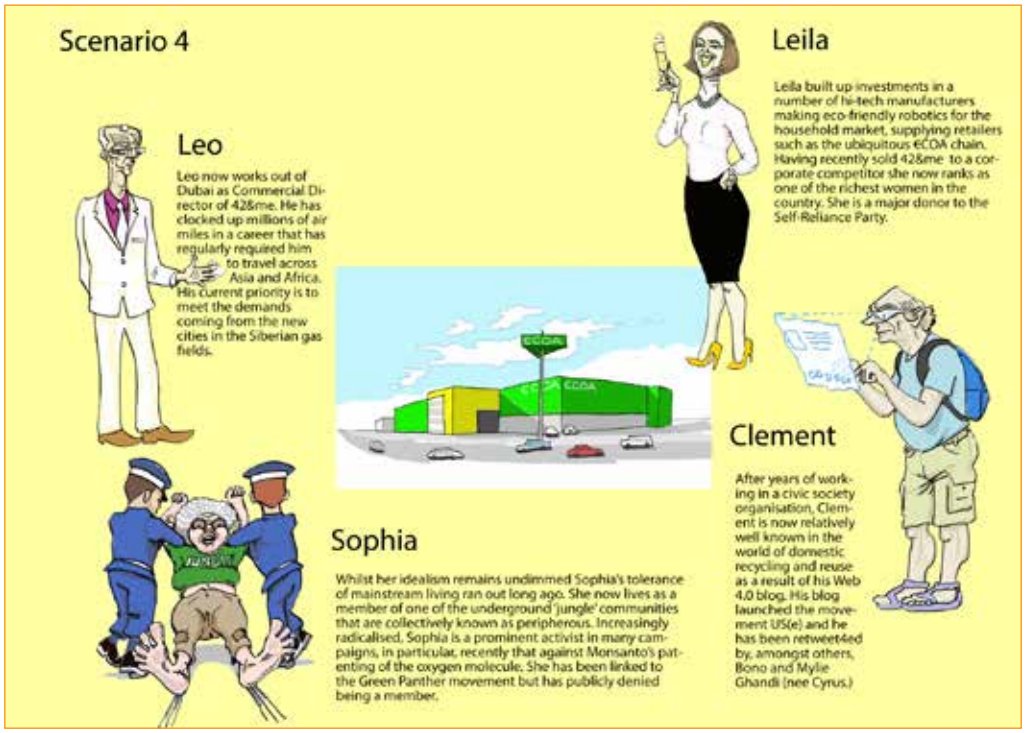
Picture 9: *Poster used to facilitate the discussion on the narrative for scenario 1*

Picture 10: *Poster used to facilitate the discussion on the narrative for scenario 2*



Picture 11: *Poster used to facilitate the discussion on the narrative for scenario 3*





Picture 12: *Poster used to facilitate the discussion on the narrative for scenario 4*

Finally, as the discussions on policy issues at workshop 4 produced mostly conventional thinking, the experts were asked to develop the next three policy issues that had been identified as important during workshop 4 in brainstorming world-café sessions.

In particular, several participants expressed the opinion that policy matters, and that it is time that key stakeholders start to recognise this once again.

During that workshop, three external presentations were given. Judith Merkies, a Dutch social democrat MEP spoke on the policy relevance of the topic. Hugo Spowers from the RiverSimple company explained how his start-up is developing fuel-cell-powered cars for leasing, while CEPI, the Confederation of European Paper Industries, presented the Two Team foresight exercise, now leading to a radical transformation of the sector.

5.2.7 OVERALL OUTPUT

The series of workshops delivered a scenario logic, a set of four developed scenarios and corresponding narratives, valuable input on a range of relevant policy issues, and a comparative analysis of eco-industries under each of the scenarios.

This concluded the first phase of the study. In a second phase, communication products are being developed and the team is organising dissemination activities, including developing a board game and participatory workshops to explore the future development of specific issues within the scenarios. This work is being performed in partnership with policy-makers, civil society organisations and private stakeholders.

5.3 TOWARDS A SYSTEMIC VISION

As eco-industries, especially as they are understood here, are complex, we wanted to address them as a whole. The rationale behind this approach was to attempt to provide a global understanding of the eco-industries 'system' in order to support strategic approaches to policy-making.

6. DEVELOPING SYSTEMIC VISIONS

6.1 THE SCENARIO LOGIC

The four scenarios in this study were built around two axes providing the overall scenario logic:

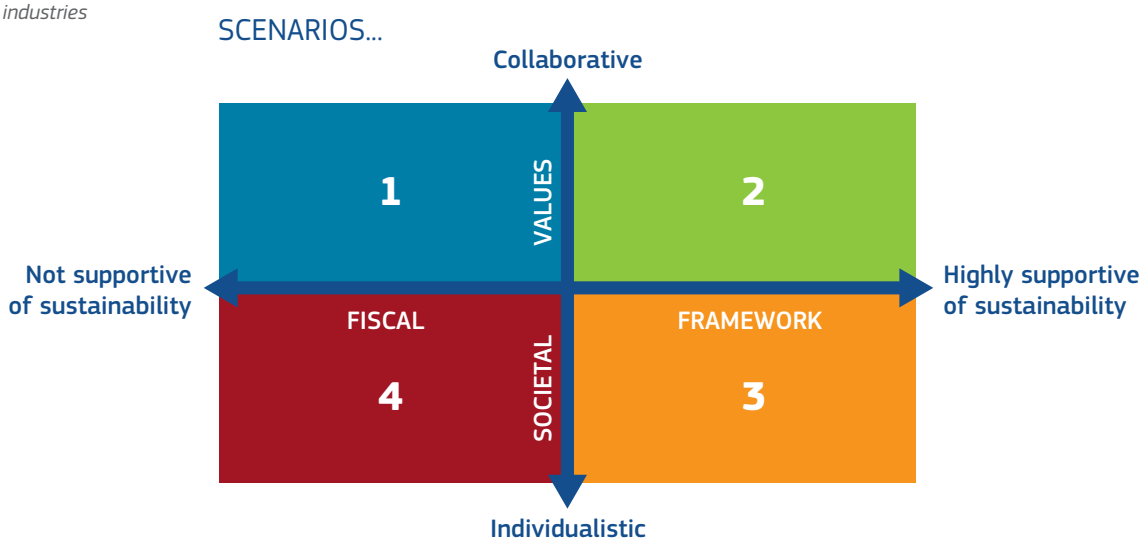
- The horizontal axis, or x-axis, represents the **'fiscal framework'** – with *high support for sustainable development* and *low support for sustainable development* being the extremes of this axis.
- The vertical axis, or y-axis, represents the **'societal values'** – with *individualistic* and *collaborative* being the extremes of this axis.

In other words, the four scenarios depict (as shown below in Figure 1):

1. A collaborative society with a fiscal framework not supportive of sustainability
2. A collaborative society with a fiscal framework highly supportive of sustainability
3. An individualistic society with a fiscal framework highly supportive of sustainability
4. An individualistic society with a fiscal framework not supportive of sustainability.

This scenario logic was the basis for expert brainstorming that led to the identification of keywords defining each scenario, as illustrated in Figure 2. This was the basis for the definition of the full scenario descriptions (see section 8).

Figure 1: *The scenario logic for developing the scenarios on eco-industries*



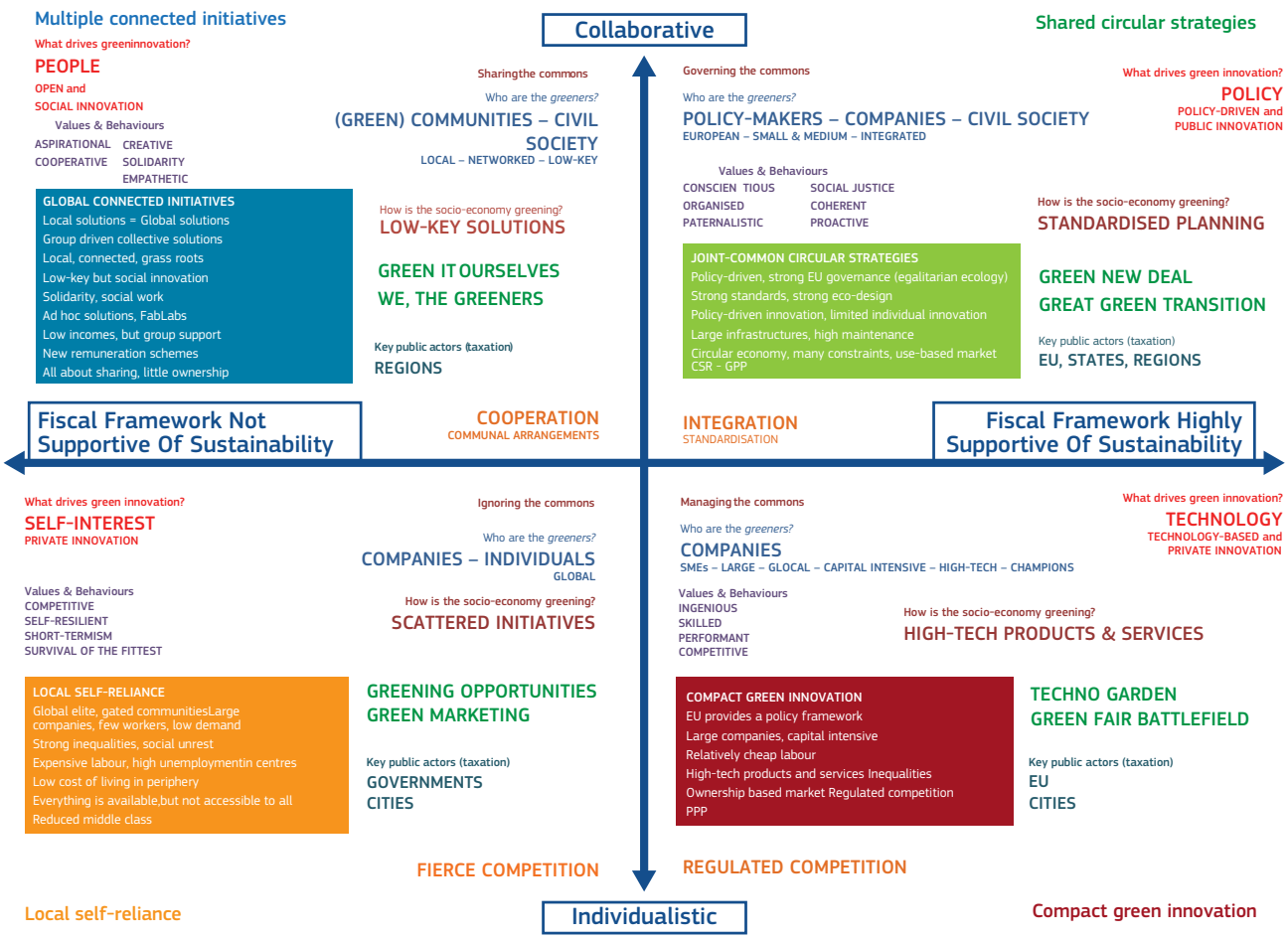


Figure 2: *Basic descriptors of the four scenarios*

6.2 BASIC DEFINITIONS

6.2.1 ECO-INDUSTRIES

As noted by the European Environment Agency (EEA) and mentioned above, it is the whole economy that must be "greened"[6]. For the purpose of this foresight study, eco-industries were defined as all the socio-economic activities that make the transition towards a green economy possible. This is a systemic and dynamic definition which recognises that greening the economy is a long-term systemic change. According to the EEA, at the most basic level, a green economy is one that generates increasing prosperity while maintaining the natural systems that sustain us[7]. The United Nations Environment Programme (UNEP) developed a working definition of a green economy as "one that results in improved human well-being and social equity, while significantly reducing environmental risks and ecological scarcities". Since 2009, the OECD has talked about "green growth" as a means to achieve a green economy[8].

This implies that eco-industries does not mean a specific group of industry sectors that can be clearly identified but rather a stream of business activities across and within the entire industrial segment of society and even beyond. It also implies that eco-industries cannot be referred to as one single business activity but should be seen as a group of service and technology providers for sustainability in an entire value chain or materials chain. However, eco-industries can be organised around three main functions:

- **Green industries** – e.g. environmental industries, clean-up, remediation, natural resources management, renewable energy, etc.
- **Industries greening** – other industries adopting eco-innovations and reducing their environmental impacts
- **Eco-innovative solution providers** – R&D, new business models, organisational/social innovation, integrators

While the first two strands of this definition are widely recognised, and known as 'Core Green' and 'Go Green' in other circles, the third strand is rarely considered as such. In addition, while the first two strands are commonly recognised as 'industry', the third strand can be perceived as mostly 'services'. However, lately, the border between industry and services has become increasingly blurred as many services are generated within industrial companies and industrial products are increasingly coupled with services. The trend

[6] http://www.eea.europa.eu/articles/greening-the-entire-economy-not

[7] http://www.eea.europa.eu/themes/economy/intro

[8] http://www.oecd.org/greengrowth/47411244.pdf

towards 'servicising' the economy is simply reinforcing this already strong association between products and services. To some extent, 'public policy services' might also be considered, as will become apparent in some of the scenarios below, e.g. through public procurement, standards setting or legislation.

6.2.2 DIMENSION 1 | INDIVIDUALISTIC VS. COLLABORATIVE SOCIETY

This refers to the degree to which individuals are integrated into social groups. At both ends of this dimension we can envision that in 2035 people will be independent individuals with a strong sense of individual responsibility. The issue addressed by this dimension is fundamental to all societies around the world. The following is inspired by the work of Geert Hofstede[9].

6.2.2.1. Collaborative society

In a collaborative society, people come together in strong, cohesive groups. The first one is most often the extended family, but people collaborate simultaneously in various groups along geographical lines, professional lines or associations related to opinions. The counterpart of the support and advantages derived by individuals from these groups is loyalty.

By 2035, a strong desire among European citizens to continue to preserve the European social model, coupled with great environmental awareness, has led to the emergence of strong social movements promoting sharing and collaboration. This trend occurs across the whole EU in varying degrees. In such a society, solidarity is important and the feeling of empathy can reach beyond the immediate group and encompass global issues such as the consequences of climate change on people far away. Such a context is likely to be favourable to maintaining a large middle class and preserving mechanisms to reduce social inequalities.

Developments in ICT associated with the maturation of social media use have given new life to participatory processes. Helped by the arrival of the first generation of digital natives in the highest levels of decision-making, direct democracy has made gains and has started to penetrate the policy-making sphere, weakening some aspects of top-down governance but maintaining a fairly centralised mode of government, thanks to a widely shared feeling for the 'common good'.

6.2.2.2. Individualistic society

An individualistic society is one in which the degree of independence among individuals is high. Social ties are loose, and everyone is expected to look after her/himself and her/his immediate family. After the 2008-2014 financial crisis, the faster economic recovery of economically liberal societies, coupled with a lack of consideration for the pre-existing establishment among the first generation of digital natives, has given new impetus to economically liberal ideas in the EU. Solidarity mechanisms are much weaker than in collaborative societies, and the societal environment allows for the emergence of various types of elites (based on wealth, expertise, etc.).

The desire to be free to undertake and to be able to enjoy the benefits of their own work has led this new generation down a path towards a largely 'live and let live', pragmatic and flexible society. This generation has been keen on repatriating some powers from governments to the individual, thereby weakening centralised modes of governance.

An individualistic society would promote 'champions' and 'experts' while, at the same time, less attention would be given to vulnerable populations and their social integration, thereby increasing the risk of social inequalities.

6.2.3 DIMENSION 2 | FISCAL FRAMEWORK

In the current economic system, one of the key issues with respect to sustainable development is the lack of clear economic signals to address environmental and social externalities. By adjusting the fiscal framework to provide transparent economic signals, governments can act to reduce these externalities. This dimension refers to the degree to which fiscal frameworks address such externalities.

6.2.3.1. Fiscal framework not supportive of sustainable development

In 2013, all the EU countries already have a minimum of green taxation. However, according to the European Resource Efficiency Scoreboard[10], the extent of this remains mainly modest, with total environmental tax revenues in EU Member States ranging typically from 4 % to 9 % of total revenues from taxes and social contributions. This is too low to have a significant impact on purchasing and investment behaviour. This is what is considered here as a fiscal framework not supportive of sustainable development.

6.2.3.2. Fiscal framework supportive of sustainable development

In contrast, we can imagine that a fiscal framework supportive of sustainable development would lead to at least 50 % of total tax receipts coming from green taxes, instead of less than 9 % in

[9] http://geerthofstede.com/

[10] http://ec.europa.eu/eurostat/web/environmental-data-centre-on-natural-resources/resource-efficiency-indicators/resource-efficiency-scoreboard

the previous case. This would be expected to influence people's purchasing and investment very significantly and would allow governments to shift taxes away from some traditional sources of tax revenue, such as taxes on labour or on income from labour, for example. These levels represent very significant sums, especially in countries where overall taxation levels come to more than 40 % of GDP. This change could happen in the long term, either through convergence of national fiscal systems under the current EU institutional set-up or through an EU approach if the Treaties were to be modified.

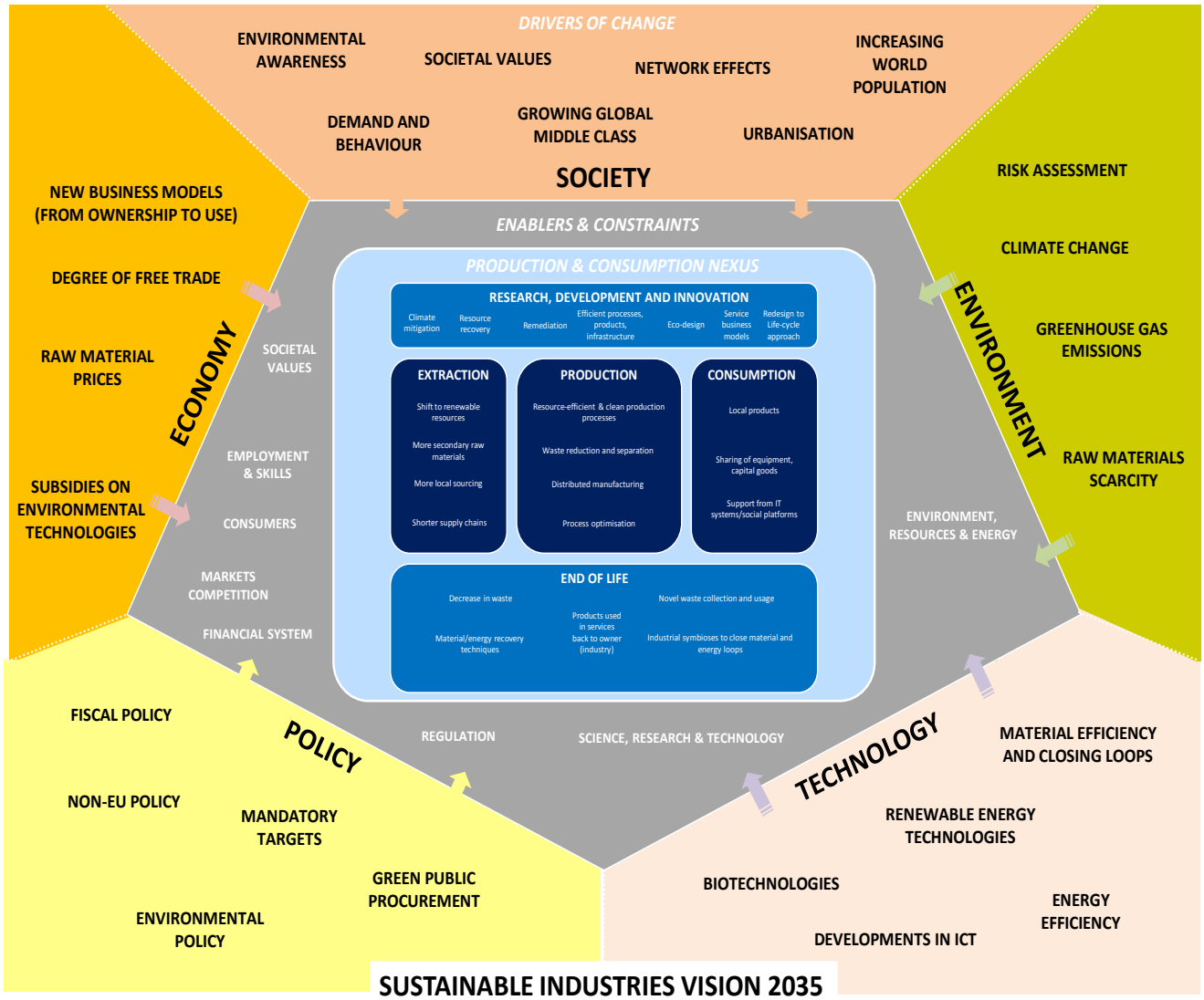
6.3 A SYSTEMIC VISION OF ECO-INDUSTRIES 2035

The Sustainable Industries Vision (Figure 3) gives a possible simplified graphical presentation of the eco-industries system and its drivers, reflecting discussions in the expert group. This presentation was prepared according to a model – Industrial Landscape Vision for 2025 – developed by the JRC foresight study on industrial standards[11]. It illustrates the use of the STEEP model mentioned in section 5.2.2. STEEP stands for Society, Technology, Environment, Economy and Policy, as indicated in Figure 3 below.

"Only if we manage to see the universe as a single entity, in which every part reflects the whole and whose great beauty lies precisely in its variety, will we be able to understand exactly who and where we are."

Tiziano Terzani | Letters against the war: Letter from Orsigna, 2001

Figure 3: *The Industrial Landscape Vision 2025 applied to eco-industries*



[11] How will standards facilitate new production systems in the context of EU innovation and competitiveness in 2025? JRC foresight study, EUR 27096 EN, 2015: https://ec.europa.eu/jrc/en/publication/eur-scientific-and-technical-research-reports/how-will-standards-facilitate-new-production-systems-context-eu-innovation-and

7. WHAT COMMON CHANGES WILL BE SEEN UP TO 2035?

By 2035, the world population has reached **8.6 billion** (mid-range of UN projections), challenging efforts to fight poverty in some countries. The population of the countries making up the **European Union in 2013 has remained relatively stable**, with a slight increase possible due to migration from Africa and Asia. However, as the birth rate of the native European populations has remained very low for the last three decades, the ethnic make-up of the 500 million in the current EU-28 has evolved in some regions. Iceland and some small countries from the Balkans have joined the Union, increasing the EU's total population slightly. Since population growth is distributed unevenly around the world and as the effects of climate change are being felt more strongly in poor countries, **immigration pressure on the EU is growing**. Also, the degree of urbanisation in the EU and worldwide has increased significantly compared to 2013, creating a lot of pressure on pre-existing infrastructures and calling for large investments in new infrastructure. Whether and how these investments are made differs in each scenario. As the situation in emerging economies continues to improve, the global consuming class is expected to rise by 4 billion people, resulting in strong demand for raw materials and energy.

In view of the large inertia in the drivers of natural climatic systems, the **rate of climate change has not changed significantly**, regardless of the efforts made to curb GHG emissions since the early 2020s. In line with the projections of the UN Intergovernmental Panel on Climate Change (IPCC), the concentration of atmospheric CO_2 has reached 450 ppm. Methane concentrations are also increasing. As foreseen by the IPCC in 2013, and consistent with the International Energy Agency (IEA) world-energy outlook scenarios, warming is reaching the 2°C level. Important differences in how various policy choices and development paths play out will only be seen after 2035.

Consistent with this trend, by 2035, **the effects of climate change have already had noticeable impacts** on agriculture, fisheries, coastal erosion and in some low-lying areas (e.g. some Dutch polders have already been evacuated). By 2013, the Dutch had already started to experiment with floating urban structures to prepare for this eventuality. The combination of climate change and population growth has significantly increased the vulnerability of the most densely populated regions of the world, especially Bangladesh. Some low-lying cities are starting to be threatened by rising sea levels, mostly during storms and floods – even the EU is affected (Venice, Amsterdam, Stockholm, etc.). Major harbours must invest in very expensive infrastructure projects to maintain their ability to operate. Some vulnerable tourist coastal areas, such as the Belgian and Dutch coasts or the Aquitaine in France, face difficult choices. Many buildings have disappeared because of coastal erosion.

As climate-change-induced floods and droughts hit different regions of the world in turn, **world food production is being periodically disrupted**. This is resulting in an unpredictable international food trade and highly volatile food prices. Far-sighted business deals arranged by some very populated countries in the 2010s to secure access to food supplies from less-populated areas of the world are coming under stress as populations living close to production areas are claiming the food for themselves.

Following the technological push since the second half of the 20th century, **technological development has continued unabated**, but with a twist. There is more **convergence between different technologies** and a much deeper understanding of the relationship between technology and its users. In particular, **IT has become significantly more embedded** in

"Creativity requires the courage to let go of certainties."

Erich Fromm

objects across the board: vehicles, buildings, communication devices, home appliances, etc. have all joined the 'Internet of Things'. As a result, **connectivity is high and people are digitally literate**, but personal decisions vary about whether and how to connect. Data acquisition has also skyrocketed across the board, thanks to the explosion of very sensitive sensors, low-energy-use electronic devices, cheap and efficient data storage and miniaturisation. In particular, data availability enables people to better manage their own health, leading to changes in the management of public health.

Following a number of cybersecurity scares in the early decades of the 21st century, privacy has become a major societal issue. **The concept of 'private life' has evolved**. People have learned to accept less privacy in some aspects of their daily life (e.g. they are surrounded by various types of 'smart meters' that can indicate when they use their oven or take a shower), although protection systems for their digital identity have become much more secure. The spread of powerful encryption and biometric methods that made this possible has also weakened the ability of governments to eavesdrop. This renewed level of confidentiality has changed the balance of power between countries and has benefited some criminal organisations.

Robotisation has also made progress to an degree which would have been difficult to imagine in 2013. The employment landscape has changed dramatically, with comparably few people working in manufacturing. A lot of mid-level, white-collar work has been replaced by robots, expert systems and a handful of software engineers and robot maintenance experts, making manufacturing both cheaper and more flexible. For highly skilled or one-off handicraft, co-operative robots are enhancing the productivity and dexterity of humans. Robotics has also penetrated homes, relieving humans of a number of household tasks, helping old people stay at home longer, and even taking care of basic medical support. Many shared driver-less vehicles roam our streets, resulting in a significantly lower number of cars in cities and allowing children, the handicapped and elderly to be mobile on demand and independently from helpers. Fewer city dwellers now own cars. Car transport in urban areas has largely become a community service. Overall, these trends will adapt to the reality of each scenario.

The first generation of **digital natives has reached the highest levels of decision-making** both in the public and private sectors, as well as in politics. The emancipation and empowerment of individuals has continued, driven by several developments:

- The increasing availability of data and information on the internet;
- The existence of powerful platforms for exchanges and social tools;
- The generalisation of easily accessible educational tools (e.g. Massive Open Online Courses - MOOCs);
- The availability of powerful encryption methods that guarantee confidentiality on the internet.

This gives people options to choose from and the ability to take their own decisions. It also gives them the freedom either to take an individualistic outlook on life and to fend for themselves, or to put their own power at the service of one or several groups and to take a more sharing and collaborative outlook. It is also likely to have major impacts on public health and health systems in both individualistic and collaborative societies.

scenario 1

Multiple Connected Initiatives

- **Collaborative society**
- **Fiscal framework not supportive of sustainability**


12 X 25 m² AVAILABLE
Repair Café
CENTRAL RAIL STATION
• INFO
BUS + CityMob

8. EUROPEAN SCENARIOS IN 2035

8.1 SCENARIO 1 | MULTIPLE CONNECTED INITIATIVES

8.1.1 HOW WE ENDED UP IN THIS SCENARIO

Year 2035: for more than 10 years already, the Arctic has been ice-free for several months each year. The IPCC reports published in 2013-2014 left little doubt about the scope and degree of human-induced climate change. Bowing to the ever-increasing effects of climate change in the first decades of the 21st century and to growing concern among many citizens, world leaders have recognised the need for drastic reductions of GHG emissions and serious efforts to ensure the efficient use of resources. However, as a result of intense global economic competition and fear in the poorer countries of missing the 'development train', many governments have continued to ignore the responsibility for making a greater effort than others. Therefore, while the scale of the problem did **lead to an international agreement in the 2010s**, the binding targets for emissions and resource efficiency were set at the **lowest common denominator.** Under pressure from large, established economic actors, no political courage was found to set the EU on a green fiscal framework for fear of losing out economically in international competition.

The strong Eurosceptic push during the 2014 European elections has had long-term consequences, leading to political paralysis at the EU level. Disenchanted by both national and European politics, **EU citizens wanted to see decisions taken closer to home**. As a result, local and regional political life has now been reinvigorated, sometimes across national borders. The EU Treaty has been revised again to give **a stronger role to Euroregions**, reflecting a trend in many Member States towards decentralisation and/or federalism (e.g. Spain, Belgium, Germany, Italy, etc.). **Subsidiarity has been redefined** and **the focus of EU action has moved to global issues** (e.g. international trade negotiations, international discussions on climate change), and on trying to make the Single Market compatible with sustainable development through means other than taxation. Energy and migration policies have also become European.

During the previous 30 years, the fast pace of technological development has resulted in the **disappearance of most traditional jobs in manufacturing** and a wide range of services (information, mailing services, clerical work, etc.).

With the empowerment of civil society, governments in Europe are focusing on their strategic guiding role. To support the evolution towards sustainable development, they are making significant use of policy instruments in areas such as education, public R&D investment, standards, public procurement, fast implementation of 'best available techniques', cohesion funding and the like.

International governance has been transformed by the simultaneous emergence of globally connected societies in many countries, the recent economic development of a set of countries, and widespread recognition that the most severe challenges faced by humanity are now global. International organisations and, through their soaring numbers of active members, global networks and local community groups are taking the lead in initiating societal development. As regards the use of natural resources worldwide, an internationally agreed set of values is being discussed at the UN that would guarantee equity among all people. Biological natural resources are being threatened by climate change. Raw material and minerals are being traded at international level and for technology development. This is starting to have sizeable **consequences for international trade** as pressure mounts on resource-rich countries, thereby weighing on their sovereignty. This new international landscape has finally convinced Iceland and Norway to join the EU.

As **questions of global equity become increasingly important**, the **number of permanent members in the UN Security Council has risen**. It now comprises representatives from all continents. The Doha Round of trade talks was concluded *a minima* towards the end of the 2010s and bilateral trade agreements are becoming increasingly widespread. More and more people are now convinced that co-operation is a more sustainable model of economic development than competition.

8.1.2 SETTING THE SCENE

Conscious and empowered citizens

In 2035, the collaborative nature of the society has translated into **strong and widely shared values** that structure the way many individuals behave. Meanwhile, the relentless developments in information technology (IT) over the last decades have **empowered individuals** as never before: they are well informed, can mobilise large groups quickly and readily engage in conversations with authorities and commercial actors.

Society gives a lot of **importance to education and lifelong learning**, resulting in a high average level of education on sustainability in Europe. As a consequence, people are aware of the environmental threats posed by the world population and climate change; they realise the importance of achieving sustainable development and are very **conscious of their health** and of the links between environment and health. **Strong social movements** press for ever-lower environmental impacts of human activities, promote sharing and collaboration, demand sustainable procurement, and request 'circular products', influencing to a degree the development of all types of infrastructures and the behaviour of all stakeholders. A sense of responsibility and solidarity permeates society.

This has created conditions favourable to the **emergence of powerful groups** that self-organise along ideological lines, geographical boundaries, wealth, and a myriad of personal interests. As regards building a sustainable world, **people have integrated the need to think globally and act locally**. They therefore belong simultaneously to various types of groups, tribes and networks which fulfil both their desire to influence thinking globally and their local needs.

This collective empowerment, based on a high general level of education and powerful social media, **weakens the role of national governments** to the benefit of other levels of decision-making, such as local communities, regional bodies and the EU level. Communities make use of web-based platforms to wield influence beyond national boundaries. In the course of the 21st century, the 'nation state' born in the 19th century is no longer the optimum level of government. Subsidiarity has changed. Social media has allowed **more decisions to be taken directly by the citizens**. Most of the key issues that must be addressed are either global (e.g. climate change, safe and secure access to raw materials and food), where the EU level is the most relevant, or local in nature (housing needs, city infrastructures, transport). This translates into many more decisions being taken than 25 years ago, either at local/regional level or at international level (EU, UN). Overall, the distribution of policy competences is much more balanced between all these levels while the distribution of power between numerous actors and groups is unclear.

People act to secure the best possible quality of life for the lowest possible environmental impact at a local level. Familiarity with social platforms has changed the way citizens deal with policy issues. By allowing the use of citizen initiatives in EU policy-making, the Lisbon Treaty opened the door to the development of direct, participatory democracy in EU decision-making. As a result, **direct democracy** has started to penetrate European policy-making, strengthening the influence of individuals (organised either in stable or short-lived, issue-based groups) and reshaping the centralised governance previously built on representative democracy. The groups that manage to inspire the most trust wield the most influence.

This trend has also **weakened traditional political parties** and society has become a mosaic of influential groups who often form ad hoc majorities issue by issue. Although majorities are easy to form, they are fleeting in nature and **the long-term coherence of policy action is difficult to ensure** (zigzag course). In this context, because of a fear of creating public resistance and of not being re-elected, policy-makers have found it difficult to radically reform European fiscal frameworks. In spite of some attempts, green taxation has not been put in place, apart from a few limited measures. The large electoral weight of old people has also slowed down reformist agendas and the development of bold initiatives. On the other hand, concern about sustainable development has enabled the development of non-fiscal policies in support of sustainability. To support the evolution towards sustainable development, governments make extensive use of policy instruments in areas such as education, public R&D investment, standards, public procurement, the rapid implementation of best available techniques, cohesion funding and the like.

Robotics, information technologies and artificial intelligence have assumed such a role in reshaping the economy and society that the concept of 'job' has been radically affected. To avoid social upheavals, employment policies have been enacted that keep everyone occupied but with **much reduced legal working times** compared to the 2010s. As a result, **take-home pay for skilled creative jobs is high but remains comparatively low for the rest**. The drastic reduction in manufacturing jobs has increased the supply of labour in the rest of the jobs market, creating a downward pressure on wages. Informal or self-employment is on the rise. Society tends to favour the middle class, and solidarity mechanisms remain strong. The reduction of working times has given people more free time which is used to develop social, often voluntary activities. This has enabled the **development of non-merchant activities resulting from social innovation** (e.g. community help, free repair services, sharing, etc.) to flourish and contribute to social well-being. Social and health inequalities have decreased, due to collective empowerment based on a high general level of education, increased high literacy and inclusive democratic processes.

Global connected society

By 2035, **international governance has been transformed:** the global connected society that was born in the first decade of the century has matured. Many countries around the world (i.e. the BRICS, the next 11 countries[12] and several other African countries) have increased their level of economic development significantly over the previous 20 years and there is widespread recognition that the most severe challenges faced by most are global. International organisations and, through their soaring numbers of active members, global networks and local community groups are taking the lead in initiating societal development. For the use of natural resources worldwide, an internationally agreed set of values (including, for example, a recommended quota of raw materials allocated per person and per year) is being discussed at the UN that would guarantee equity among all people. This is starting to have sizeable **consequences for international trade** as pressure mounts on resource-rich countries, thereby weighing on their sovereignty, especially in view of the institutional changes that took place at UN level.

As competition, especially for raw materials and food, has continued to increase (the personal raw material quotas are being traded), many products, and increasingly services, are sourced from global companies operating on all continents. However, the actual manufacturing or service delivery tends to take place as close as possible to markets. The pressure on food supplies and the unpredictability of the effects of climate change is making all governments anxious about this issue. Protectionist measures on food remain in many global regions, including the EU. On the other hand, the EU remains one of the leading sources of emergency assistance and relief to victims following natural disasters, wherever they occur in the world.

Strong migration flows are also increasing connections within the global society. In particular, and in spite of the largely jobless economic take-off in Africa, very **strong population growth in that continent** has steadily increased **immigration** pressure on Europe over the last 30 years. This has been made worse by climate change refugees. In spite of the persistence of strong xenophobic groups, humanitarian considerations, coupled with the pressure of the relentless ageing of its population (whose pensions must be financed), have finally pushed the EU to adopt a coherent and pragmatic immigration policy combining preventative approaches (e.g. comprehensive development aid to countries of emigration), humanitarian principles, economic considerations and practical issues. As a result, more and more co-operation and business opportunities have also emerged between the two continents.

Participatory processes and transparency

In spite of the absence of fiscal support, **resource and energy efficiency is improving**, promoted by new regulatory requirements (e.g. legislation, standards), a new collaborative ethos, and a general increase in raw material prices driven by growing international demand.

Developments in ICT along with the maturation of social media have given a new life to **participatory processes and direct democracy**. Many small initiatives, relevant at local level, are popping

[12] The eleven countries – Bangladesh, Egypt, Indonesia, Iran, Mexico, Nigeria, Pakistan, the Philippines, Turkey, South Korea and Vietnam – identified by Goldman Sachs investment bank and economist Jim O'Neill as having a high potential of becoming, along with the BRICs, among the world's largest economies in the 21st century. (http://www.bloomberg.com/news/articles/2012-08-07/goldman-sachs-s-mist-topping-brics-as-smaller-markets-outperform)

up everywhere. Thus, **governance is sometimes unpredictable**, as consensus building on wide-ranging and complex sustainability issues takes time and sometimes lacks coherence. The large share taken by the more elderly section of the population, who tend to have a more conservative outlook, tends to stabilise the results of participatory democracy. Strong interconnections between local initiatives at the European level help to identify best practices and promote the design of collective European solutions.

Corporate Social Responsibility (CSR) had never had such a high profile, thanks to increased transparency and the sharing of best practices. This is largely due to the existence of very active social groups among all categories of stakeholders (from sector organisations to consumer groups). They are instrumental in an efficient exchange of information between all corners of society through many forms and channels (e.g. labelling and information campaigns by social groups). This general increase in transparency has been made possible by ICT. It sustains reputations and trust. Because of greater transparency, corruption is easier to control. In this context, **corporate reporting now routinely goes beyond financial data** and covers aspects such as material flows, GHG emissions, customer and employee satisfaction, social activities and the like. This in turn has given new impetus to the discussions on 'beyond GDP'.

From open-source technologies serving society ...

Solidarity values create societal pressure to bring the benefits of technology to the largest possible number of people. Therefore, there is a **strong push to make technology open source, as much as possible**, or to force licensing so that all those who stand to benefit from it can do so.

The transformative role of information and communication technologies (ICT) over the last 30 years in both society and the economic system has accelerated the **socio-economic evolution of European society**. Data generation, capture and transmission, information exchange and knowledge sharing, transparency and automation have all grown. Open data and standards are at the root of the new production and consumption system.

However, ICT has also continued to generate strong ethical and cyber-security issues, especially concerning privacy, surveillance and identity (e.g. bioethics). People use participatory platforms to organise many public debates on ethical issues related to the use of technology on an ad hoc basis. As a result, they have managed to gain the right to the self-determined use of their personal data, and have oriented innovation in the ICT field towards the development of very powerful cryptographic techniques that protect privacy. In this strongly collaborative society, reputation and trust are playing a central role in the governance of the internet and ICTs.

The internet infrastructure outside of the USA, especially in Europe, China, India and Russia, but also in other industrialising countries, **has developed strongly**. Therefore, the US National Security Agency is no longer able to monitor as much of the global e-mail traffic, and other powers have scaled up their digital-intelligence gathering efforts. Governance of the internet is now truly international with the strong involvement of citizen representatives. Cyber-terrorists are very sophisticated and old-style (human-based) intelligence gathering techniques are enjoying a new lease of life.

The **Internet of Things has largely become a reality** and what people used to call 'big data' back in 2013 now looks like 'small data'. Fortunately, Moore's Law is still going strong: computing power has pursued its exponential growth and has kept up with big data. Quantum computing has become operational. Advanced analytical and visualisation tools have also been mainstreamed so that any user can transform this abundance of data into useful information and services.

Other technological domains have also seen significant developments. Biotechnologies have progressed on three main fronts: medicine, (renewable) resource efficiency, and food. An ever-better understanding of biological systems and processes, coupled with many developments in e-health, have finally ushered in the long announced take-off of personalised medicine, leading to a **general improvement in public health and signs of decreasing health-care costs**. Even in the EU, **a new generation of GMOs for bio-based industry and food has finally reached acceptance within society,** thanks to new environmental and nutritional benefits.

In the wake of these developments, synthetic biology is also slowly coming of age, delivering results in the renewable resources sector. Organic wastes, in both solid and liquid form, are now being used efficiently as feedstock, thanks to new generations of micro-organisms capable of producing hydrogen, methane, liquid biofuels and high-value-added chemicals and materials. This is reinforcing a bio-based economy and creating a basis from which to start developing an embryo of the hydrogen economy. More generally, observations of nature have become a key inspiration for innovation, and bio-mimicry is being translated into many models, systems and technologies able to foster resource and energy efficiency.

The diversification of propulsion systems for cars, buses and lorries continues, leading to a sharp decrease in petroleum-based fuels for road transport. A side benefit is a major improvement

in air quality across Europe, especially in the previous pollution black spots in Europe (e.g. Lombardy and the Belgium, southern Netherlands triangle and the Ruhr Gebiet).

The shock caused by the 2008-2014 financial crisis and the ensuing new regulatory initiatives for the financial sector led a few years later to the emergence of **new financial instruments geared towards the long term** (20-50 years). There is a high level of innovation based on notable transparency in the markets and significant access to financing through open financial markets.

… to open innovation

The collaborative nature of society permeates technology development circles and the business world. In many areas of technology, **social preferences and social innovation are driving the selection of successful technological innovations**. Social debates on spending priorities contribute to orientating public spending on R&D, which is a major driver of technological innovation. Health remains a major research priority and the desire for renewability has given a new boost to biological research into secure food production and the production of renewable resources (e.g. biological/chemical feedstocks, building materials, etc.). Overall, the bridge between science and society has narrowed, and science and innovation is working more consciously for society. On the business side, open innovation has become mainstream, with more sharing of intellectual property and more pooling of R&D in order to benefit most from the knowledge distributed throughout society and to maximise innovation. This approach to sharing the risks of innovation is also leading to shared rewards.

Overall, there is serious concern about maximising the social and environmental benefits of innovations, and making technologies more socially and environmentally oriented. For example, this can influence advanced manufacturing (e.g. human-centred factories, safe and inclusive workplaces, the factory as a good neighbour), robotics (especially co-operative robots and safe human-machine interactions), advanced materials (in particular renewable biomaterials) and reuse, remanufacturing and recycling technologies.

Where technology stops, social behaviour and policy help: for example, waste collection and exploitation have become very efficient, thanks to a combination of enhanced design for recycling, regulations that have set stringent recycling and recovery targets, and civic behaviour, all nurtured by a collaborative society aware of the needs to become sustainable. Of course, not all interest groups are green minded – some pursue corporatist or commercial interests.

Rising sea levels and more flooding have also spurred **investments in resilience**, in terms of both technologies for fast responses and infrastructures, in particular to protect cities and keep harbours operational. Smart grids are becoming a reality.

The funding for these public and private investments in technology has been made possible by the emergence of new, long-term-oriented financial instruments (20-50 years) created in the aftermath of the 2008-2014 financial crisis. Much innovation now benefits from more transparent markets and easier access to funding through open financial markets monitored according to their environmental and social performance, in addition to the classic financial parameters.

Resource efficiency

Threats to the EU's fossil fuel supplies in the 2010s helped many people to realise that resource and energy efficiency also had short- and long-term benefits in terms of public health (through reduced pollution, noise, etc.), resilience and commercial advantage, in addition to reduced geopolitical vulnerability. This spurred many public and private actors in the EU to give even higher priority to resource efficiency and to the absolute reduction in resource use. Over the last 25 years, a combination of **high public, private and crowd-sourced investment in R&D** has delivered significant improvements in resource and energy efficiency, although policy action was necessary to avoid rebound effects. The **rapidly increasing share of energy production coming from renewable resources,** along with policies setting ceilings on CO_2 emissions, have led to a drastic reduction in the use of coal for energy production. Overall, slow but steady efforts to cut energy use in buildings and the growing share of alternative propulsion systems for road transport have made a serious dent in fossil fuel use. Binding limits on GHG emissions have put greater pressure on coal use, leading to a relative increase in the share of natural gas in the power mix. The relatively slow reduction in total energy demand means that nuclear power is still indispensable for achieving Europe's GHG emission targets.

As seen previously, efficient waste collection facilitates material and energy recovery. Reuse, upgrade and remanufacturing are also on the rise. Alongside new technologies, this makes **recovery and recycling much more efficient** than it was 25 years ago. Greater sharing of appliances, tools and vehicles is also resulting in the disposal of fewer white and brown goods. Formal repair services are only flourishing to a certain extent as labour costs remain high, although the free time people now have is enabling informal support networks to help in many simple repair tasks. Overall, the 'throw-away culture' has receded, essentially because

of **a shift in values**. Planned obsolescence is increasingly frowned upon by society, and manufacturers whose products are perceived as becoming obsolete too fast are undergoing a strong backlash from consumers through social networks. Wastefulness is considered unethical. Single-use items, where they still exist, have been designed to be more easily recycled or recovered, and repair cafés are flourishing.

In line with the new societal values, and facilitated by the Internet of Things, all resource chains across the economy are submitted to a high level of transparency. Some dedicated social groups provide assessments, labels and rankings, thereby informing and creating peer pressure to 'do the right thing'.

Companies can benefit from new technologies with higher material and energy efficiency than 25 years ago, and they want to cater for the generally high environmental awareness within society. Thus, they are **developing new business models around sharing** (e.g. car sharing, DIY tools), **collaboration** (one person's waste is another's raw material, waste collection, etc.) and low energy use.

Integration, networks, spatial planning and industrial symbioses

Since resilience is taking on a new meaning in the face of continuing climate change, and the externalities of the old economic system are now more visible and must be reduced, **new forms of integration are emerging**.

Beyond what was mentioned previously, now stimulated by society and policy interventions, companies are developing a broader understanding of their operational environment and looking for opportunities to 'integrate', for example in industrial symbioses. This creates many systemic win-win opportunities, although it requires the involvement of both citizens and public authorities.

The activism of some social groups combined with a greater sense of the common good present in a collaborative society is leading to lengthy debates and a **new approach to urban planning**. The desire to maintain quality of life and preserve the landscape, coupled with the will to close economic and material loops as much as possible, is resulting in a new clustering of manufacturing and energy production facilities near cities. This helps **industrial production systems to reduce their environmental impacts**. In addition, it stimulates the progressive emergence of **industrial symbioses** that make it easier to **close materials and energy loops,** helping industry address challenges regarding the sourcing of their raw materials and energy.

As regards agriculture, there has been sustainable intensification of production and sustainable management of natural resources, including the accurate valuation of ecosystems services. This is also addressing climate change mitigation and adaptation needs. So-called 'enabling' technologies and satellite-based applications are an important element in achieving these goals.

At the same time, the optimisation of dynamic, integrated economic systems requires a permanent exchange of huge amounts of information. Thus, networks of facilities are being complemented by very **complex and dynamic information-exchange networks**. Such developments create a significant need for **renewing and creating infrastructures** that are both robust and flexible.

Transparency, trust and reputation

European society is creating **a dynamic for building new business models** that are either based locally or begin within a particular group. A challenge is often to scale them up beyond the original group. This creates **trust issues** beyond the group's boundaries, and success is linked to the ability of the business to network effectively beyond their group of origin. Social media can be very useful but can also put a reputation at risk as news of any mishap can be quickly circulated and lead to rapid customer defections. **Class action responses**, appearing on a regular basis within this collaborative society, can be devastating for a business.

These strong global network effects are **forcing companies to become more transparent** in order to establish trust. This transparency is paying off by progressively reducing the scope for cheating, especially in business deals. The collaborative nature of society, coupled with both this transparency and powerful IT systems, stimulates business cooperation and the **development of co-operative solutions**. In this context, **communication is gaining in importance**: to conquer new markets, to build a brand, to deal with reputational risk, to engage customers and the public, and to demonstrate the social responsibility of businesses, etc.

There are no widely agreed criteria to define the sustainability of companies or products as sustainability is perceived differently by different people. This leaves the field open to various stakeholders to peddle their own visions of sustainability in order to promote their own agendas.

Group working and funding

A strong will among European citizens to preserve the European social model, alongside high environmental awareness, has led to the **emergence of strong social movements promoting sharing and collaboration**. Society has started a strong move away from ownership of many objects of daily life towards the adoption of numerous **service contracts delivering the utility of previously owned objects**. This trend is occurring across the whole EU to varying degrees and opening up many opportunities for resource efficiency. The various groups that make up society are **often value-based**, which makes them very cohesive. A **high level of general education** is considered essential, leading to a high level of sophistication within European society.

Pooling resources has become very common and new technologies have made distributed energy production and access to manufacturing (e.g. through 3D printing and handicrafts, as many people are no longer employed in factories) easier than a few decades ago. Consequently, **many co-operatives and peer-to-peer production platforms have emerged** to serve a wide range of purposes: banking (e.g. peer-to-peer lending platforms), do-it-yourself equipment, food production and distribution, transport, energy production and so on.

Thanks to the development of social media, **crowd-funding has also emerged as an increasingly used funding mechanism** for a range of purposes. Not only is it employed to start businesses or bring novel products to market, but it also helps public authorities finance infrastructures, often for local communities, and funds research and development initiatives originating from civic movements. Within this context, **alternative currencies also find fertile ground** in which to develop. They are used by various groups to secure local businesses and increase social cohesion, and are a sign that groups engage in social innovation for their own benefit. **Bottom-up initiatives influence the evolution of society** to a large extent. What used to be called 'ethical finance' or 'sustainable finance', and accounted for a few percent of the financial sector in the 2010s, has largely become the mainstream financial system.

Demand and behaviour are still mainly influenced by market signals, although the markets themselves are strongly influenced by societal norms, public attitudes and policies. Well-informed consumers promote the application of high ethical and environmental standards for the products and services they consume. This has caused changes in the way private companies operate and has promoted a general increase in safety standards and more sustainable and responsible modes of production. Industries are still motivated by profit but are very aware of the **new social norms and demands as well as of the new modes of consumption**. Society has high ethical norms and strong demands concerning transparency. It is also promoting collaborative processes of resource allocation (e.g. fair access, compensation, etc.). **Many initiatives are driven by social groups**, ranging from sector organisations to consumer groups. In response, businesses are putting their CSR agendas at the core of their strategies. In such an environment, **best practices and voluntary standards** elicit a much higher following than in the past, sometimes reducing the need for binding legislation. The economy has become more service oriented than it was two decades earlier.

Groups influence consumption patterns and fashion, which then according to changes in the relative influences of the various groups in society. Collaborative solutions are being developed to care for the elderly.

8.1.3 INDUSTRIES IN 2035

DYNAMICS

Global population growth, coupled with continuous economic development, has led to a large global increase in the demand for raw materials. A few temporary shortages have arisen and the general trend for raw material prices is now upwards, except for fossil fuels. This is in spite of significant technological progress that led to a general increase in resource efficiency. In Europe, this has resulted in the emergence of several trends affecting eco-industries:

- **A trend towards more resource efficiency**: technology development, a rise in urban mining, decrease in waste production, increasing

application of eco-design paradigms (lower-use phase energy consumption, easier repair/recycling), trend towards self-sufficiency for basic needs (group based, at local level, focused on food and energy);
- **A move towards more integration, but at local/regional level**: development of smart infrastructure, development of industrial or other 'symbioses' (e.g. eco-neighbourhoods), distributed/small-scale manufacturing, more community involvement in local solutions, adaptation of local infrastructures to increase resilience and adapt to climate change;
- **Collaborative developments at various levels**: Public-Private Partnerships (especially for infrastructures), business initiatives based on sharing, increased CSR, rise of crowd-funding;
- **Development of local sustainability initiatives**: growth of community-owned businesses/utilities and of local food production/urban farming; new business models based on alternative (local) currencies, more niche, natural selection of business models/products, adapted solutions, 'small is beautiful'. The Transition Towns movement expands;
- **More environment and health protection**: societal solidarity, the move towards sustainability leads to a general decrease in environmental pollution with side benefits for health (fewer chemical contaminants, less air pollution, less noise).

In brief

Pulled by a strong demand, eco-industries are flourishing on an ad-hoc and local/regional basis:
- Development of regional eco-strategies and industrial symbioses;
- Rise of crowd-funding schemes and people-private-public partnerships (PPPP);
- Development of group-based sustainability and self-sufficiency initiatives at local level;
- Increased connection between environmental and health-related activities.

Current examples

- In **Hamburg**, citizens are in the process of **taking over their local grid** to deliver cheaper electricity;
- **Across Europe and the USA**, communities are looking to half electricity costs by having **the right to buy their own energy** at wholesale (rather than retail) prices;
- In **Denmark**, 90 % of wind turbines are **community-owned**, with the benefits retained entirely by localities;
- An **international array of towns and cities** is already looking to become energy independent by combining **community ownership of energy generation, distribution and storage with their own agendas for energy saving.**

ELEMENTS OF THE INDUSTRIAL LANDSCAPE

Large companies and strong corporate interests remain dominant, but there are also local co-operative initiatives. Pressure for local sourcing is impacting supply chains. New manufacturing technologies are reducing the importance of scale, and niche markets are growing.

There is a **balanced industry in terms of private and public ownership,** with public participation at local/grass-roots level. Municipalities are playing an active role. Corporations push strongly on the issues and technologies they consider to be the most promising in terms of future business potential. There is some regulatory development, but it is moderate as national governments are weak.

The **use of services is increasing** and group-based demands are growing. **Business is adapting to new demands,** both in terms of CSR and from the market. **Public and private R&D are equally important,** and the private sector has a strong coordination role.

In this scenario, on the one hand there is plenty of networking going on, while on the other hand, societal organisation in groups is leading to groups integrated locally but with few external links. CSR is now being pushed by society, with a significant demand for transparency and for new reporting beyond financial data.

There is a diversity of employment models and flexibility in employment. Regional support for employment is commonplace. **There is a trend towards the greening of value chains in business through** reactive eco-optimisers, although there is no overall strategy at market or societal level. Farmers markets are increasing.

In brief

The overall industrial landscape is much more fragmented geographically and more heterogeneous than in the past in terms of size of companies and origins of investments (i.e. public vs. private vs. crowd). Business is very demand-driven and service-oriented, and CSR is now demanded by society.

Examples of emerging business models

- **Bio Intelligent Quotient**, a standard for smart material buildings in Hamburg, Germany;
- **Kalundborg Symbiosis**, a pioneer in industrial ecosystems in Kalundborg, Denmark;
- **Repowering London**, a community-owned renewable energy project in Brixton, UK;
- **'Our Hamburg, Our Grid'**, a citizen initiative which led to the municipality taking control of the local energy grid in Hamburg, Germany.

ECO-INNOVATION

In a collaborative society highly conscious of sustainability issues, but where fiscal frameworks do not allow for strong public R&D and infrastructure investments, eco-innovation patterns are more scattered and originate from a wide range of actors, starting from individual manufacturers, community-based fab labs and SMEs to large companies and public institutions.

Enabled by local innovation networks and new funding schemes, social innovation is at the source of most initiatives contributing to the transition towards a more sustainable economy.

Firms practice open innovation much more than in the past. Companies actively engage with universities to find the highly skilled and creative profiles required for building eco-innovative solutions. They create schools within their premises, funded with the support of Euroregions. Massive Open Online Courses (MOOCs) contribute significantly to a higher level of education throughout society.

Collaborative product design and development. Gaming, idea competitions, incentives, product/service/software development platform. A mix of open source and open innovation. Open source communities act as innovation intermediaries. Ideas banks.

POLICY ACTIONS TO PROMOTE SUSTAINABILITY IN COHERENCE WITH THIS SCENARIO

☐ **Research and innovation**
prioritise policy interventions in a very heterogeneous European eco-innovation landscape, foster open innovation and civic science, and create synergies between many entities of actors, fields and local initiatives;

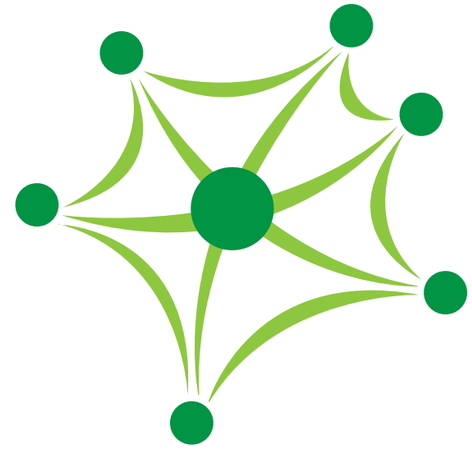
☐ **New business models**
foster clusters of activities and partnerships along the value chains (e.g. through green public procurement), and promote a new European business culture to develop sustainable modes of production and consumption;

☐ **Education**
support new, inclusive educational models and lifelong learning opportunities to raise environmental awareness and help build consensus throughout European society on long-term visions on sustainability, and align skills and talents with demand;

☐ **Transparency**
establish and use transparent governance models to ensure trust between governments, local authorities, companies and citizens, in particular in the field of natural resource management and new business models;

☐ **Regulation**
engage citizens in the design, implementation, and evaluation of outcome-driven regulation based on a shared prioritisation between all environment-related issues;

☐ **Employment**
merge education, employment and social security policies to foster the creation of new green and social job opportunities for youth and unemployed people.



scenario 2

Shared Circular Strategies

- **Collaborative society**
- **Fiscal framework highly supportive of sustainability**


Ministry of Sustainability
CENTRAL RAIL STATION
district school
VAR GIAEVER
district
Co-op Grocery

8.2 SCENARIO 2 | SHARED CIRCULAR STRATEGIES

8.2.1 HOW WE ENDED UP IN THIS SCENARIO

The blunt messages from the IPCC reports released in 2013 and 2014 triggered a raft of discussions at all levels. In the following years, a number of **devastating weather events** coupled with the rapid disappearance of Arctic ice focused minds. It became clear even to old established industries that business as usual was no longer an option. By the late 2010s, governments the world over finally reached an agreement. However, diverging short-term national economic concerns prevented this agreement from including more than **modest binding GHG emissions targets**.

By that time, in the EU, people recognised that the international targets were still insufficient to keep climate change even below 3°C while the impacts of climate change were of dramatic proportion. In some countries, unemployment was becoming chronic. In addition, geopolitical pressures pushed the EU to drastically reduce its dependence on energy imports. Faced with these combined pressures, by the 2020s, European citizens had given a **broad mandate to the EU** to rethink the economy. **Policy-makers then set long-term visions** on sustainable development. This led to Treaty changes and to the emergence of bold European fiscal measures to address sustainability and tackle unemployment without waiting for corresponding international agreements. In 2035, green taxation is in place, and levies and taxes on labour have been lowered significantly. Governance has evolved towards more service for the citizens. As a consequence of all these decisions, the **EU has pulled out of existing free-trade agreements selectively and strategically.** This has affected international trade, promoting shorter chains and putting pressure on 'dirty" trade. Economic compensation mechanisms were installed at the EU borders to avoid unfair international competition, especially from the US, China and resource-rich countries, bankrupting EU companies. The reaction of multinational companies has been diverse.

The collaborative nature of the society translates into **strong and widely shared values** that structure the way people behave but create peer pressure. The relentless developments in ICT in recent decades have **empowered individuals** as never before: they are now well informed, they can mobilise large groups quickly and they easily engage in conversations with authorities and commercial actors. However, this tends to reinforce peer pressure. Data availability and genetic information has stimulated the **development of personal health management**. Comprehensive, cross-sectoral policies for health promotion and health education are in place.

Digital natives, also known as 'millenials' or 'Generation Y' are now in positions of influence. The strong intellectual property rights that were still slowing innovation down in the 2010s have been relaxed to give the best possible chance to the EU economy to find new stimulus. **Openness and sharing** are the new mottos, with an overwhelming sense of wanting to work collectively to create a sustainable economy and survive. As people recognise the strength of collective action, the Euroscepticism that almost destroyed the EU in the late 2010s has receded and central authorities now retain significant power. They decide on broad societal issues and engage other players on the international scene but operate in a transparent way under the concerned watch of the citizens. Many decisions with local implications have been devolved to lower rungs of decision-making but within strict boundaries regarding sustainability. Widely used **social media have redefined subsidiarity**.

8.2.2 SETTING THE SCENE

A green European economy

The warnings of the 2013-2014 IPCC reports and the subsequent **devastating weather events** in Europe acted as shock therapy, winning most minds across the continent, mainly through a sense of fear. New political leaders emerged who took decisive measures and **set long-term visions** on sustainable development. Governance moved back towards a top-down approach and a managed 'survival' economy. The resulting collaborative nature of society is an earnest realisation that **solidarity on a broad basis is humankind's best chance for long-term survival**.

It is in this context that the Generation Y leaders are implementing **openness and sharing** and Euroscepticism has receded. They decide on broad societal issues and engage other players on the international scene but operate in a transparent way under the concerned watch of the citizens. Consensus and peer pressure have made it easier to devolve many decisions with local implications to lower rungs of decision-making.

As European society has grown very concerned about sustainable development, with a strong sense of urgency, **bold policy measures** have been taken to make the EU economy greener and more resilient to climatic events. This has removed some geopolitical vulnerabilities of the EU. Following further treaty changes, the EU rolled out a very "green" tax system without waiting for corresponding international agreements. As a consequence, the **EU pulled out selectively and strategically of existing free-trade agreements**. Mechanisms of economic compensation were installed at the EU borders in order to avoid that unfair international competition, especially from the US, China and resource rich countries would bankrupt EU companies.

Strong social movements in the EU, some global, are **pressing for ever-lower environmental impacts** from human activities, promoting sharing and collaboration, demanding sustainable procurement, and requesting 'circular products'. To a degree, they influence the development of infrastructures and the behaviour of all stakeholders. Under these circumstances, **technology has evolved to become increasingly open source**. The ageing society is also very conscious of health and of the links between environment and health. The general fall in pollution as a consequence of resource efficiency is beneficial in that respect and technology are helping people to take better care of themselves.

The consumer market has changed compared to 25 years ago – **people are now used to sharing** tools, equipment and facilities. **Many companies which used to sell products now sell services** derived from their traditional products. These products, now redesigned, remain in their ownership (clothing, lighting, home furnishings, etc.).

In health care, instead of paying for each medical consultation and each dose of medicine, **patients are reimbursed on the basis of flat rates for therapies**. As medical costs are mostly covered by social security systems and insurance companies, the interest of these stakeholders lies in keeping costs down and making therapies efficient. Pharmaceutical companies no longer have an incentive to increase profits by selling more doses of medicine, and doctors no longer have an incentive to prescribe more medical tests. This reduces the over-consumption of medicine and the performance of unnecessary medical interventions, resulting in lower social security costs and better health care. Across the board, **the trend is towards stimulating the application of best practices and away from business models linked to material consumption**.

Integrated solutions flourish, creating many network effects. Thanks to progress in additive manufacturing and agricultural technologies, in particular biotechnology, **to a large degree, production and consumption in the EU is local**, resulting in **less material dependency** on other regions in the world. Specific policies address critical raw materials that still have to be imported from outside Europe. **Green procurement has become the norm**. Thanks to the relatively high prices of agricultural commodities on world markets, the EU has increased its food exports.

Regulated trade and immigration

Due to a series of climate-change-induced catastrophes after 2015, world leaders accepted binding GHG emissions reductions, although more efforts are still needed. Most green taxation initiatives around the world remain mild. **Embracing green taxation has given the EU a new clout on the international scene** that has unlocked both further negotiations on GHG emissions and a new round of trade talks. In order to maintain its socio-economic model, the EU has set a **new import/export regulation system**. Import duties are levied on goods that are not manufactured according to the EU-agreed best available techniques or which come from countries that do not apply the same levels of taxation on energy or raw materials. Similarly, targeted export subsidies are used to counteract tariffs applied by other countries.

The international debate on green taxation is raging with old liberal market ideas still going strong in some countries. Promoted by the EU, a new kind of tax is being mooted at international level to be applied to both non-renewable resources and overexploited renewable resources,

such as certain fish and tree species. **Strong competition for natural resources is shaping international agendas**. An internationally agreed and monitored compendium of all main natural resources is the basis for raw material prices on international markets. Non-renewable resources are priced according to demand relative to proven reserves, and renewable resources are priced according to demand relative to renewal rate. In this general context, **the WTO has become largely irrelevant** with discussions taking place on either changing its remit radically or replacing it by a new international body in charge of aligning trade rules closely with sustainable development goals. It seems likely that international free riders are still making the introduction of a Tobin tax on financial transactions look remote.

The **issue of migration has moved to centre stage** on the international scene. Severe coastal erosion in some countries, and repeated floods and droughts in certain important agricultural areas coupled with strong population growth have created acute problems in various regions of the world. With its still excellent quality of life, **the EU is perceived by many as a desirable target for emigration** at a moment when the effects of an ageing population are weighing heavily on the EU economy. As a consequence, policies and public perception of migratory movements have become more pragmatic than in the 2010s as regards the securitisation of the migration debate. However, some social groups maintain a strong resistance to immigration, and the social issues linked to mass immigration require strong policies.

Nevertheless, at the international level, **the EU has signed collaboration agreements with some countries** of origin and of transit **to manage migrant flows**. **EU aid is targeted towards economic development to prevent emigration** but nonetheless, quotas of migrants from developing countries to Europe are higher than they were two decades earlier. The number of non-EU students accepted in European universities has also increased in the hope that they will facilitate knowledge transfer by moving back to their countries of origin, thereby increasing the potential for eco-industries and sustainable development back home.

World food production systems are increasingly vulnerable for three main reasons: increasing disruptions due to climate change (erosion, changing weather patterns), growing demand resulting from population growth, and urbanisation, leading to the loss of agricultural land. This means that the usual patterns of exporting and importing regions are being disturbed. The export of surpluses from some regions are still used to compensate the deficits in others, but the unpredictable effects of climate change mean that different regions are affected every year, resulting in local famines and very variable food trade patterns. Occasionally, this is used as means of pressurising in geopolitical games.

Sustainable strategy with green taxation

In the period 2015-2020, unemployment in the EU remained high, especially among the young, and GDP growth remained subdued. In 2018, a final IPCC report provided the material to convince the last sceptics of the man-made nature of climate change and of its likely catastrophic consequences in the long-term. Combined with the **desire to end unemployment** and with the coming of age of mobile ICT, this created a new societal consensus. Mainstream political parties abandoned part of the old right/left rhetoric and embraced **new collaborative solutions**. In particular, the interdependence between ecosystems and the economy became clearly recognised.

This gave credence to a new generation of politicians more willing to engage in **economic renewal**. The need to drastically reduce both GHG emissions and the use of resources, alongside a chronically high level of unemployment made the conditions ripe for a radical economic rethink. Having despaired of reaching stricter binding targets at the international level, taking advantage of the sharp fall in oil prices in 2014-2015, and very conscious of the geopolitical and economic advantages that it would acquire, the EU decided to go it alone and **embraced green taxation wholeheartedly**. The purpose: to **reduce emissions, reduce imports of energy and raw materials and address unemployment**. This led to lower taxes on labour to tackle unemployment and to keep service companies competitive.

In addition, the EU enacted a raft of binding legislation on energy and resource efficiency based on steadily improving best available techniques. Under pressure from European public opinion, EU leaders decided to **set up cost compensation mechanisms at the EU borders** in order to avoid unduly hampering the international competitiveness of EU companies. Significant efforts were made to boost public R&D spending in the EU to 4 % of GDP.

Green public procurement has become the norm and now gives EU companies a **competitiveness boost**. These radical policy changes coupled with new long-term societal visions and a strong sense of purpose in this collaborative society have ushered a rapid adjustment of both European society and its economy, which is now more integrated than ever.

As the **EU economy is adapting very quickly to the 'green' tax system**, this system must be very **dynamic**. It adjusts tax levels frequently to keep public finances afloat. This adjustment occurs following transparent rules and principles so that economic actors can continue to follow **long-term strategies** in line with sustainable development. **Economic decisions are no longer taken on the basis of GDP figures and trends alone**. Financial data are complemented with comprehensive **social and environmental accounts**. In any case, socio-economic well-being is now clearly disconnected from the evolution of GDP. **Keeping labour costs low is a priority** as employment in manufacturing has virtually disappeared following an explosion in the use of robots. Most people now work in services and unemployment remains a challenge.

Resilience and environmental sustainability have become the core objectives underpinning EU policy development, with equal importance given to economic and societal aspects. **Many material loops in the European economy are now almost closed**. High levels of energy and material consumption by either industry or private users are frowned upon. New billing strategies have been introduced that increase unit cost as consumption increases, reversing past practice of decreasing unit cost as consumption increased. Similarly, in shops, marketing tactics, such as selling three for the price of two, have become socially unacceptable. More and more products, especially food, can be bought in amounts determined by the consumers to **avoid waste**, helped by smart and connected appliances. Fixed package sizes that pushed consumption have disappeared. Consumers can bring their own reusable containers to most food shops.

The worsening effects of climate change and increasing raw material prices in a connected European society has given rise to a new sense of purpose and **new forms of solidarity**. **Euroscepticism has receded**. Fora for second- (or third-, fourth-…) hand items are very active; citizens are more involved in local and European politics, contributing badly needed reality checks in political discussions. **The collaborative economy is in full swing**. The rapid strides towards energy and resource efficiency have made the **EU much less dependent on international markets for raw materials** and hydrocarbons, resulting in both economic and geopolitical benefits.

Green taxes favour renewable energy but the fast roll out of solar and wind energy during the first decades of the 21st century has slowed down. These sources of energy are reaching the maximum of their potential without having covered all energy demand. Fossil fuel use remains indispensable. Therefore, **new low-carbon energy technologies must be mobilised** to achieve the lower targets for GHG emissions. This has relaunched the **debate on the role of nuclear energy**, especially in light of new, safer and more modular technologies (Generation 5).

Green markets have matured. There is a single market for renewable energy and access to it. The use of both public and private space for renewable energy production is creating specific interest and profits. **'Urban mining' is now common practice**, with 'waste' materials still considered of value. Communities are keeping an eye on this waste to avoid theft.

As a result of green taxation, environmental sustainability requirements and the consequences of climate change, **food prices in the EU have increased**: they are now higher in relative terms than they were in the 2010s, stimulating the adoption of better diets. Agricultural production in energy-intensive greenhouses in the north of Europe has decreased significantly except in places where biogas and geothermal energy can be produced in sufficient quantities. Overall, the **food available on the markets is more local and more seasonal** than it was 25 years ago. **New GM crop varieties have gained public acceptance** and have increased the range and growing seasons of many fruits and vegetables. Agriculture is now as important as a source of renewable raw materials as of food.

Trading of shares, bonds, real estate or commodities as well all their derivatives follows a very strict code of practice addressing **transparency**, rights and responsibilities regarding ownership, **ethical issues and sustainable development**.

A new planning culture

Discussions on urban planning and infrastructure development are attracting a lot of attention and are strongly oriented towards resilience and sustainability. **Immediate threats from rising seas** to Amsterdam and Venice resonate with the public. Climate change is starting to threaten not only European cultural heritage, but also European harbours. Under pressure to adapt, citizens become more forward-looking within a **common interest perspective**. While keeping central decision-making power in check, this helps **in taking decisions with significant long-term benefits** for society.

Consensus on urban planning is facilitating the development of industrial symbioses, helping to reduce the overall environmental impact of European industry and to **develop efficient transport infrastructures**. Car-sharing schemes have become widespread as the development of mobile IT has made them very practical. Other **web-based applications make it possible to share** tools, objects, facilities or infrastructures in a much more efficient way than was possible two decades ago. This leads to quick dematerialisation of economic activities. This trend away from ownership of equipment has favoured **the poorer parts of the population** as the investment barrier has been removed. For example, access to the convenience of a car or any other expensive equipment no longer requires a large investment upfront.

Populations living in vulnerable areas (e.g. exposed to sea-level rises or in easily flooded regions) are being encouraged to move to safer areas. With their strong tradition in looking to the future and estimating financial risks, **insurance companies have been a major force behind offering incentives to change public and private investment decisions**. The **cost of insurance policies in accordance with new risk calculations** has become a strong incentive to rethink old habits. As a result, innovations such as floating cities in low-lying coastal areas have become commonplace.

State systems are optimised and flexible. Thanks to technology, **state functions have become more transparent** and are subjected to regular quality reviews. This development in e-government has resulted in **greater trust on the part of citizens**. People are happier than they were 20 years ago. Direct democracy works well for some initiatives but consensus is difficult to reach on others.

Following the wave of privatisations between the 1980s and the 2010s, **ownership of most infrastructures and public services is back in either public or not-for-profit hands**. Infrastructure is generally run with high transparency regarding ownership, costs and profit creation.

From life-cycle design to new lifestyles

Products are usually designed now to be durable, shared/reused, repaired and recycled. **Life-cycle thinking at the design stage** also takes into consideration a product's consumption of energy and resources during production and use as well as at the waste stage. This is affecting the success of products on the market as green taxation is weighing on energy and resource consumption. **This is a major driver for technological development,** in addition to public R&D spending. There is a high rate of innovation and R&D has also come to mean redesign and durability.

Due to the high price of raw materials, relatively lower labour costs and an ageing population, **the service economy is booming**. Mobile services, robotics-based support functions, virtual reality, artificial intelligence, e-health applications and other technologies have multiplied the range of services that can now be offered. Thanks to enhanced virtual reality, better videoconferencing capabilities and more powerful mobile technologies, telework, or **'remote' work has really taken off**. In combination with smarter transport technologies, this evolution has reduced rush-hour traffic significantly compared to 20 years ago. It has also enabled **more people to work freelance and share their expertise** with a wider range of users. As a result, combined with the disappearance of traditional manufacturing employment, the shape of the job market has been transformed. There are **few '9-to-5' jobs now but many occupations, often combined, which allow people to earn a living**. Many people even earn their living by pursuing several occupations in parallel.

The general increase in transparency and the weakening of intellectual property rights while public R&D was growing have led to a lot **more open innovation**, in particular to take advantage of the vast amounts of data and information being generated. However, administrative barriers to innovation still have to be addressed.

The combination of favourable political, social and fiscal environments has led to a **boom in green technologies, green business models and green initiatives,** making European players leaders on the world markets. Even the financial sector has evolved. A significant share of capitals is now being invested for the long term in **sustainable and responsible financial products**. The insurance sector has been a precursor.

Resource compendium and resource efficiency

The pressure on international markets for critical raw materials, the rising prices of raw materials in general, and green taxes have created very strong incentives for the development of technologies and approaches in the EU to **keep material consumption to a minimum**. As a result, the non-recoverable fraction of waste has shrunk dramatically: most former waste streams are now used as sources of **secondary raw materials**. Thanks to progress in biotechnology, the biological fraction of waste can be recovered to a large extent to produce **biological feedstocks** that are renewable, for energy and green chemistry purposes. Historical landfill sites are being mined using very efficient technologies. All this results in fewer imports of raw materials from outside the EU and **increased resource security**.

Many material loops are being closed and practices such as exporting waste to developing countries have ceased. **Specific waste streams**, in particular electric and electronic waste, **have become critical sources of raw materials**. Raw material imports have been radically reduced but oil and gas imports, while much lower than 20 years ago, cannot be eliminated yet. For some critical raw materials, such as some rare earths, the EU is still largely dependent on imports.

Mineral resources are priced in accordance with their relative abundance, the energy intensity of their extraction and the sustainability of their use. An internationally agreed compendium of all natural resources serves as the basis for this pricing, compiled after a thorough and elaborate review of all tradable resources worldwide. This was made possible by strong developments in sensing, monitoring and communication technologies in the 2020s, making **real-time monitoring possible along the whole use chain**. Telecommunication networks, the Internet of Things and mobile technologies make it possible to monitor precisely all flows of materials through the economy, increasing transparency and making it possible to optimise resource use continuously.

Smart systems ensure optimum use of resources at system level (e.g. transport, energy, industrial logistics, etc.). **Novel energy-storage technologies** have started to make smart grids really efficient and able to take full advantage of intermittent and distributed sources of energy. **Only passive or positive energy buildings are being built**. An active policy is in place to upgrade older buildings to the highest possible energy efficiency standard, helped by the green fiscal policy.

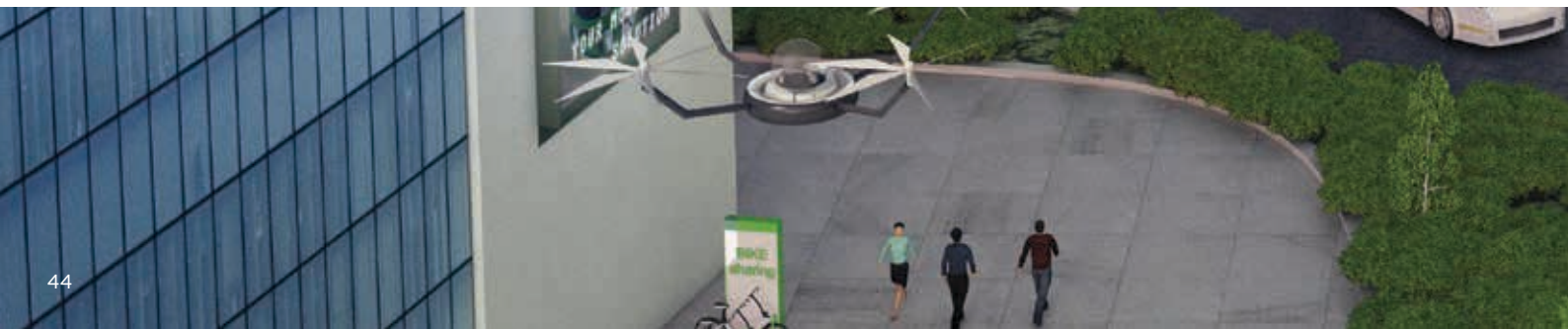
A very welcome side benefit of this drive towards resource efficiency is a **general decrease in pollution and improvement in ecosystem services**. Cleaner air and water not only result in a significant improvement in public health, but also lead to lower clean-up and treatment costs.

Integrated and networked solutions

The reduction in the mass of products sold, coupled with higher long-distance transport costs (especially road transport) and the development of ICT, robotics and additive manufacturing have led to a **decentralisation of manufacturing**. Objects for personal consumption now tend to be manufactured close to where they are sold or used, whether they are sold directly to the consumer or purchased by service providers.

The combination of a collaborative society and green taxation has stimulated the **development of integrated and collaborative solutions** significantly in both public and private spheres. The main reason is that well-designed integrated systems are both more sustainable and more resilient than individual solutions. **Powerful and ubiquitous IT platforms help this integration** across the board.

The collaborative society has also stimulated the development of **smart infrastructures** for telecommunications, transport, energy production and distribution, logistics, etc. **Deliberate strategies have been adopted to generate synergies deriving from network effects**. This often transcends particular interests from certain social groups. Groups can also use crowd-funding to kick-start the construction of infrastructures that authorities do not have the means to fund on their own.



Local organisational multi-hubs are often used by the growing number of community-owned businesses and flexible freelancers. **Eco-neighbourhoods**, first experimented with in the early 2000s have become very popular as a sustainable form of social housing outside large cities.

This networked world influences the behaviour of companies both at the global and local levels.

Widespread smart services

As the relative cost of labour vs. materials has decreased, **new business models have burgeoned**. More and more companies now peddle their **services** rather than their products. Even though these services still rely mainly on products, they have become very high-tech, green, often 'smart' and connected through the Internet of Things. Ownership remains with those companies providing the services. While companies used to rely on the sales volumes of products to generate cash flow, they are now generating their profits from **selling high-quality services**. Therefore, while product durability could previously work against company profits, **the durability, reliability and frugality of products have become assets** in a services-oriented world. Economic paradigms have changed radically, except maybe for food distribution. This has created an **incentive to build long-term relationships with customers** and has widened the scope for customer feedback to keep improving services.

This universal 'connectedness' of many products and appliances is creating **privacy issues**.

Legal definitions of ownership and right of use are in place to regulate the **dematerialisation of consumption**. Demand and behaviour are largely driven by:

- **Societal values** oriented towards social and environmental sustainability;
- **Price signals** given by economic fundamentals and fiscal policy;
- **Legislation**, now often influenced by behavioural insights.

Respective rights and duties in service contracts and accounting standards have been adapted to the new circumstances.

In this society, **status has fewer links with material wealth** than in the past, and **more with influence and fame**. Technology has also enabled people to have more time and to become less stressed. In particular, the stress of commuting has been largely eliminated (better connectivity, smarter transport systems, more teleworking). **The concept of 'shopping', a symbol of the consumption society, has been radically altered**. Buying is mostly online, and often for services.

A sizeable proportion of food is bought through **local markets**. Efforts are being made to source as much as possible as near as possible, in order to save resources. Robotics and additive manufacturing have made mass customisation possible, giving people a new way to express their personality.

The **ageing of society** is also resulting in a general lowering of consumption and is pushing the service economy further: old people like culture, need advice and use personal help when they are physically impaired. However, advances in information technology, medicine and robotics have enabled people to stay active and healthy longer, leading to the emergence of a 'silver economy', with adapted products and services. This is helping older people to be an active part of society for longer.

8.2.3 INDUSTRIES IN 2035

DYNAMICS

Under this scenario, all eco-industries operate within a very favourable framework with respect to technological development, economic incentives and social acceptance. As a result, they are all flourishing. Trends in infrastructure adaptation and development are also the most favourable, making the transition to a sustainable economy the fastest of the four scenarios. Variations between different regions can be explained largely by local specificities.

- **A strong trend towards adaptation to climate change:** this is strongly supported by the combination of the collaborative nature of society and the politico-economic context. The increase in public investment for adaptation to climate change (e.g. large infrastructures), while generating intense debate among the various constituencies in society, end up being supported by a wide consensus. Some initiatives even benefit from crowd-funding.
- **A strong trend towards mitigation of climate change and energy efficiency**: investments in mitigation (commonly agreed targets at the UN

global level) are resulting mainly from the economic signals provided by the market and fiscal policy. Most externalities are internalised. This has helped in the creation of an EU single market for energy underpinned by a robust smart grid in which, on average, renewables cover 50 % of demand. Social support is strong for infrastructures that are seen as contributing significantly to sustainability. Conversely, demand for fossil fuels is down, which is hampering investment in back-up facilities of sufficient scale. This in turn is making fossil-fuel-based electricity generation expensive, thereby accelerating the trend away from fossil fuels.

- **A trend towards more resource efficiency**: technological development, more urban mining, less waste production, increased application of eco-design paradigms (lower-use-phase energy consumption, easier repair/recycling), and a trend towards self-sufficiency for basic needs (group based, local, focused on food and energy). The waste industry has been transformed by 25 years of innovation for waste reduction, recycling, material efficiency and the development of service-based business models. True waste management is now a minor line of business. The focus is now on material extraction and recycling and energy recovery from all kinds of materials from industrial, agricultural and domestic activities. Almost all new buildings are now either passive or 'positive energy', and embed the latest innovations. In general, innovations have led to products that are a lot more frugal than they used to be: priority is being given to robustness, longevity, frugal operation, etc. The business environment has become very favourable to life-cycle thinking.
- **A trend towards more integration throughout the economic system**: development of smart infrastructure, development of industrial or other 'symbioses' (e.g. eco-neighbourhoods), distributed/small-scale manufacturing, more community involvement in local solutions, adaptation of infrastructures to increase resilience, information exchange platforms and standards (footprint, person to person, person to company), networked companies, and fully integrated companies.
- **Collaborative developments at various levels**: development of Public-Private Partnerships (especially for infrastructures), business initiatives based on sharing, increased CSR, rise in crowd-funding, cooperatives. This may increase access to services and products for less-well-off socio-economic groups. It could even have beneficial effects on the integration of migrants. New service-based business models are growing in importance.
- **Development of local sustainability initiatives**: growth of community-owned businesses/utilities and of local food production/urban farming, New business models based on alternative (local) currencies, more niche, natural selection of business models/products, adapted solutions, SMEs, a shorter food chain, and more local, transport.
- **Quality of life (environment, health protection)**: more environment and health protection/promotion, solidarity, (borderless)/work less, better work/free-time balance.

ECO-INNOVATION

All sectors of the economy operate within a framework which is very favourable to eco-innovation with respect to technological and regulatory developments, economic incentives and social acceptance. Investments in infrastructure adaptation and development make for a swift transition to a sustainable economy. Local specificities give rise to adapted solutions. Technological and social innovation work hand in hand.

ELEMENTS OF THE INDUSTRIAL LANDSCAPE

Overall, there is a coherent, if forced, strategic evolution towards sustainability.

Large companies and strong corporate interests remain, but they have developed close links with small suppliers and distributors in an attempt to keep value chains as short and sustainable as possible. CSR has become a core part of large companies' business strategy, largely due to new non-financial reporting obligations. Co-operative businesses are on the rise and numerous green innovative start-ups are emerging. IT systems are being developed to support this trend.

The public sector has extended its place and role at all levels from local to EU-wide, with a robust top-down influence and many regulatory developments. Encouraged by public authorities, the **use of services is high**, with the corresponding business developments. There is also a strong policy push **towards the greening of value chains in business.**

Public R&D plays a very strong role, opening fields for the private sector to invest in, especially energy and resource efficiency, renewables and infrastructures, eco-design, etc. Frugality is on the rise.

There is diversity in employment models and flexibility in employment.

There is an active policy to engineer sustainability at the macro level and in particular a push for industrial symbioses and a major shift towards the use of renewable resources.

POLICY ACTIONS TO PROMOTE SUSTAINABILITY IN COHERENCE WITH THIS SCENARIO

- ☐ **Research and innovation**
  more research to better understand the dynamics of natural resources and reduce their dissipative use. Improve understanding of material flows and products in a life-cycle perspective to feed policy action and reduce rebound effects. Foster open innovation and open science, and create synergies between many entities of actors, fields, and local initiatives;

- ☐ **New business models**
  foster service-oriented, non-price business models adapted to a business environment with high taxes on raw materials. Promote a new European culture to develop sustainable modes of production and consumption through business and social innovation;

- ☐ **Natural resources management**
  develop an ecosystem-based governance approach for natural resources supported by a novel set of indicators to monitor flows connected to 'green GDP'. Need for a systemic view;

- ☐ **Education**
  need to meet the needs of an evolving labour market with a long-term outlook. Lifelong learning is important for lifelong employability;

- ☐ **System integration**
  as in this scenario, there is a clear sense that the whole is bigger than the sum of the parts, and there is a need to bring coherence into systems across the board in a systemic way. The development of industrial symbioses can be seen as an example of this;

- ☐ **Employment**
  in view of the top-down nature of this scenario, it is important to develop tools to manage the employability of people and to increase 'green' skills.

scenario 3

Compact Green Innovation

- **Individualistic society**
- **Fiscal framework supportive of sustainability**


CENTRAL RAIL STATION
TECH SCHOOL
QUANTI ROBOT
RESEARCH CENTRE
30
30

8.3 SCENARIO 3 | COMPACT GREEN INNOVATION

8.3.1 HOW WE ENDED UP IN THIS SCENARIO

In spite of their clear messages, the 2013 and 2014 IPCC reports did not have much short-term policy impact. The **very slow recovery of the European economy** in the years following the 2008 financial crisis impacted on the efforts to invest for the future. Banks were still consolidating their balance sheets in line with the new financial rules and continuing pressure to reduce public deficits prevented governments from embarking on bold investment plans. The savings on social expenditures that followed the financial crisis continued and, combined with the ageing of the European population, led progressively to a significant **weakening of social protection systems**. The failure of the EU economy to pick up led to **persistent high unemployment and an increase in inequality**. People started to become more selfish, fending for themselves. The unemployed were concerned with short-term survival, the people in work were concerned with losing their jobs and many were trying to evade a heavy tax burden. As solidarity mechanisms weakened, social unrest began threatening political stability. **Calls for reducing the cost of labour** were getting louder. Something had to be done.

By the early 2020s, the decision was taken to **profoundly reform the tax system to address the chronically high level of unemployment and foster the development of a sustainable economy**. Following a **fiscal 'Big Bang'**, company contributions per employee and taxes on income from labour were reduced drastically, and compensated for by much higher taxes on material and energy consumption and on financial transactions. The continuing pressure to reduce national debts prevented an increase in social spending or embarking on bold investments, but green procurement was reinforced as it tended to lead to lower running costs. A coincidental catastrophic hurricane season focused minds and made the shift an easy political sell. **Sustainable behaviour came to be seen as a sound economic and social paradigm**. Governance, in the hands of proponents of a 'small government' approach, became more pragmatic.

Older people are at a disadvantage as they are perceived by the younger generation as being responsible for climate change, and economic pressures are making the pensions they were promised unaffordable. The **weakening of social protection** systems and the clash between generations as the millenials moved into positions of authority led society to evolve towards individualistic values.

European **society is now business-driven, technically advanced, and great at paid services**, with many SMEs forming a major part of the economy. **Society is also highly innovative**, where innovation has moved from big government projects to smaller business, combining high technology and frugality, often taking advantage of connectivity and web-based networks.

8.3.2 SETTING THE SCENE

Towards a greener and more urban market economy

By 2035, the fiscal Big Bang has started to show its effects. It unleashed a wave of societal transformations and technological innovation. The need to fend for themselves has made the digital natives **creative and innovative** with a resulting clash of generations. They use all connected resources for their own advancement and respond to the new market signals by developing **small businesses oriented towards services** for other people and/or for resource and energy efficiency. The low-skilled work in menial service jobs and the social sector has become a significant provider of jobs. Large companies have adapted. There is a strong trend towards frugal i**nnovation**. Selling points now focus on **energy and material efficiency, durability and recyclability**. As the materials embedded in end-of-life products have become more valuable, some companies are developing business models to make sure that they will recover and valorise their own products at the end of their life. This provides them with a **steady stream of secondary raw materials** of known quality that they can easily recycle into new products. One way to achieve this is through deposit schemes (you get money back if you bring the product back); another is not to sell products, but to sell the services linked to those products (e.g. lighting,

carpeting, propulsion). Since **waste disposal and virgin raw materials are heavily taxed**, recovery schemes represent costs savings but expensive waste disposal and high prices for materials are creating economic incentives for illegal waste disposal and theft of secondary raw materials.

The population is environmentally aware, whereas on other societal issues the new generations are on a path towards a largely **'live and let live' society**. For example, public health is not a high priority and programmes for the elderly remain modest. **Social inequalities persist**, and green taxation still affects the poorest members of society most. As, driven by the green tax system, material efficiency requires systems integration and sharing, co-operative approaches appear in certain circumstances. Progress in IT and medical technologies have allowed people to better manage their own health.

As creative and dynamic hubs, **European cities are at the heart of new societal trends**. However, they sometimes follow **diverse development paths**. Many become the focal point of the regions surrounding them regardless of national borders. Geo-climatic conditions, historical legacy and diverse visions implemented by their managers create very different local dynamics. Some cities manage to create sustainable paths for development and are very attractive, whereas others fail to overcome adverse conditions and decline. The well-off manage to move to the more successful cities, reinforcing negative trends in real estate prices in declining cities and price rises in the successful ones. This creates **issues of social equity** in a context in which centralised modes of governance have become weaker.

Modest international ambitions

After years of political dithering in international negotiations, the effects of climate change became so severe that **world leaders finally agreed in the 2020s that something had to be done**. The severity of environmental pollution, coupled with severe water shortages, forced China to rethink its manufacturing-based economic model. This was made possible by the new manufacturing technologies and the capability of industry to mass customise. **Manufacturing is largely global**, even if the legal form of manufacturing enterprises can be diverse (from holding companies and conglomerates to individual 'foundries'). The rapid development in robotics and additive manufacturing, along with the pressure on natural resources, has led to the **decentralisation of production facilities**, bringing them as close as possible to the various markets. **The EU sees a limited return of manufacturing,** thanks to relatively cheaper labour costs resulting from green taxation and the general redistribution of manufacturing around the globe enabled by robotisation.

The improving level of education among the Chinese population also resulted in change in the political system, ushering greater transparency and more democracy than in the previous decades. However, the **numerous vested interests in international economic competition kept the ambitions of international agreements in check**. Lack-lustre economic development at home **prevented the EU from taking a leading role in the discussions on climate change**.

The population growth in many countries, coupled with recurring natural catastrophes in various regions of the world (from flooding in Bangladesh to droughts in Russia and East Asia) has led to a the greater **volatility of the global political situation**, generally speaking. Food-production systems are often disrupted, not only in Africa, but also in the US and Europe. The resulting periodic spikes in food prices cause food riots in the poorest countries and contribute to political instability worldwide. **Economic disruption of agriculture** in rich countries requires government intervention and adjustment of traditional import/export flows. In contrast to the situation on other continents, the political situation in the EU and the US remains relatively stable, albeit fragile. Social instability is feeding on inequalities.

Green taxation in a flexible society

By 2015, unemployment in the EU remained high and GDP growth subdued. At the end of the decade, following the 2008-2014 financial crisis, the comparative analysis of the various models of economic recovery, alongside a radical change in management and democratic practices brought by the first generation of digital natives, has produced a **new EU framework for economic competition**. The young generation is familiar with the threats to the environment from previous decades of industrial development, and as these young people have reached levels of responsibility in both the public and private sectors, they have brought **a new vision of both society and the economy** with them. This has opened the door to a new generation of EU politicians ready to engage in economic renewal.

The **concurrent need to address the effects of climate change and to address unemployment** made the conditions ripe for a change of tack on the economy: EU governments embraced **green taxation** wholeheartedly by increasing taxes on resources, fossil carbon and on speculative financial transactions noticeably, and by **decreasing taxes on labour**. They did this unilaterally, even as international discussions on GHG emissions dragged on with only slow progress. The development of this new financial framework was inspired by behavioural economics to entice citizens to adopt more sustainable attitudes.

Thanks to the development of ICT and cultural shifts over the previous 20 years, **transparency has increased**, especially in financial flows and on the outcome of policy actions. Sometimes there are **conflicts between short-term and long-term economic, environmental and social objectives**.

The lower labour costs and higher long-distance transport costs **gave the EU a renewed competitiveness** vs. low-wage countries. EU exports were not too badly affected as they consisted mainly of services (made cheaper by lower labour costs) and high-added-value specialised equipment that were difficult to substitute. Also, as a result of the global redistribution of manufacturing, imports of manufactured goods in the EU fell, resulting in an improvement in the balance of payments.

The desire to be free to be able to undertake and enjoy the benefits of their own work has led new generations on a path towards a largely **live and let live, pragmatic and flexible society with reduced levels of solidarity**. In other words, we should all be able to lead the life we want to, as long as we do not jeopardise our future on earth.

Society is based on a few strong organising principles:

- Government is kept as small as is practical and the state system is flexible.
- The national level continues to lose relevance as the most important issues affecting EU citizens are either local/domestic (relating to the local quality of life) or global, where the EU level is the most relevant for engaging in international negotiations.
- Citizens try to ensure that they and their families have the best possible prospects; public social protection systems are frugal.
- Transparency is paramount and tools are in place to monitor it; this applies to procurement, government operation, the tax system, etc.
- The education system is open to competition, and many functions in education are privatised. Citizens value education but limits to free education put a brake on accessing the highest levels.

Sustainable behaviour is largely market driven, market signals being strongly influenced by tax decisions. In line with that, the social consensus that has led to the adoption of a green tax system has created a basic societal understanding that sustainable behaviour is also a sound economic paradigm.

On the social side, the coming of age of mobile ICT and the arrival of digital natives in responsible positions have changed society. NGOs have become less important, but people's intense use of social media sometimes leads to ad hoc **initiatives to move towards more collaboration**. Improved economic conditions, a limited social safety net and reduced dependency on raw materials influenced people to take control of their own way of life. The **industrial evolution towards mass customisation and the development of service-oriented business models fits the individualistic character of society.** Each family or individual can develop tailor-made lifestyles, based on high ICT usage, the use of more services and the purchase of more resource-efficient products, each according to his/her financial means.

However, this individualistic development led to rebound effects. The state (at national and EU levels) is now perceived as less of a provider and carer. This favours the rise of a **strong 'nimby' (not in my back yard) attitude** that limits the development of new infrastructure, community projects and industrial symbioses. It also leaves urban planning initiatives for more sustainable cities hostage to private interests.

Trust in political parties and state functions are low and there is a high risk of tax evasion and contraband in raw materials. However, people do have a high mobilisation power when faced with real and engaging stories and concerns. Political life at the European level has gained importance compared to the national level.

Employment remains an issue. The lowering of taxes on labour has had a very positive effect

but technological progress combined with the drive towards sustainable development has **changed the nature of the jobs market radically**. Rapid advances in robotics and IT have led to the disappearance of many middle-class jobs as well as most jobs in manufacturing. This has given very highly skilled creative jobs a premium and has opened a large market for menial, low-paid jobs. Adaptability and flexibility are essential. **Training needs are often difficult to determine** as **technology is moving fast** and creating a basis favourable to the **emergence of a new elite**.

Private sustainable technology innovation

Businesses exploit price signals created by green taxation, making available sustainable products and services. There is a high level of entrepreneurship, and smart systems and solutions are common for saving money and resources. To protect their business, SMEs are keen on confidentiality, thereby moderating the sharing of knowledge.

As governments are still hampered by the weight of national debts, **capacity for public investment remains limited and there is no smart connected high-tech system in place for the distribution of products and goods.** As a result, private investment is playing a greater role in both R&D and infrastructures, creating a **dynamic innovation landscape** from which many local solutions are emerging. **Crowd-funding** is an increasingly important financial source for technology and business development.

Mainly as a result of a fall in government spending, **big national programmes, such as the nuclear programme, are a thing of the past,** and investments in national or continental smart grids infrastructure has been piecemeal. There are a lot of coal-based and nuclear-stranded assets to deal with in Europe. In line with this, the **power systems are becoming highly distributed and diversified** with local and regional solutions for the production and transfer of energy growing in importance. As a consequence, many traditional utility companies went bankrupt during the previous decade. This is because many **people want to increase the resilience** of their own home and neighbourhood (limit risks) and reduce their consumption of 'official' (and expensive) energy. Technologies for individual power supply are popular (e.g. household-sized fuel cells). Medium-scale, flexible gas-fired power plants are the technology of choice for providing the necessary back-up power in such a situation. Poorer people are left depending on creaking public utilities.

Additive technologies, such as 3D-printing, coupled with better material technologies and efficient material recovery techniques have enabled the local production of many parts and products. This has become increasingly attractive due to the higher cost of transport. It also allows for mass customisation and increases the availability of products for the lower middle class.

Many new technologies support services for the individual. **Health applications are particularly popular** because of an ageing society, the availability of lots of relevant data and a general desire to keep health-care costs (for governments) and expenditures (for citizens) in check. **Technological supports for daily life have taken off**: digital home control systems, household robots, Internet of Things, etc. This tends to benefit everyone as the tremendous pace of technological innovation over the past 20 years has made the equipment very cheap. It is the unequal level of education that is creating most discrimination in the use of technology and services.

Innovations in green chemistry and life sciences have also made huge progress.

Significant efforts are being made to develop cleaner technologies (e.g. for climate change adaptation), whereas there are less incentives for developing more long-term climate change mitigation technologies. **Mitigation is occurring mainly through short-term efforts** to save resources and energy in response to green taxation.

There have been great improvements in ICT for seniors according to their specific needs. **Technology development is oriented towards simplicity** (for use by the very young and very old) **and frugality** (because of the high price of raw materials and energy). This helps to increase accessibility for most people.

Incentives for resource efficiency

As a consequence of green taxation and increased global demand, **raw material and energy in Europe have become expensive**. The business world has adapted, mostly by improving production processes and making products for local consumption more frugal. Occasionally, this leads to 'rebound effects' when a larger

quantity of products are purchased, resulting in a greater consumption of resources. Technological innovation is also applied to the exploitation of new natural resources (e.g. new plants for biofuels) or known resources from previously inaccessible areas (e.g. deep-sea mining, the Antarctic).

Higher energy prices due to taxation have made **transport, and especially individual transport, more expensive**. This makes long-haul shipping of goods by road less attractive and **stimulates multimodality**, which has prompted many companies not only to look into sourcing raw materials and producing locally but also to make efforts to recover their own products at the end of their life as a source of raw materials.

Companies consider energy and resource efficiency internally as there is little societal and policy support for new urban planning laws or developing infrastructure. For example, there is little public support for industrial symbioses. New initiatives mainly take place in existing industry parks. Progress occurs on an ad-hoc basis. There are no society-backed grand plans, only specific business investments, sometimes promoted by the elite.

Glocal, seasonal markets

Even though local/seasonal production and distribution are on the increase, **the global market continues to be important**. **Many large companies now work 'glocally'**: they have a global strategy, are active internationally and can establish a suitable presence in different and diverse markets, they still procure some raw materials globally, but they produce closer to their markets in a drive to be closer to customer demands, to take advantage of local raw materials and to keep costs of logistics and distribution to a minimum. This is also related to strong personalised local consumer interest and has advantages in terms of supply-chain resilience and material recovery. The global companies that did not manage to customise their products are now experiencing difficulties.

In this context, the combination of **an individualistic vision with limited public efforts are weighing upon infrastructure development**. There is little appetite in governments for major new infrastructure initiatives. **Private companies develop what they need for their own business** while a lot of infrastructures have difficulty in reaching optimum scale and remain in private hands. A strong nimby syndrome in an individualistic society also dampens ambitions for major infrastructures. Therefore, ageing infrastructures limit evolutions.

However, ICT, supported by infrastructure developed by private operators, has given individuals the means to **network and mobilise both globally and locally ad hoc on single issues**.

Green behaviour for low cost

Individual freedom, personal choice and desire for personal advancement guide people's behaviour. Many business-based bottom-up initiatives emerge, which is characteristic of an **entrepreneurial society with many service-based SMEs**. The weakening of social safety nets has led to a **rise in inequalities**, sometimes large, which is now largely accepted in society. Most people try to obtain the best possible conditions for their family and their neighbourhood. For many, patchwork families make this into something of a challenge.

Green taxation provides the economic signals to be careful with energy and material use, which together with the (varying) level of education and new business models, influence how and what people consume. Broadly speaking, **individuals are responsible towards the environment, care about sustainability, and are resource-conscious but do not engage in broad societal initiatives**. Internet and social media serve mainly as a source of information for the individual. Overall, these trends are resulting in better health and well-being

The sustainable mandatory targets and incentives shape the open-market-driven behaviour, and **trust is an essential component of the economy**. Nevertheless, **the individualistic society has not been very supportive of business models based on sharing**. The only initiatives that succeed are those that manage to bring more convenience as well as lower costs, such as car-sharing, for example. For other products (e.g. tools, washing machines, etc.), frugal innovation has made it easy for people to prefer ownership to sharing.

The demands of an active ageing population influence the types of goods and services being produced (e.g. demands for accessibility, mobility, health care, etc.). **As social spending has fallen, pensions have suffered**. Better health and an entrepreneurial society stimulate people in their 60s and sometimes 70s to remain economically

active. This is good for those who can, although people in poor health are much worse off.

The low taxes on labour have encouraged many SMEs to start up on a hybrid concept between the old postal service and courier services of the early 2000s to offer consumers and business same-day delivery by bike, e-bike or similar vehicles. This has become popular among young people as a flexible work practice.

Consumer interest is increasing in buying products that match their style and interests, both in terms of looks and function. Local and seasonal fashions play a large role. Evidence from behavioural economics is being used to build 'niche' markets. The demand for green products, and to some extent green services for the individual, has been increasing steadily.

8.3.3 INDUSTRIES IN 2035

DYNAMICS

The 'green' fiscal framework is creating market signals to which the individualistic and entrepreneurial society is reacting. Prices create incentives for direct material efficiency, but systemic effects remain limited as most people are focusing on the immediate and local. The market economy is adapting to sustainability without strong solidarity mechanisms. There is also little desire by governments to develop broad societal consensus that could open the door to investments in new major infrastructures, or into rethinking how society uses its territory (e.g. changes in urban planning laws). The general growth in resource efficiency is mainly the result of private initiatives in response to price signals. In Europe, this has led to the emergence of several trends:

- **A strong trend towards more resource efficiency**: technological development, mostly privately supported, is driven by a desire to maintain competitiveness in an environment of high raw material prices. All opportunities to make money are being seized: increases in urban mining, desire to minimise waste production and to produce products that are cheaper to make and to use. The circular economy is not being pursued per se, but many aspects of it are appearing under the pressure of the price signals. Short-term eco-innovation and frugal innovation are on the rise.
- **Development of market-driven local sustainability initiatives**: high transport costs and raw materials prices lead to an increase in use of local and renewable raw materials. Local banks and green services for individuals flourish. While not becoming organic, farmers experiment with new techniques to try and reduce costs linked to energy, herb-/pesticides and fertilisers. As labour costs fall and raw material prices rise, business opportunities emerge in recycling, repair, remanufacture and renovation to fill niches. For example, the export of certain business ideas is done through franchising with or without fees. Some companies have moved to offer eco-services, and eco-services dominate for public money. 3D-printing has enabled some consumer products (and their parts) to be produced locally. The fragmentation of society also calls for more local solutions, and businesses to make homes and neighbourhoods more resilient to natural catastrophes are developing.
- **Environment and health protection**: this is mainly driven by people's desire to take care of their immediate living conditions and local environment. There are general improvements resulting from resource and energy efficiency, but high inequalities between different localities, geographical areas and regions since people are not equally empowered and knowledgeable. Best environmental management practices are being implemented in retail and supply-chains. IN general, eco-innovation has become more short term.
- **Climate change mitigation**: the taxation of non-renewable energy resources on the basis of carbon content is resulting in a general lowering of fossil fuel use, with the sharpest decline in coal to the benefit of gas, and the associated positive side effects on air pollution.
- **Development of renewable resources**: taxation of fossil fuels provides a strong incentive for implementing existing renewable technologies and for R&D to use a broader range of renewable resources for energy (e.g. second- and third-generation biofuels) and biobased compounds as well as in the development of efficient energy-storage technologies.

In this scenario, eco-industries are shaped mainly by the taxation regime. Here is how the three strands of eco-industries (i.e. green industries; industry greening; eco-innovation) respond:

- Among green industries, eco-efficient, material-saving and recovery-type industries would be successful while paradigm-shifting, longer-term, businesses, including those involved in infrastructures such as smart grids, would be absent;
- Industry greening would occur moderately at the individual company level, motivated by material efficiency in reaction to price signals;
- Eco-innovation, dominated mainly by private R&D on eco-efficiency, is considered as poor for saving costs and serving people's needs to become autonomous and resilient.

ELEMENTS OF THE INDUSTRIAL LANDSCAPE

Governments are very eco-innovation friendly. As the prices of energy, materials and water have risen significantly, there has been a shift towards an economy based on environmental performance. However, as this leads to ever-smaller tax revenues, the green taxes continue to rise to maintain revenue and avoid rebound effects, creating a virtuous circle for resource and energy efficiency.

SMEs vs. large companies

More small-scale production is taking place, with SMEs and start-ups forming a large part of the economic landscape. New business models related to efficiency in water/energy/materials emerge. There is an increase in eco-innovative start-ups, as well as start-ups providing education. Many SMEs are appearing in the repair/fixing/refurbishment sector.

Large companies cherry-pick SMEs to buy and reinforce their own position (e.g. big breweries buy micro-breweries). Financial products shift towards more 'sustainable' profiles, supported by institutional investors. Global banks use local banks as relays, and mature crowd-funding platforms take over some activities traditionally held by banks.

Larger private-sector and more private R&D

The reduction in government services has been compensated in part by the private sector's increased role in public services. This was been helped by the liberalisation of labour laws (easier hiring/firing) under 'light-touch' governments. However, the role of green public procurement is key. Public procurement procedures are simplified to enable eco-innovative suppliers to bid. This is accompanied by higher private green R&D spending, although some money from green taxation is used for green public R&D. Regions also support green innovation.

Money drives business models

Business models have the potential to increase profit, regardless of whether they are focused on consumption for private use or on sharing. There is likely to be an increase in 'service business' models (e.g. consumers using washing services pay per wash). New partnership models are directed towards value creation, which stimulates eco-innovation in a highly competitive economy.

Independent vs. networked

In this individualistic world, innovation takes place in chaotic patterns although open innovation is going strong. The management of energy, waste, water and other 'public' services becomes more decentralised and privatised, to the detriment of large incumbents. However, this does not occur without some resistance. Individuals do collaborate, but only out of self-interest, where it makes strong economic sense. In such a world, local communities promote the use of alternative currencies (e.g. LETS - Local Exchange Trading Systems) to reward proximity.

More circularity

In this scenario, there is a premium on education and skills. Repair businesses, start-ups, open innovation and R&D all require skills. Videos on the internet, regardless of whether or not they are repair instructions (e.g. IFixit) or online courses (MOOCs) play a key role by empowering individuals to contribute to a more circular economy.

POLICY ACTIONS TO PROMOTE SUSTAINABILITY IN COHERENCE WITH THIS SCENARIO

- ☐ **Research and innovation**
  as this scenario relies heavily on technology, it is important to have a long-term R&D strategy supported by significant efforts on standardisation and on the integration of innovation across sectors to solve complex problems. Efforts are also needed to support the uptake of the right types of innovation;

- ☐ **New business models**
  foster a new European business culture and regulation to take advantage of the 'green' fiscal framework and develop sustainable modes of production and consumption;

- ☐ **Education**
  create the right conditions to breed eco-entrepreneurs, enabling civil servants and industry actors to get the best from the green fiscal framework. Have eco-entrepreneurship taught in business schools, and improve general access to green knowledge;

- ☐ **Ethics**
  need to be supported strongly to enable a reasonable exploitation of the commons[13] and to avoid society becoming too market driven: moral framework for capitalism;

- ☐ **Regulation**
  provide a stable and predictable regulatory environment that responds to a clear vision and promotes the sharing of best practices;

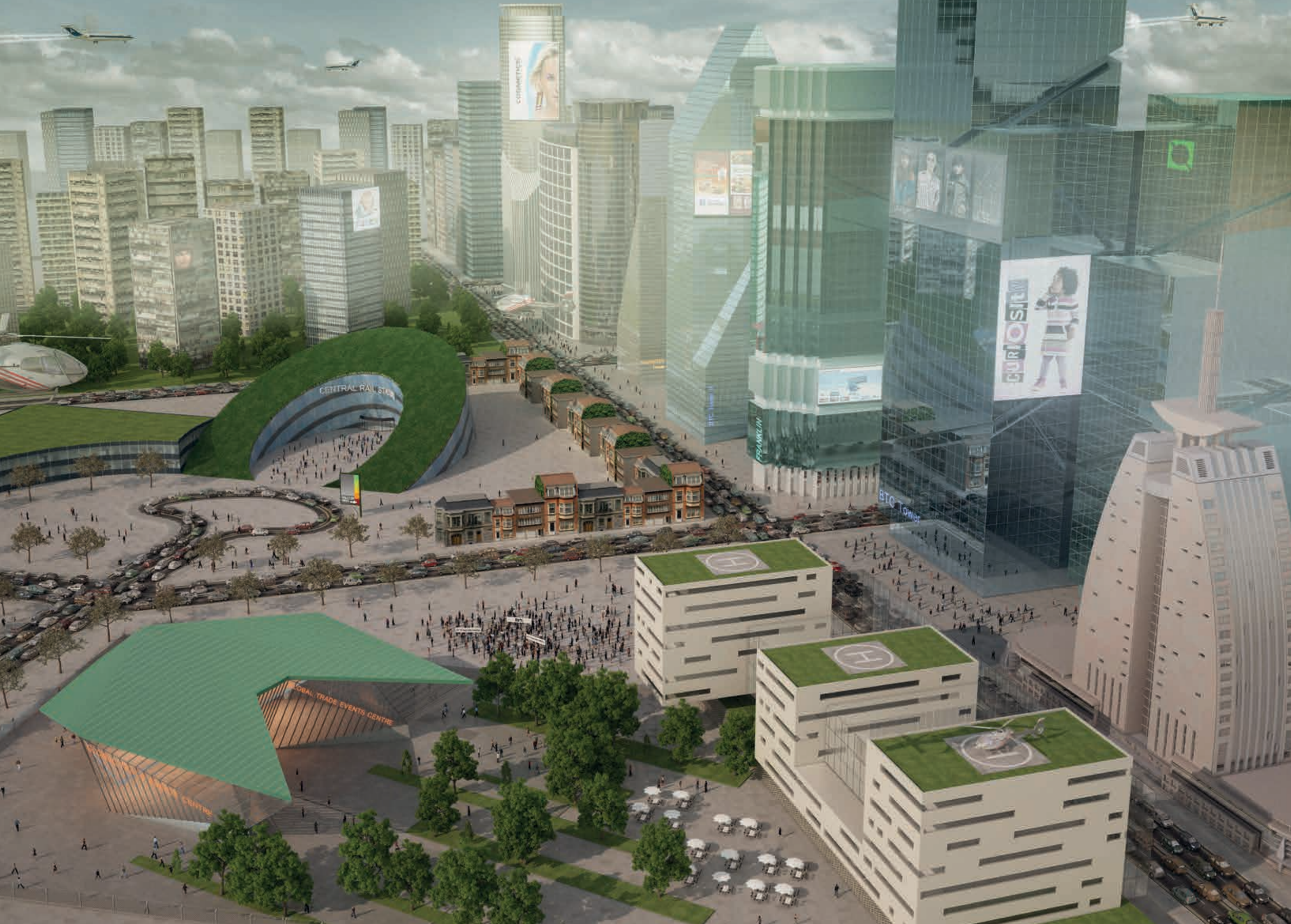
- ☐ **Social protection**
  in view of the weakening role of public schemes, alternative means of providing social protection are needed (philanthropy, private schemes?). This might mean redefining the role of business in society.

[13] Natural resources held in common and accessible to all members of society, including natural materials such as air, water, and a habitable earth.

scenario 4

Local Self-Reliance

- **Individualistic society**
- **Fiscal framework not supportive of sustainability**


COSMETICS
CENTRAL RAIL STATION
GLOBAL TRADE EVENTS CENTRE
FRANKLIN
BTC Tower

8.4 SCENARIO 4 | LOCAL SELF-RELIANCE

8.4.1 HOW WE ENDED UP IN THIS SCENARIO

Since the 2013-2014 IPCC reports, the frequency of strong storms and droughts has increased and seasonal weather patterns in the EU have continued to change, although overall **disruption related to climate change remains manageable**. The lack of strong leadership over the last decades means that the **EU has become a relatively small player on the international scene**. In 2035, governance at EU and national levels is weak. The US and China continue to be the strongest international actors, but challenged by India. Now that many countries, especially in Africa and Latin America, have large populations and have become more attractive markets for the USA and China, **the EU and its Member States are no longer able to fight effectively for their own interests on the world scene**.

Management of the EU economy has remained confined to **recipes in line with 20th century economic wisdom** to tackle the EU's public deficits and unemployment problems, regulate banks and manage the euro. Macroeconomic governance has become more integrated at EU level but **tax policy has remained very similar to that in the early 21st century**. Some EU Member States are still working hard to reduce public debt and those who have re-established their public finances are very wary of deviating from the new **financial orthodoxy**.

The harsh cost-cutting that started in the 2010s has **continued to erode social protection systems**. The severe underfunding of pension funds at a time when many baby boomers are retired has forced a reduction in pensions. As a result, economic inequality, as measured by the Gini coefficient in what is left of the European nation states, has grown and **social equity is a problem**. In spite of progress in health technologies, this problem has consequences for health inequalities and is creating social instability.

Helped by the spread of the internet and powerful mobile communications to the most remote corners of the world, people who were until recently removed from international discussions gained political and geopolitical consciousness. This created pressure that caused a number of emerging countries to threaten to withdraw from the UN. In response, **the UN Security Council saw the number of its permanent members increase** to include countries from all continents. Voting rules were also amended. A weighting system now takes countries' populations into account. Countries like India, Indonesia, Nigeria and others with more than 150 million inhabitants can wield significant influence.

Through the shrewd use of social media, **powerful interest groups have created niches of influence**. Some of these groups are animated by multinational corporate interests which provide their members with social protection. The ability to raise awareness and to mount campaigns around the world gives rise to a new form of **distributed and global direct democracy** that affects how the UN operates. Western countries no longer hold the sway they used to enjoy up to the end of the 20th century.

8.4.2 SETTING THE SCENE

Weakening nation states in Europe and a redistribution of influence on the international scene

The weak political leadership in Europe has led to a weakening of both national and EU levels. Under external pressures, macroeconomic governance has become more integrated at the EU level but **tax policy has remained very similar to that of the early 21st century,** with policy-makers not daring to deviate from **financial orthodoxy**.

The **erosion of social protection systems has also chipped away at citizens' respect for the 'state'**. People feel that they have to rely on themselves more, with the result that they feel they need government less. Inequalities increase and powerful ICT platforms make direct democracy (and self-help) increasingly attractive, keeping governments in check.

In parallel to the continuing development of information technologies (social media, Internet of Things, etc.) **information flows and transparency have continued to grow**. Information systems provide information on the state of the earth

and on events in real time to anyone interested anywhere. As a consequence, **many people now have a global outlook on the state of the environment**. They identify themselves as citizens of the earth although they care more about their own well-being and immediate environment than about concepts such as nations or continents, like Europe. It is **a live and let live, pragmatic and flexible society**.

All this has resulted in **the EU losing a lot of influence on the international scene** compared to the USA and China, as well as to other countries with large populations. **The UN Security Council has been reformed to reflect this change.**

Private interests

Society is consumption-based, technologically very advanced, business-driven with multinational companies becoming larger and more diverse in their activities. Economic hardship is forcing older people to maintain activities to complement their pensions. A lot of the **middle-class and manufacturing jobs that were at the core of European society until the early 21st century have disappeared**: automation, data mining and robotics, combined with a general decrease in material consumption, have taken their toll. Average incomes are low but the number of people working in very highly skilled technology-linked occupations has increased.

Private initiatives, mostly opportunistic, **have become a major driver of change**. However, a heightened general level of consciousness about climate change is influencing decisions. **Technological progress has improved the resource efficiency of individual products**, but overall flows of raw materials across the economy are not being optimised, creating rebound effects. Over-exploitation of existing resources and the search for new sources can take place in reaction to market prices. There is some sense of general interest, but **the economic competition between individuals and companies is pre-eminent**. There is little interest in devoting time to the community or bothering to invest in infrastructures unless there is a strong business incentive. Most people are too busy trying to get ahead, which results in very little attention being given to the tragedy of the commons.

The development of novel oil- and gas-extraction techniques, initially in the USA at the beginning of the 21st century then emulated in a range of other countries, was very successful. Together, carbon capture, the use of supercritical CO_2 to improve hydrocarbons extraction, and a general increase in energy efficiency have caused a drop in **gas and oil prices**. The geographical diversification of supply and the overall higher output have led to the disappearance of OPEC (Organization of the Petroleum Exporting Countries). This has ushered in a new era of prosperity for the developing world and has reduced investments in renewable energy sources worldwide.

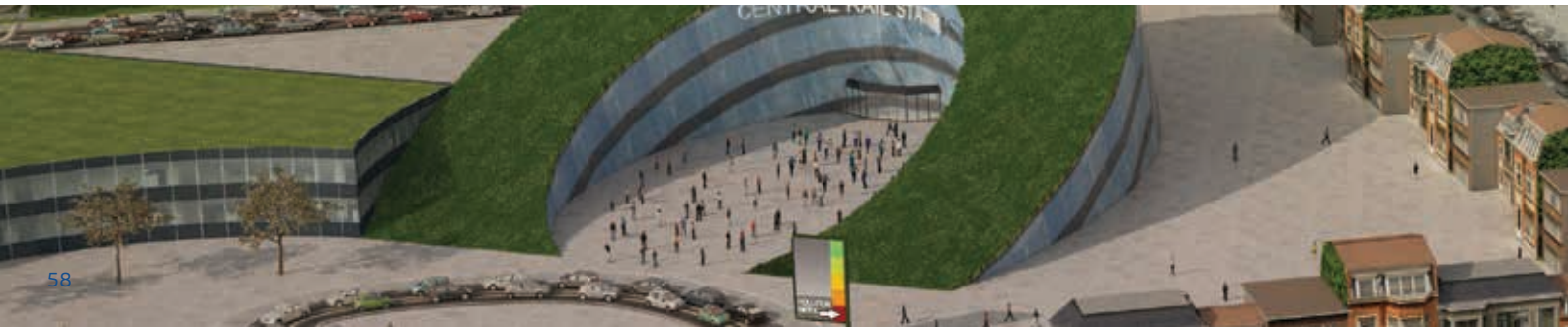
Conventional policies in Europe …

In 2015, unemployment in the EU was still high and GDP growth remained subdued. After the 2008-2014 financial crisis, the faster economic recovery of economically liberal societies and a lack of consideration for the pre-existing establishment among the first generation of digital natives gave **new impetus to economically liberal ideas.** The EU harked back to free-market ideas from the 1980s and 1990s, albeit with a heightened sensitivity to sustainable development issues.

However, although the young generation was familiar with the threats to the environment from previous decades of industrial development and to the man-made nature of climate change, the very **progressive increase in natural disruptions due to climate change** did not generate truly catastrophic events. This gave voters the impression that adaptation to and mitigation of climate change were achievable **without any major changes to the way society and the economy operate**. Thus, drastic reductions in GHG emissions were seen as a long-term, progressive objective.

Simultaneously, the **slowly improving economic situation in the EU kept politicians away from trying bold economic reforms**. EU governments maintained the tax system largely as it was, intent on reducing public debt using classic 20th century economic recipes. They also engaged in international negotiations to reduce GHG emissions, but with little weight and little success.

The main approaches used to try to reduce GHG emissions and resource use were **public R&D and regulatory action, kept in check by heavy industrial lobbying**. This led to some emission reductions and some progress in resource efficiency, although high labour costs dampened the efforts to develop new, more resource-efficient



business models. **GDP growth in the EU remained largely reliant on consumption**. Slow progress in resource efficiency, combined with global population growth, led to a **growing demand worldwide for raw materials**. As a result, raw material prices kept increasing with a high level of volatility, which was detrimental to an EU economy still very dependent on raw material imports. **Unemployment remained an issue, with the emergence of plenty of informal employment** indirectly supporting the collection, sorting and recycling of raw materials.

Governments have mainly remained focused on managing short-term issues, which has proven to be problematic when dealing with complex issues such as sustainability, climate change and world competition. To a large extent, **private initiatives are driving change**, which has given rise to many lucrative new business ideas. The financial sector has changed little over the last 30 years.

The heavy tax burdens inherited from the late 2010s led to a political backlash. As social security systems had already been eroded, European citizens opted for less government and more individual say in decisions affecting them directly.

… with privatisation …

The desire to be free to undertake and to be able to enjoy the benefits of their own work has led this new generation down a path towards **a largely competitive, pragmatic and flexible society**. There is disappointment with the political world, perceived as being under the thumb of strong lobbies. Environmental consciousness is moderated by short-term economic considerations. Rather than trying to reform central government, this generation has been keen to repatriate some powers from governments to the individual, sometimes even short-cutting hierarchies altogether, thanks to social media, and thereby **weakening centralised modes of governance**.

Flexibility and entrepreneurship have become the new mantras. **Privatisation of public goods and services has happened step-by-step** and few public companies still exist. Those that do mainly provide public infrastructures for private companies. Many public services are provided by private contractors. Overall, public services are as good as what people pay for them, which also impacts education.

The degradation of public education created openings for **both expensive private schools for the elite (with their networking opportunities) and cheap private online education** (e.g. MOOCs). One consequence is the increased flexibility and diversity of education paths. The certification of acquired competences became a critical issue as many people had unique profiles. **Private insurance schemes flourished**. Demand and behaviour are linked to market prices and the supply/demand balance.

… and rising inequalities

Powerful ICT tools and platforms allowed referenda and **direct democracy** to develop, although this did not lead to coherent sets of policies. **Policy-making became very difficult**. Individuals can quickly create – on a worldwide scale of networking – a critical mass of noise-makers on specific issues. Transparency clusters develop around highly educated social groups and networks.

This trend towards privatisation facilitated the concentration of capital. In addition, the combination of high unemployment, privatisation and automation/robotisation led to a shrinking of **the middle class while median income levels fell significantly**. Following the post-2008 'great depression', there is **no longer an expectation that living standards will continue to rise**. Compared to 20 years earlier, **many people downsized**: they lived in smaller houses following a more frugal lifestyle. However, this lower cost of living did not adversely affect the quality of life as much as might have been imagined. Many services, especially cultural ones, had become very cheap or even free, following in the steps of Spotify, Facebook, YouTube, Hulu, etc. New medical technologies and the personalisation of health care played a positive part in disease prevention.

In such a context, **wages and GDP are no longer a useful gauge for measuring the quality of life**. Thirty years of technological progress in the renewable energy and energy efficiency sectors, coupled with a lack of investment in infrastructure, has encouraged many people to go 'off-grid'. A backlash against giant wind turbines was followed by R&D efforts into individual-scale technologies. At the same time, continuous improvements have resulted in cheap photovoltaic and solar thermal technologies. A less reliable public grid combined with increasingly frugal appliances and lighting technologies compounded the situation.

Overall, the continuing technology development has transformed society into a **high-tech, connected, flexible world** in which few people have 9-to-5 jobs. There is no longer a classic 'job market', as it was known up until the early 2020s. **Many people earn a living by combining income from various activities**. Creative work can even be performed on-demand, ' remotely'. One side effect of this shift is a drastic decrease of commuter traffic. This wide-scale change created a challenge for the tax authorities, which were used to collecting large contributions from established companies and were now having to collect taxes from a multitude of more or less informal activities.

Most people's individualistic perspective translated into a lack of social cohesion. **Solidarity mechanisms remained weak and the development of sharing platforms,** as they were in the 2010s, only continued **on a strictly commercial basis**. Ambitious new infrastructures for a more sustainable development were discussed from time to time, but no consensus could be found for the long-term support and financial efforts needed to develop them. **Digital natives look for satisfying activities**. They want to make an impact, they want freedom and want to choose what they do, rather than be ready to lose their freedom in a chase for high salaries, just as previous generations did. Society is also highly aspirational, where consumption is personalised, which results in many niche markets.

Civil unrest continued to flare up periodically as unemployment remained high and in a context of inequalities, severe international competition, and recurring natural catastrophes. Differences between regions increased.

Innovation to satisfy market demand

The resource intensity of the European economy did decrease to some extent thanks to R&D efforts and high raw material prices linked to increasing global demand, but it was not enough to become truly sustainable.

Over the last 20 years, R&D has continued, especially in new materials, ICT and biotechnologies. In 2035, all these sectors have made incredible progress, which has resulted in **technologies that create opportunities for small-scale eco-industries and innovative SMEs to create viable individual and sustainable solutions**. Public R&D spending is now mostly oriented towards applications that are supported by large industrial players. The **triggers for innovation are determined by market potential**. They are not necessarily the most sustainable or the most cost-effective for society, but high raw material prices are providing an incentive for material efficiency. In this individualistic society, the pressure on raw materials has tended to push people towards **hoarding for fear of not being able to access basic necessities**. Competition between trading blocks and protectionist tendencies prevented an easy optimisation of raw material flows in the global economy, thereby hampering resource efficiency.

Since top-level governance is weak and policy has remained largely conventional, resource and material efficiency depends on individual market-driven initiatives in a context where there is no green taxation. **Eco-industries are largely oriented more towards self-sufficiency and individual resilience, and not so much towards social equity and general well-being**. As labour costs remain high, the development of **robotics continues** across the board: manufacturing, replacement of menial jobs, household help, etc. This, in turn, is leading to **high un(or under)-employment**.

Little effort on infrastructures

The lack of social consciousness, combined with a strong nimby attitude, is **limiting the development of new infrastructure and industrial symbioses** which stimulates investment in individual resilience. It has also left urban-planning initiatives developed by the more prescient authorities for more sustainable cities hostage to private interests.

Resource efficiency can be characterised as opportunistic, with cherry-picking where possible, depending on market drivers.

Over the last two decades, the economic conditions were **not conducive to investment in maintenance and the upgrading of infrastructures**, let alone for investment in new large public infrastructures. What was actually created was the result of private investment by large business actors, especially in ICT, where business cases could be defended. In view of the large number of people who went off-grid and of the prevailing nimby attitude, **smart grids developed slowly**, mostly around large urban centres where economies of scale made them

economically viable. The persistent hostility of the public also hampered nuclear energy technologies and, as gas remained relatively cheap, **baseload power was mainly provided by natural gas turbines**. Industries made little effort to organise their facilities into symbioses.

8.4.3 INDUSTRIES IN 2035

DYNAMICS

In spite of the absence in Europe of a fiscal framework favourable to sustainable development, global population growth, coupled with continued economic development in emerging economies worldwide, has led to a general increase in demand for raw materials. A few difficulties have appeared over supply and the general trend in raw material prices is upwards, even though fossil fuels remain abundant and relatively cheap. In Europe, this has led to the emergence of several trends affecting eco-industries:

- **A trend towards more material efficiency**: increased demand for raw materials globally led to a general increase in raw material prices and to some shortages in supply that stimulated product developers to improve the resource efficiency of products and industrial processes. This stimulated technological development, urban mining and a fall in waste production. The application of eco-design paradigms (lower use-phase energy consumption, easier repair/recycling) progressed.
- **A trend towards more individual resilience**: individualism fed a trend towards self-sufficiency for basic needs (at local level, focused on food and energy) which gave rise to the development of adapted products. More people going off-grid resulted in higher demand for autonomous DC systems, which no longer rely on the grid. As regards manufacturing, the development of robotics and automation led to the emergence of distributed/small-scale manufacturing well equipped to embark on mass customisation and to supply niche markets. Revived entrepreneurship stimulated locally sourced/local-market business initiatives, especially among those who had difficulty in finding traditional employment.
- **More adaptation than mitigation**: the entrepreneurial but individualistic environment is favourable to reactive behaviour to exploit potential markets but not so favourable to forward-looking policies mobilising society and investing in infrastructure for the long term.
- **Resource efficiency is unavoidable**: but occurs ad hoc depending on market conditions, mostly for reasons of cost-cutting and resilience.

The potential for eco-industry in this scenario, and the type of industry would depend largely on the global price of raw materials and energy. Here is how the eco-industries strands (i.e. green industries, industry greening, and eco-innovation) would respond:

- Among green industries, short-term, cost- and eco-efficient, material-saving type industries would be successful while paradigm-shifting, longer-term, businesses, including those involved in infrastructures such as smart-grids, would be absent;
- Industry greening would occur moderately at the individual company level, motivated by material efficiency in reaction to price signals;
- The potential of eco-innovation was considered to be low, dominated mainly by private R&D on eco-efficiency, for saving costs and serving people's desires to become autonomous and resilient.

THE INDUSTRY LANDSCAPE

Governments remain secondary players with regard to shaping eco-industries. Competition for resources plays a larger role, together with cost-cutting and resilience.

SMEs vs. large companies

In this world, the dominant eco-industries are seen as cost-efficient and fairly large, with SMEs occupying the remaining space. The development of new, service-based business models remains modest, limited to cases where there is a strong business rationale in terms of cost-cutting. Rather than being disruptive, innovation is expected to be incremental.

Larger private-sector and more private R&D

The reduction in government services has been largely compensated for by the private sector's increasing role in public services as governments downsized. Some green public R&D is still being carried out, and regions also support green innovation.

Ownership vs. use

While the development of new, service- or use-based business models is expected to remain modest, both use and ownership could predominate in particular niche sectors. For example, the poor would consume through use-based business models where it makes economic sense, while the rich would continue to purchase to own. For high-end idealists, eco-friendly 'leasing' packages might be attractive in terms of cost-efficiency and as a status symbol.

Public vs. private R&D

Mostly private and ad hoc R&D is carried out if it is considered to make business sense, and mainly by global corporations. Innovation tends to be incremental.

Independent or networked

It is mainly the independent businesses that dominate, although 'niche' communities or networks could arise, particularly for those who are becoming increasingly disenfranchised in this individualistic society – social networks and 'underground' community movements are a possibility.

Importance of CSR

Corporate Social Responsibility remains very low because there is little incentive from society or government. CSR depends on a company's client base, and whether or not it is factored into its competitiveness.

Global or local

It is mainly a few global economic actors which dominate. Local start-ups and SMEs will cater for smaller niches but are likely to be very focused on short-term objectives, leading to numerous start-ups, as well as failures. There is quite a lot of debate around this, especially in relation to Europe's position vis-à-vis the rest of the world. In this scenario, most of the greening and innovation would take place outside of Europe (and some global companies could potentially be successful outside Europe). European business could cater for some niches (e.g. waste management), but would not be able to compete easily at the global level.

Employment

Most people have low skills sets and specialisation, especially as a result of the declining quality of education, except among the elite. Job insecurity is rife.

POLICY ACTIONS TO PROMOTE SUSTAINABILITY IN COHERENCE WITH THIS SCENARIO

- **Research and innovation**
  in view of the limited resources, prioritise interventions contributing directly to sustainability;

- **New business models**
  foster the development of standards and good practices to support sustainable modes of production and consumption. Help desirable business models to reach critical mass;

- **Education**
  provide a basic set of core values and skills, promote multi-disciplinarity and breadth in education; fight short-termism.

- **Ethics**
  link ethics to business profitability and sustainability. Encourage responsible individual and corporate behaviour and more responsible research and innovation;

- **Regulation**
  needed to guide and constrain consumption and economic behaviour to avoid resource depletion and to reduce harmful emissions. Develop standards;

- **Natural resources management**
  monitor the rate of resource depletion and set ecological thresholds. Put systems in place to preserve stocks of natural resources;

- **Governance**
  encourage CSR and long-term thinking, promote good governance practices.

9. NARRATIVES

9.1 INTRODUCTION TO THE NARRATIVES

SOPHIA

Back in the 1980s, we were just kids. The four of us lived in different areas of town. Clement was the boy from the terraced house over on Chestnut Street, Leonardo lived in the red-brick house near the park, and I was the girl from the apartment complex on the east side. Leila lived really far out, we weren't sure exactly where... but we were all in school together.

Reading about it later, I understand that the 80s was a time of many extremes. Industrialised countries were doing very well with stock markets setting new records. Acid rain and the ozone layer were issues, but they could be solved. Everybody kept mainly to his business and things were OK. While voices were talking of the emergence of China, newspapers wrote that many poor countries had economic and social difficulties hampering their development. There was also instability in Eastern Europe and the Middle East but we did not know then how quickly things would change and how different they would turn out in to be in both regions.

In those days, we went to school dressed in oversized brightly coloured clothes, with our hair slicked back with water, pretending to be cool. It was a time for learning, experiencing new things and trying to make sense of the world. Our values and interests were beginning to take shape but little did we know that some of those would face serious challenges later. The fall of the Berlin Wall, and the creation by the UN of the IPCC in 1988 ushered in a new era, but we had yet to find out the impact of these changes.

By the 1990s, we were still good friends even though the teenage years really started to bring out our true characters. We were all in the same class, but our personalities were developing in different ways – it was almost as if we had learned completely different things at school. This was most obvious on the occasion of the environmental science project during our last year in high school. We were all supposed to think of ways to recycle our waste.

Clement was always sociable and loved working with people. He had the idea that each classroom should elect a class 'committee' to take charge of organising the collection of class waste and old clothes from home. Paper, glass, aluminium and other metals from cans could be recycled. The 'interesting' parts of other waste, especially wood and plastic, would be cleaned collectively. These were then used creatively in art class and special workshops for presentation during school exhibitions. We created sculptures, art pieces, and jewellery. We also repaired things; I remember fixing an old bicycle. We tasked six final-year students with the responsibility of collecting any food surplus to serve to the poor in weekly soup kitchens. To motivate the students, we gave prizes for the most creative use of waste, the first prize being a full-day group nature excursion.

Unlike Clement, who had a strong interest in bringing people together, Leo's interests focused more on creating technological solutions to problems. He made a blueprint of an irrigation system for a school rooftop greenhouse built from metal, plastic, and glass waste. Paper waste could be burned to help produce hot water for the school, and food waste composted to fertilise the rooftop garden. Leo was always inventive and often built things. While his system did not really require a group effort, it did mobilise teachers and parents. At some point, he even tried to build a clothes- recycling machine! I am sure Tekno, our science teacher, still remembers how his favourite jacket did not survive!

Leila was practical, too, but more interested in enjoying the luxuries of life. She suggested that each month a class should be selected to sell any food that was not eaten during school lunches at the school's sport competitions, or to the poorer town communities at a low price. Sorted metal and glass waste could be sold to local factories for recycling. She also organised the school art exhibition presenting the products from the creative workshops which could be sold to bring in even more money. The ultimate aim was to make good use of waste while making some profit from it. To motivate students to participate, any profit could then be spent on whatever the students of that class decided. Leila suggested using our money to help fund a cool class trip. As you can see, Leila's concept was more about "we did the work, so we should benefit"... Typical!

For my part, I suggested addressing the core of the problem: manage our usage to help reduce waste. Being seen as "best of the class", the director trusted me with information on how much office and food supplies our school consumed. I significantly reduced how much we were ordering, bringing down our waste production. As for school lunches and snacks, I created a weekly calendar system where students could fill out their lunch requests based on three options, and I managed the orders. This allowed students to be included in the decision-making process and to have a say in what they were eating, while ensuring that the food served matched demand. Already by then I loved the responsibility.

It was evident that we were starting to follow different paths. Clement wanted to set up a co-operative and do good in the community; Leonardo wanted to create things that could simplify people's lives; Leila wanted to work hard and play hard; and I wanted to keep doing my best to try and work with the people, for the people to make the world a better place. Our hormones were at work, but we were still living protected, carefree lives. Meanwhile, Germany had been reunited and the Cold War had ended. The mood was generally upbeat.

The next decade started with the burst of the dotcom bubble and the launch of the euro, followed in 2004 with a 'big bang' EU enlargement. By that time, two of us had finished university while the other two preferred to start their professional life and find a job. The economy had been doing so well under the liberalisation phase during the last 25 years that we were all optimistic about our professional futures, even if we were conscious that everything was not quite so rosy. That was until 2008... financial crisis, credit crunch, bank bailouts... when it became clear that our school days were well and truly over.

SOPHIA
March 2015

9.2 NARRATIVE | SCENARIO 1

CLEMENT

I have always thought nature was clever.

I remember when we were kids. Sophia, Leonardo, Leila and I spent all our weekends playing on Grandpa Joe's farm, exploring the surrounding fields and woods. On countless Friday afternoons we would skip class, taking our bikes and riding as fast as we could go across the five kilometres that separated the school's urban neighbourhood from the sunflower fields around the farm.

We were so lucky that Sophia's grandfather lived in the countryside, not that far from home or school. Everything was so different when we were there. We were all different. If I had only known Sophia, Leonardo and Leila at school then they would not have been my friends. Sometimes I was exasperated by Sophia in the classroom! She was always in the first row, always had the answer, always raising her hand to explain things we simply did not care about... And Leo! He was constantly going on about his Amiga 500, and the Atari ST, and so on, and so on... And Leila? Well, she was another story... she would always cheat when playing marbles, but what could we say? She loved winning.

I don't know whether something was wrong at school or something was special in the countryside, but we were different. Me? I was just myself when we were all together in the countryside, not bored like we were at school, and I enjoyed being with my friends. Sophia knew so many things that her Grandpa explained to her about nature: the names of the trees, the plants, the animals. Of course, she could not stop making fun of my ignorance but that was okay. Like the first time I noticed that the sunflowers were pointing towards the hill when we were leaving school at sunset while they were pointing at Grandpa Joe's farm when we had just arrived.

"Well, don't you know, Clement? Why do you think they are called sunflowers? They follow the sun, dummy! By doing that, they can take its energy and grow faster."

I was a bit ashamed but also fascinated. That's clever, I thought to myself. That's very clever.

Leonardo knew stuff as well. His father was an engineer after all.

"Do you know why the trees and the plants are green, Clement?" he asked me one day.

What a strange question! They were green because they were green, right?

"It's because of the chlorophyll. It uses the light to make the plants grow. It takes the carbon dioxide and it produces oxygen. Like that, you can breathe! Pretty cool, right?"

Indeed, it was! There were so many things to learn here, so much more than at school. And I learned it all from my friends, which was much more fun than with the teacher…. Leila? Leila could not care less about nature, but she did care about the honey belonging to Grandpa Joe's neighbour. How many times did she open the hives to get the honey? I was just afraid of the bees, and also of getting caught by the grumpy neighbour. But she just could not resist it. Leila would always share the honey with us, but only after she had taken what she wanted for herself!

Now that I am in my living room looking at this old picture of the four of us in the woods, in front of our hut – which took us many pretty exhausting days to build and a healthy dose of collective cleverness – I really understand how much we learnt from our shared experiences in the countryside, close to nature. It was probably during those days that I came to understand – and probably the others did as well – that we were part of a whole, that everything was linked, and that life was so much more enjoyable when working together.

Nostalgic – not really. We are still friends. Close friends, actually. We no longer live in the same area, not even the same country, but nowadays there are so many ways to bridge that distance. We never lost contact thanks to social networks, and today's simple Holo Xperience lenses and earpieces makes you forget completely that you are talking to someone a thousand miles away. Technology was never my thing, but I must admit that people around the globe would not be as close to each other as they are if it was not there.

In fact, we have all been working together remotely for a few months. And me – who always stayed in the background, being less knowledgeable and resourceful than the others – I am kind of the leader now. Well, leader is maybe the wrong word. I launched our initiative and connected all the pieces. I am kind of a bridge-builder, I would say. After all, that is what our world needs, especially if we want to do something about global warming! Certainly not the government, neither the federal European one nor national governments, will help! I do not know what they do with the tax money, but there is certainly not enough going to sustainability.

Sure, new public investments from the EuroRegion take into account climate change mitigation and adaptation, but there is a whole infrastructure to refurbish and rethink: roads, buildings and transportation. This is expensive and European regions are no longer the economic powerhouses they once were. Things are moving so slowly! And temperatures have already risen by 1.5°C since we were kids! Sure, our region is not suffering as much as others in Europe and in the world, but we cannot stand by idly. This is irresponsible and not equitable, it is the wrong behaviour. Co-operation fosters co-operation. If you help with something, you will be helped with something else, tit for tat. It is that simple. No need to procrastinate! And after all, our region is one of the main poles for quantum servers for Europe and Africa, which is a great opportunity for our local economy. All the new start-ups are located around here. But it also has huge side effects in terms of energy consumption. And they don't cool these quantum servers with clean, renewable energy, do they? No, surely not!

Of course, I did not wait for this project to become engaged in climate change action. Since the late 2010s, I have been working with other activists all over the world to design, test and implement solutions locally and evaluate the global benefits. At first, we worked on changing people's behaviour regarding energy consumption. We simply tested different schemes by trial and error, and now we know what works. But it is not enough. All the new technologies use electricity and they offer so much. It is useless to go against what people want, so we must make sure either that these technologies do not end up increasing energy consumption or that this electricity does not release greenhouse gases. We also need to clean up the mess of energy that is not so clean!

That's why carbon dioxide capture is so important nowadays and the EuroRegion has worked with us to plant synthetic trees in all urban parks. They capture more than a thousand times what a natural tree can fix and produce light from that energy, but it remains marginal without real cost-efficiency. What we need is more ambitious action without waiting for government initiatives.

It all began in the digital work rooms of the 'community arena'. I was chatting with the Northern European Collaborative Innovation Network to get an update on synthetic trees when my Holo Xperience lens informed me that Leo was also following the forum discussion. What a terrific surprise! I had not heard from him for five years. He told me he was just out of the network! I informed him of my presence and we agreed to have a private HoloChat afterwards. It was so great to be in touch again.

Leo explained that he spent most of the past few years working on providing computing technology to a research lab on a vessel that was cruising the oceans. They were running experiments on algae, using the latest developments in synthetic biology. The research vessel was crowd-funded by hundreds of communities around the world to enhance an old technology from the beginning of the millennium that never managed to become mainstreamed: applying an algae-based varnish to buildings in order to capture CO_2. At the time, it was too costly, inefficient and, above all, nobody really wanted walls in the cities that they believed would be slimy green! The reality of climate change had not yet hit home for most people.

Leo told me they had created a varnish which could not only capture CO_2 very efficiently, but also methane and the mix could be used as a very high-quality biofuel! To top it all, the varnish could also be pigmented in all possible colours! Virtually all the conditions for mainstream adoption had been met; it just needed to be tested. Would people be interested in investing in such a new solution for their houses? Maybe it could be made compulsory for all new buildings or renovations, if the authorities were to be convinced. After photovoltaic panels, heat-recovery windows, super insulation and so on, it was becoming easier to produce sustainable housing. Leo attended all the Collaborative Innovative Networks he could to present his findings and to look for pilot communities. I was definitely in! Retrofitting housing infrastructure everywhere – that was exactly what was needed.

Sophia was sure to help, too, as she was now the leader of the Green Party in our EuroRegion. Not only had we stayed best friends, but we had also worked together on a number of initiatives. She was always interested in what we – in the field – were proposing for social, green, collaborative innovation. We were kind of their think-tank – living labs to test ideas, and help them win votes eventually! If my attempt to implement these new algae facades proved successful in the area where I lived, she would move heaven and earth to mainstream this initiative throughout the whole EuroRegion, and then elsewhere in Europe. After all, she was so well connected!

I knew what I had to do to get this to work. I had done it for years with colleagues in my association. Work on our communication, go into the field, door-to-door, find a volunteer family in each neighbourhood where we would implement the solution for free, organise workshops with the inhabitants – especially the kids – get them used to the idea, focus on the climate change impacts, and only talk about money much much later! Indeed, mindsets have changed: people now care about climate change, they want to collaborate, they simply don't know how or on what. So we took the initiative to put these new mindsets to good use. The money they could get from the energy produced, the money that would be generated through new jobs in those areas, but also the money they needed to make an initial investment… yes, as always, investment was the problem. Of course, it was always easy to crowd-fund a thousand or so euros but there are so many initiatives nowadays… Here, I needed some help. Here, I needed Leila.

Leila had spent the 2000s working as an exotic options trader in some of the most prestigious banks. But that was before Black October – 2008 and the large demonstrations by the 'indignados' against the financial system were nothing compared to what happened in 2021. This time, massive demonstrations, general strikes, total paralysis, the European economy on its knees… We had many conversations with Leila at that time, and I believe I might have had something to do with the change in her career. Today, she is a financial consultant in an alternative lending association. The peer-to-peer lending platform she created is the most successful one in the region. She brings all her experience to attract small investors and big companies. No one is better than Leila at convincing a CEO to invest in a grass-roots project. And she takes her cut every time! It is all about talking to them about Corporate Social Responsibility, corporate reporting and long-term positive externalities, she claims. And it is always as soon as possible! She really knows how to make things move.

Now that also Leila is on-board, I have no doubt we will succeed. Household by household, neighbourhood by neighbourhood, the greening of our houses and buildings will pollinate across the whole region. A bio-inspired technology, a local initiative and some collective action will help us to make a giant step forward. So yes, nature is clever. And we are pretty clever too!

CLEMENT
May 2035

9.3 NARRATIVE | SCENARIO 2

It is 1 January 2035. The Euroscepticism that almost destroyed the EU in the late 2010s has receded and changes have been made to the EU Treaties. EU political leaders decide on broad societal issues and engage other players on the international scene but operate in a transparent way under the concerned watch of the citizens. Many decisions with local implications have been devolved to lower rungs of decision-making, the wide use of social media having led to a redistribution of responsibilities in subsidiarity.

Sophia, who is now a successful politician in the Sustainability Party, has just been appointed as the minister of sustainability, which now covers the economy portfolio. After a long refreshing walk in the forest, Sophia is in her kitchen when her husband walks in, clearly still half asleep from his afternoon siesta.

SOPHIA, feeling energetic, greets him | *Good afternoon Darling! You know, it was surprisingly cold out today. I thought that the melting of the Arctic had freed us from such cold winters. Brrr... I will have to dress really warmly for tonight's celebrations with the Party.*

Bernard yawns and looks outside. Scratching his head, he says:

BERNARD | *Afternoon Sophia. When will you stop complaining about climate change? Now that's a nice New Year's resolution...*

SOPHIA | *I'll stop when the effects of climate change start to subside! I was glad to see that Leonardo and Leila came to our New Year's Eve celebration last night. It had been a long time since we last saw Leila. The poor girl was so upset at the green taxes and circular laws from a couple of years ago! She is so focused on making money! ...And she doesn't care much about sustainability. With her it's always me, me, me and now, now, now... And you know Clement. He is really nice. It was a nice opportunity for us all to catch up... I am happy to see that all my friends are fine. What did you think?*

Bernard is now almost awake, and starts preparing coffee. He thinks about how much time they had spent with Sophia's friends over the years, especially when Clement and Sophia were involved in organising the public campaigns that finally led the mainstream policy-makers to develop long-term visions on sustainable development and put green taxation in place.

BERNARD (hesitantly) | *It was OK. But you and all your friends! It would be nice to have a party on our own once... Anyway, you can't expect everyone to be as invested in sustainability as you are.*

SOPHIA, *who has already been reflecting on these issues during her walk* | *How can you talk like this! You know that it takes co-operation if we want to develop a truly sustainable society in Europe! Think of our children! Listen, I want the terrible winter storms and floods we are now getting every year to stop.*

Sophia thinks about the ridiculous international emissions targets and how governments spent decades arguing to avoid taking real action. If people had only been thinking a bit more about co-operation rather than competition! We are all in the same boat after all! Wherever greenhouse gases are emitted, they are a problem for us all!

SOPHIA | *At least the big storm of three years ago finally got us in government! I just wish that thousands of people didn't have to die first... That was really awful!*

BERNARD | *But it was unpredictable!*

SOPHIA | *Remember the 2013 IPCC report? It was already clear enough! So yes we couldn't precisely predict one event, but the trend and the need for preparedness were clear.*

BERNARD | *Really? What do you mean?*

SOPHIA | *Look at Amsterdam and Venice. We have to evacuate them now! Is that cheap? Think of all those people who used to say that investing in emissions reduction was too expensive! And now look ... I'm glad I could talk to Leo. I got the heads-up on some really impressive technologies that they're testing. Their robots are starting to be able to rely on quantum computing: immensely powerful while smarter, cheaper and less energy hungry!*

Bernard thinks about how interesting it is that some people can be so focused on the small things in life while others prefer to think about the big questions:

BERNARD | *Come on! Leo and his gizmos! We're at it again. Remember the school project? His recycling machine mangled the science teacher's jacket! That was so funny!*

SOPHIA laughs for a while, and then becomes serious again | *Yes, but now, he is a pro... Since he has become Head of R&D at QuantiRobots, I have managed to convince him to invest much more in applications for sustainability and he has developed a much more systemic thinking. He's even franchised Leila to distribute his equipment. That was a nice break for Leila. Her capitalistic approach was not leading her anywhere in our new society. At least, now, the circle is complete.*

Bernard is not convinced, because no matter what the political talk and the technology, people tend to focus on what still does not work and find it hard to think of their society as advanced, especially as it struggles to adapt to the dramatic effects of climate change and as the new civic behaviour has led de facto to a restriction in freedom:

BERNARD | *In your eyes... but is everyone on-board? There is still quite a bit of resistance. Look at Leila. You saved her but she doesn't realise it and she hates the restrictions on her free choice; and there are many more like her.*

SOPHIA | *They are fewer than before. Look, the storm has unleashed a tremendous wave of solidarity. I think most people understand how important co-operation, solidarity and mutual support are. Clement agrees on this, and he is the person I know with possibly the highest understanding of social trends. Now is the time to implement our grand vision: reinforce societal and economic resilience by thinking long term, promoting frugality and integrating systems. Once people understand the rationale behind our large infrastructure plans, and the security that it will bring, opposition will be much weaker than in the past.*

BERNARD | *Wishful thinking! You know how people are. They don't like change, they strive to fulfil their pleasures and they hate complexity. And on top of that, your laws limit their freedom!*

SOPHIA | *Come on, Bernard! The survival of our society is at stake! Climate change kills! We have simply changed the taxation system to reflect the true costs of our behaviour and consumption. The problem was the old system. It made people believe that they were free to consume whatever without any consequences! And look where that led us! I am glad to see that people are now well informed, share our main societal values and are empowered. At the same time, they are more responsible.*

BERNARD | *Mmmm…*

SOPHIA | *Why are you reacting like this? People have changed! Look at all these new small service-based companies! Even you are using them! We don't own a car anymore and we have never been as mobile as we are now! All this robotics, computing and internet have made our home more comfortable and less energy intensive. We hardly pay anything for heating and utilities anymore! We pay for services that generate jobs here. Much better than buying fossil oil or gas on the world markets, no?*

BERNARD | *Yes, but…*

SOPHIA | *But what? Stop playing the devil's advocate! The EU's strides forward have also supported the dissemination of all types of eco-innovation across the world and have shown that a new way to provide well-being for all is possible! This is win-win! Remember the face of the free traders when we pulled out of the WTO? They thought we were facing Armageddon! And it turns out that managed trade with due attention paid to sustainability is much better than free trade… And, the icing on the cake, it has removed quite a few of our geopolitical vulnerabilities…*

BERNARD | *Ok, ok. But I'll continue discussing with your colleagues when we go to the party.*

SOPHIA
May 2035

9.4 NARRATIVE | SCENARIO 3

LEONARDO
LEO

In 1988, my father brought home our very first computer. I was so excited that I still remember that it was on a Tuesday not long after the start of the school year. It was after school and I was sitting on the floor in my room upstairs. I was trying to build a house by putting together coloured plastic bricks of various sizes on a large, square, grey plastic plate. I wanted to build a model of our house, but the idea turned out to be futile as I was missing too many pieces. By the time Dad came home I was feeling frustrated.

He called as soon as he came in. His voice sounded different, excited. It was a complete surprise! I hoped something big could be going on but had no idea what. Curious, I crashed through my boxes full of plastic bricks and ran downstairs.

He had put an enormous carton on the dining-room table and my excitement grew bigger. My curiosity burst even before he had taken his coat off.

What is it, what is it, what is it? I demanded.

We walked towards his office, me carrying a bag of small packages and he the large box. He explained that it was an Amiga 500. My excitement dwindled as I had no idea what this was. Dad explained that it was a computer he had bought so that he could do some work at home – but that it also happened to play video games.

Once again, I was all ears, and as we approached the desk to put the box down I understood that, at that very moment, we were sharing something. This new piece of technology seemed to bring a unique excitement, and with it a feeling of endless opportunities.

After instructions to be careful and to let him set everything up, Dad opened the box while I impatiently studied the pictures on the packages in the bag. One was a game set in medieval times, my favourite era, and it had dragons!

Once installed, the computer consisted of two pieces: a thick keyboard and a bulky monitor. It was light grey. Dad said it could display 32 colours. Wow, I thought.

By bedtime, the next weekend could not come soon enough. Dad was going to learn how to use it the right way so that he could show me how to handle it correctly. Otherwise, it could break down.

Since then, my father and I have each had many computers, mobile phones and other pieces of high-tech. We have shared this interest and talked about new stuff constantly coming on to the market.

We have often exchanged gadgets. Some are still in the attic, while others have been thrown on the 'electronics' pile at the waste-sorting facility. Over the years, we have shared the special excitement created by new technology many times.

Now, in 2035, as I sit back at my desk and look at this incredibly small package containing the next big thing in technology – a 'P4C', Portal for Computing – I think about my father and about that evening in 1988. I realise how much that experience has shaped my interests and choice of career. Letting my thoughts stray away once again before unpacking the P4C, I start to wonder…

LEO | *How did this little thing come to be? Not long ago, we were still churning out products that were very powerful, but so much larger!*

I started to think about the early 2020s, when society reached a milestone. I remember that I wasn't really interested in politics, but my old friend Sophia was very engaged in the Sustainability Party. One day I saw her looking very excited. She told me that the EU had just reached an agreement that had long remained elusive:

SOPHIA | *Taxes on labour will be drastically lowered, compensated by heavier taxes on raw materials and energy! At last we will be able to tackle climate change, environmental degradation and unemployment effectively and simultaneously!!*

My first thought was: This sounds mad!. However, on second thoughts, I realised that I knew quite a few people who had lost their jobs in manufacturing and we had all long been hoping that politicians would do something about the rampant unemployment we had known for years.

LEO | *So are you hoping for a lot of new technological innovation for sustainability? I asked.*

SOPHIA | *Yes! And we will engage in green Public-Private Partnerships and green public procurement to really activate all stakeholders! Sophia told me.*

LEO | *At least, the overall level of taxation is not going up, I thought.*

At first, Dad was more optimistic. I worried about how this would affect our quality of life but I soon had some interesting sustainable business ideas to explore.

DAD | *It is time for the big ones to adapt, they can afford it, Dad said. We want your grandchildren to have a nice future, too, don't we?*

This radical policy change put energy and material efficiencies centre stage for good from one day to the next. Not only did it make people change their behaviour, but at the same time technology it also boosted development and new ways of doing things.

A few years later, Sophia's promising career in the Sustainability Party took a knock. Ambitious colleagues who wanted quick decisions attacked her inclination to co-operate and reach consensus. She also wanted governments to take a firmer grasp on social issues, while her colleagues stayed focused on a small government dealing mainly with economic and environmental sustainability goals. She was sidestepped.

It then became clear to me that the political changes gave a significant boost to innovation in energy and material efficiency. This gave a new meaning to my framework for a deep integration of high-tech hardware with complex software. My small business was then bought by Quantirobots, where I soon headed up the R&D department.

Around that time, my wife and I moved to this newly built house in the outer suburbs, quite close to our respective workplaces. We thought these 'cities in cities' had become increasingly attractive to live in as in this case the mayor, who funnily enough was also from the Sustainability Party, had improved the basic services to those remote areas and most of what we needed was within walking distance. Finally, we didn't have to commute, saving us both time and money!

There was also a hacker-space and fab-lab in the neighbourhood. I could go there, get inspiration from the youngsters on smart chipset design ideas and other tricks to make our robots easy to repair. At that time, many young people were already receiving training on eco-design at engineering school.

Our house was actually not too far from the suburbs where Leila was still living with her family. I used to meet her for coffee every now and then. She was doing okay, but not great, as competition in her line of work was fierce, and she was getting by mainly by doing green financial consulting for small companies and government projects.

Leila said that for a long time she had wanted to buy a new house with a garden in another area because there were even more homeless people in her neighbourhood now than when she was a child. But she didn't have the money.

Once, Sophia joined one of our coffee meetings. She was living in a small apartment in a sustainable high-rise, some distance away.

LEILA complained | *They are really distorting the market. If they could only adjust the green taxes so I could take advantage of some investment ideas I have and finally make some real money!*

Having known poverty as a child, she was still craving for the luxury of a gasoline-powered high-end car and a large old house with lots of land.

SOPHIA exploded! | *How dare you say such things with the super-clean and efficient automatic car services now available! How can you whine about such egoistic and polluting things?*

I thought this reasoning was hard to argue with, but Leila felt threatened in her individual freedom and disagreed strongly. I did all I could to divert the conversation by telling them about how I had been offered to feed excess electricity from my home PV installation into the planned neighbourhood smart grid. This strategy was not very successful, however... I could not even tell them that it seemed I wasn't the only one reluctant to join because it is always good to have some energy in the personal hydrogen storage system in case something should happen. By the time we left I was convinced they would not see each other again for quite a while...

But only a couple of weeks later, our old friend Clement contacted us again to try and organise a picnic. He told me he was (still!) trying to get his co-operative ideas off the ground. He was still trying to change society... and he was still going everywhere by bicycle... So he chose a picnic spot we could only get to by bicycle.

CLEMENT | *Let's have a picnic by the large oak tree in the forest and discuss what we can do to tackle the problems still arising from people wanting to own their own stuff. I have a new idea for a sharing system that I want to discuss with you.*

In the end, my old rusty bicycle broke down after just 20 metres and I couldn't make it to the forest. I didn't mind terribly though, as I was not convinced by these wishy-washy co-operation ideas. They don't really fit our modern technology-driven society. Poor Clement, often unemployed and with time to explore some marginal ideas... He has had little social protection and has kept going back to his odd collective that has managed to survive since the 1970s. Out of the mainstream and without access to even the most basic of automatic car services, I suppose you don't change your world view easily.

One of the key steps towards the P4C came in the late 2020s when we were finally able to mass produce quantum computers. It was clear that this was the next paradigm shift in technology, since the raw computing power lived up to the high theoretical expectations, putting an end to Moore's Law. Quantirobots made a fortune from being the first mover in this step change.

The end of Moore's Law meant that prices never fell as much as what we had seen in the first generation of electronic products. With high energy prices and extraction of key raw materials becoming increasingly expensive, our competitors also soon realised that quantum computers had little potential to become significantly cheaper. At the same time, the P4C's computing power was much greater than any single client could ever need.

A small start-up saw an opportunity in this fact. In 2032, a brilliant engineer working in techniques for sharing network bandwidth managed to make a computer-like device the size of a one-euro coin. When demonstrating it in public for the first time, she said: - It's a window to the world – to anything you want to – and it gives you the cheapest concentrated computing power ever.

In itself, it was actually not that powerful, but had enough 'oomph' for many domestic apps and domotic applications. What made it special was that it was very frugal, had been made from cheap materials and was running on almost no energy. The media speculated that one of the big players would buy the company out, but according to Leila who gave them financial advice, they received enough public funding to be able to remain independent.

Meanwhile, Quantirobots had already started to co-operate with other players in exploring new business models for its quantum computers. All the major players had recognised the need to maximise the use of quantum computing power on a global scale by manufacturing a limited number of devices distributed strategically for leasing at the local level. This lowered both energy and resource consumption enough to make it economical and to create a viable business model. For those wary of cloud computing and shared resources, the P4C made it possible to still own a personalised little gadget, without being prevented from buying access to shared quantum computing power.

As my thoughts came full circle, I finally started to unpack the P4C I had just bought. As a techno-enthusiast, I felt great at the idea of having fulfilled my latest 'ultimate' tech fantasy. Every analyst on the planet had predicted that, with its record-breaking sales, essentially it would make the whole computing industry sustainable in just a few years – yet another move towards the greening of the European economy. Promising days lie ahead…

LEONARDO
May 2035

9.5 NARRATIVE | SCENARIO 4

LEILA

It is January 2035, and Leila is out with her venture capital fund partners celebrating the sale of the successful eco-start-up '42&me' to a multinational. While drinking her glass of champagne, she reminisces about the past, remembering how it all began back in 2008 and the rocky road she had to travel to get to where she is now.

After finishing her studies in finance and economics, Leila worked as an investment banker and did quite well for herself. She bought a fast car and enjoyed parties with the wealthy. She loved her young urban professional lifestyle! The 2008 financial crisis bombshell took her completely by surprise. Fearing that she might lose everything, she decided to leave the financial world and get some concrete knowledge of the industrial sector. Being hard-working and focused, she was immediately hired by a large management consulting firm. This, she thought, was a strategic move which would help her understand better how companies work and ultimately help her to start her own, one day. After nearly five years in consulting, Leila had gained a lot of know-how about many different companies, the way they work and the problems they face, and she was able to identify what she thought would be the most promising businesses.

Being particularly intrigued by the high potential profitability of mobile ICT, Leila left management consulting to collaborate with one of the company's clients who was focusing on using ICT to develop energy efficiency in individual homes. Leila joined the 'LightHouse' company which was developing efficient energy-management and lighting systems for houses. She truly believed that home automation was the future, at least for the wealthy, a class to which she now proudly belonged. After several years climbing the management ladder, she was back on track making her six-digit salary, but this time with a more concrete knowledge of ICT applications.

Never being the type to stay in one place for long, in 2025, Leila finally decided that she wanted to use her well-chosen group of friends, mainly consultants, tech geeks and former investment bankers, to start something up herself. Her network, together with her wealth and acquired expertise, gave her the confidence she needed to set up her own venture capital fund. For the last 10 years, Leila has invested in various start-ups, some of which were founded by her former consultant colleagues, who come to her for extra funds in the absence of a green fiscal framework. Obviously, the general start-up failure rate was still high (around 10:1), but Leila was good at what she did. She had a certain sense for where things would go well, especially in fields related to home robotic systems, and domotics to help reduce household energy consumption and ultimately the cost of living. For example, Leila helped finance 'Moulin Vert', a company creating domestic renewable-energy systems, specifically highly efficient individual windmills.

Leila loved her new job: it was high-adrenaline, fun and, if done wisely, highly profitable. But most important was the fact that Leila was proud because she had made her way to the top all by herself. Facing such intense competition, it was a long, hard slog – but, all-in-all, it was worth it. Her business was now running smoothly. She witnessed the transformation of several start-ups, manufacturing and selling eco-innovative products, into profitable businesses, and today they have signed yet another big deal with a multinational company, selling 42&me, a company to which Leila, as a successful venture capitalist, had given an important boost through her private equity fund. The deal was a huge success. A bottle of champagne was just the start of tonight's party…

Feeling light-hearted but excited, Leila is asked to give a speech:

LEILA | *Dear friends and colleagues, today, I am a proud woman. I've now been a successful investor for a number of years, dealing in particular with sustainable finance. Back then, I advised a few companies that hedged their bets not only on rare earths, but also on wood from renewable forests and other natural resources, when prices were going up, and they struck gold… As have I! The apparently strange advice from Sophia, an old friend, on resource efficiency and renewables, proved to be a boon. Increasing world population, investment in renewable energy and a growing global consuming class have all led to increased demand. This is what gave me the starting capital for 42&me.*

Today, 42&me owns a few large facilities in Europe and manufactures robotic appliances for the entire continent and beyond. The most amazing thing is that thanks to the robotics revolution, not only can we manufacture great products, but our own factories benefit too. Each factory is essentially a robot farm run by four 'techies'. Even logistics, both for raw materials and for shipping finished products, are largely automated. This keeps costs down and production predictable. Maintenance is the most labour-intensive part of our operation but it has been outsourced.

Besides, nowadays it is pretty difficult to find people with the right skills in the first place. As the best education is now almost completely privatised, most kids earn their degrees through MOOCs. While those who can afford private schools have the right skills sets and recognised diplomas, those who follow MOOCs end up with qualifications that are more difficult to assess. The best start their own companies, provide some consultancy here and there, or leave Europe for greener pastures elsewhere. And anyway, the instability among today's youth makes it pretty difficult to find reliable long-term employees. Through automation and robotisation and with most of the required manpower to run the company's facilities outsourced, 42&me keeps costs low, but profits high. 42&me has pretty much cornered a niche in the market in robotic appliances that are cool, trendy but, at the same time, sustainable.

Funnily enough, my secondary school buddy Leo, here in the front row, is one of those techies running the 42&me facility. Among my three childhood friends, Leo was always the problem-solver. Sophia and Clement were the idealists, each in their own way. Now, Leo has the technical knowledge needed to keep a company like 42&me running. He also has a lot of experience working with the Chinese and the Americans, who run the operational and some of the manufacturing side of things. But although Leo has some of that competitive spirit that I like so much, he's just too focused on performance and ingenuity. Fortunately, I have been there to keep an eye on profits!

When I ran into Leo on a business trip to Beijing several years ago, he explained that he had started a company called QuantiRobots, designing robotic household appliances, like vacuum cleaners that work alone or kitchen robots. He was looking for some extra funds in China, having been repeatedly denied credit in Europe. Leo had attempted to start various companies with his college friends with whom he studied engineering and computer science. Year after year, he worked on developing projects, which he found would not only be useful but highly beneficial for the environment. Fascinated with robotics and artificial intelligence, he had an idea, for example, to design autonomous devices capable of detecting harmful substances in water and soil to help farmers improve their crop quality and yields. Despite his efforts, however, it was almost impossible to get any help from governmental institutions, who Leo referred to as being "useless, incompetent, short-sighted and incapable of knowing what's best for society".

Unfortunately, I didn't see any real hope in Leo's QuantiRobots either and turned him down as well, suggesting that he do some more market research to identify a true gap in the market. I knew that there wouldn't be enough money in the business. Friends or no friends, I had to remain professional.

After his start-up went bust, Leo was pretty much set on moving to Silicon Savannah to work in the iHub, dismantling derelict 3D printers. But last year we ran into each other again at one of Nairobi's airports, and got talking about business opportunities. I told him I was thinking of investing in 42&me, and knew they were desperately looking for someone with technical expertise and knowledge of the Asian and African market. He jumped at the opportunity! Good for him!

I also want to say a few words about my dear friends Sophia and Clement, a completely different story altogether. IN fact, a pretty sad one, if you ask me.

I have already told you about Sophia and what I owe her. She is now living in 'Peripherous', also popularly known as 'the jungle'. This is basically a community of greens living in the countryside, apparently trying to lead a lifestyle that is more "in touch with nature". Really it is mainly just a bunch of marginal people who can no longer afford to live the fast-paced life of the big urban centres. Being the activist that she is, I am sure she must be quite involved in all these social uprisings, resistance movements and organised instances of resource theft and sabotage. Just last week, AguasUnited's water supply network leading into the urban centre was sabotaged again by activists from the jungle, who have yet to give up on the fight against the global privatisation of water supplies.

Clement's story is quite different. He used to run XYZ, a civil society organisation. But after his sponsors withdrew and his funding dried up, he became really active on social media, earning some income through his blogging activities on Web 4.0. He succeeded in starting up a small, but increasingly active, social movement that advocates and organises community recycling and reuse schemes. This is quite typical of Clement, I suppose. I've always found him to be quite anti-establishment. If you ask me, I don't believe his supposed social awareness will get him very far. How could anyone think of making money by inciting people to share their cars and lease their phones? It just doesn't make any sense in today's economic climate where consumption and ownership are the name of the money-making game. Anyway, one place where Clement's reuse/recycle schemes have had a lot of success is the jungle through, for example, the buying and reselling of old-school solar-power generators, and converting organic waste into compost to sell to local nurseries and farmers, which in turn helps to feed the jungle inhabitants and provides them with their basic energy needs.

Clement and Sophia really do live in a different world – Sophia at the margins of this fast-paced and dynamic society, while Clement is somewhat dreamily trying to ease the pain for those people who just didn't have the ambition and drive to make it to the top. Trust me, there's a lot of them out there today!

Clement is still in touch with Sophia, but I have lost touch with her completely.

Anyway, sorry for going off-track. Back to tonight! And tonight I say Cheers! Let us cheer for all of our hard work. It hasn't been easy to get here, but the struggle was worth it. We are doing well now, so let's not worry too much about the past or the future. With one in 10 start-ups and SMEs failing and investment risk being so high, we can be proud of belonging to the 'haves' today. As long as we keep our eye on the ball and focus, our own future at least is looking bright.

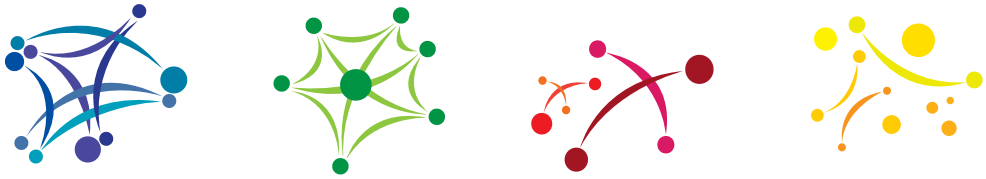
So tonight let me finish my speech with the motto for the evening: If we work hard, I say we play hard!

LEILA
May 2035

10. SYNOPSIS OF THE SCENARIOS IN 2035

One of the main objectives of this foresight study was to better understand how differently eco-industries would evolve depending on what general framework conditions would be prevalent in the future. The scenarios present four significantly different sets of framework conditions, making such a comparative analysis possible. Table 2 provides a synoptic view of how different the eco-industries landscape would look in each scenario. Of course, this is a simplified view but is complete enough to support a systemic outlook that can be used as a basis for more in-depth discussions. Indeed, this framework could be used advantageously to feed policy discussions, possibly during dedicated expert workshops. Of course, it must be remembered that this is not a set of predictions or forecasts, but simply a systemic presentation of possible futures to foster in-depth forward-looking reflections.

Table 2: *Synopsis of the four scenarios setting out their differences in terms of industrial landscape*



	Scenario 1	Scenario 2	Scenario 3	Scenario 4
	MULTIPLE CONNECTED INITIATIVES	SHARED CIRCULAR STRATEGIES	COMPACT GREEN INNOVATION	LOCAL SELF-RELIANCE
SOCIETAL VALUES	Collaborative		Individualistic	
GREEN FISCAL FRAMEWORK	NO	YES	YES	NO
GENERAL	Tension between local and global economy and society. High social consciousness leads evolution towards sustainable development	Coherent strategic evolution towards sustainable development. High social consciousness	Evolution towards sustainable development led by the economy; society highly cost sensitive	High competition, no grand plan, elitist but also highly fragmented
LARGE COMPANIES	Often global, adapt products and manufacturing to specific markets/groups	Integrated with smaller suppliers/distributors. CSR and sustainability at the core of business plans	Traditional ones respond to green economic/ market signals. Cherry-picking among small enterprises causes tension	Dominate and act according to market signals
SMALL ENTERPRISES	Focused on niches, many group-based collaborative businesses	Many co-operative businesses and green innovative start-ups	Market-driven eco-innovative start-ups and small businesses	Occupy remaining economic space, and ideas go in all directions
PUBLIC VS. PRIVATE ECONOMY	BOTH with an advantage for the public	Large role for public action and large publicly owned businesses	BOTH with an advantage for the private	The private economy dominates

	Scenario 1	Scenario 2	Scenario 3	Scenario 4
	MULTIPLE CONNECTED INITIATIVES	**SHARED CIRCULAR STRATEGIES**	**COMPACT GREEN INNOVATION**	**LOCAL SELF-RELIANCE**
OWNERSHIP VS. USE	USE: mutualisation of certain goods	USE: a strong dematerialisation of the economy (mutualisation of goods, sharing, social innovation)	BOTH: dematerialisation occurs where it makes economic sense	OWNERSHIP (rich) & REUSE (poor): economic hardship forces the poorest people to adopt use-based consumption
SOCIETY DRIVEN VS. MARKET DRIVEN EVOLUTION TOWARDS SUSTAINABILITY	Society driven	BOTH	Strongly market driven	Weakly market-driven
PUBLIC VS. PRIVATE R&D	BOTH	BOTH	PRIVATE dominates but PUBLIC R&D funding important for SMEs	PRIVATE
INDEPENDENT VS. NETWORKED	NETWORKED	NETWORKED	INDEPENDENT: competition with some room for PPPs	INDEPENDENT: with pockets of eco-industries
IMPORTANCE OF CSR	RISING: for marketing	HIGH: indirectly forced	MODERATELY STEADY: indirectly forced	LOW
GLOBAL VS. CONTINENTAL VS. REGIONAL VS. LOCAL	REGIONAL: global social consciousness	CONTINENTAL: strong EU focus, distinctive EU operation for multinational companies; local focus too	GLOCAL: global perspective for large companies, local for small ones	GLOCAL: global perspective for large companies, local for small ones, local social consciousness
CHARACTERISTICS OF OCCUPATION	FLEXIBLE – DIVERSE, large public sector; more co-operative	ORGANISED, large public sector. Shorter working days, more in service sectors	FLEXIBILITY – TENSION	LOW SKILL – LACK OF SPECIALISATION: traditional service sector, and small idea-based business
DEGREE OF CIRCULARITY/ INTEGRATION	INCREASING: greener value chains – ad hoc progress where people want it	HIGH AND INCREASING: overall coherent strategy, one basis is new infrastructures	INCREASING: market driven	LIMITED: ad-hoc initiatives where it makes immediate business sense
INNOVATION	Social and open	Public R&D for sustainability is a key support for innovation	Sustainable and high-tech, public R&D supports SME innovation for sustainability	Short-sighted and technological
LANDSCAPE	Symbioses	Integrated	Fragmented	Highly fragmented

11. POLICY ISSUES RAISED BY THE SCENARIOS IN 2035

11.1 UNDERSTANDING THE ROLE OF SELECTED POLICIES IN MOVING TOWARDS SUSTAINABILITY

In addition to generating a systemic discussion on the eco-industries landscape, the scenarios created by the foresight exercise were used as a basis to generate a more general reflection on policies for evolving towards a more sustainable future at EU level.

The experts were asked: "*What policies would one have to use today to bring each of the four scenarios as close as possible to sustainability?*" The exercise was not meant to compensate for the intrinsic attributes of the scenarios, but to reflect on the full potential of selected policies to foster sustainability within the constraints created by the logic of each scenario.

Table 3 presents the policy areas the panel of experts identified as being most relevant for each scenario. Each policy area was subsequently discussed and explored for each scenario in which it was relevant. Only three policy areas (research and innovation, new business models and education) were recognised as being important for all four scenarios.

The following sections present in more detail what came out of the reflection with the experts for each policy issue in each scenario. Again, most policies were not considered by the experts as relevant for all scenarios, which explains why not all scenarios are covered in all of the following sections. Only research and innovation, new business models and education have been developed for all four scenarios.

Table 3: *Policy areas discussed and explored for each of the four scenarios*

POLICY ISSUES	Scenario 1	Scenario 2	Scenario 3	Scenario 4
SCENARIO TITLES	MULTIPLE CONNECTED INITIATIVES	SHARED CIRCULAR STRATEGIES	COMPACT GREEN INNOVATION	LOCAL SELF-RELIANCE
RESEARCH AND INNOVATION	X	X	X	X
NATURAL RESOURCES MANAGEMENT		X		X
NEW BUSINESS MODELS	X	X	X	X
REGULATION	X		X	X
EDUCATION	X	X	X	X
ETHICS			X	X
EMPLOYMENT	X	X		
TRANSPARENCY	X			
GOVERNANCE				X
SOCIAL PROTECTION			X	
SYSTEM INTEGRATION		X		

11.2 RESEARCH AND INNOVATION

SCENARIO 1

Rationale
- Needed in this scenario to prepare for the future and to develop technologies to the right level of maturity

Objective
- To understand the big picture and prioritise government interventions
- To allow for the integration of systems

Challenges
- How to create supportive regulation and manage innovation without resorting to legislation
- Where does the money come from? Public-Private Partnerships?
- The EU must create synergies between many entities of actors, fields, and local/group-based efforts
- How to better organise the intellectual property rights market and create openness

Actors/ stakeholders
- Regions target local interests. Increased 'civic' science – people sharing knowledge
- EU supports fundamental science. Open public procurement

Targets
- Increased open innovation
- Fewer rebound effects

SCENARIO 2

Rationale
- Science, technology, and industry (STI) policies
- 'Steering' society
- To produce more/higher/new volumes of natural resources

Objective
- Strengthen innovation
- Articulating communication challenges for STI
- Set strategic priorities but allowing for bottom-up input
- Increase research on understanding the dynamics of natural resources
- R&D, investment in infrastructure
- Circular economy

Challenges
- Reduce the dissipative use of resources -> circular economy
- 'Jevons' paradox creates rebound effects
- Incentives for enterprises decrease
- Fewer breakthrough innovations and more fundamental science
- R&I are not demand drivers

Actors/ Stakeholders
- Interaction between actors
- Civil society, SMEs, CSOs, applied science industry, universities, and collaborative public/private research

Targets
- Increased sharing of ideas/knowledge
- Impacts of science, technology and innovation programme
- Life-cycle assessment+Life-cycle Cost analysis (LCC)
- Relax intellectual property rights

SCENARIO 3

Rationale
- This scenario needs a medium- to long-term strategic direction for research and innovation
- It also needs support for the commercialisation of green technologies

Objective
- To agree on standards, reach targets and respect regulations
- To integrate innovation in order to solve complex problems

Challenges
- To 'de-risk' innovations fast enough to reach market
- Research and innovation on their own do not ensure a move towards sustainability
- The risk-finance sector and availability of private investment could be small
- Ethical, licensing and intellectual property rights issues may arise
- It might be difficult to mainstream niche markets, because of initially higher-priced sustainable products (e.g. energy)
- Risk of 'creative collision' between public and private sectors
- EU-level green taxation impacts research and innovation

Actors/ stakeholders
- SMEs, start-ups, and industries do most of the research and innovation
- Governments facilitate, provide incentives and support green research and innovation by, for example, setting a vision and a green public product policy, being the first buyer and procuring green innovation
- Long-term public contracts

Targets
- Degree of integration
- Increase in innovation reaching the market

SCENARIO 4

Rationale
- Limited public sector
- Market-pricing of resources

Objective
- Ensure private sector R&D is sustainable/working on sustainable solutions and competitive at the global level

Challenges
- R&D must be profitable
- Coordination/strategic approach to avoid overlaps and redundancies
- Very little networking
- Very high ratio of failure
- Private company interest – loss of public goods
- Education enabling the right skills sets
- Less curiosity-driven research
- Less neutrality in science and how it is applied
- Behaviour of the financial sector

Actors/ stakeholders
- Public-Private Partnership
- Standards watchdogs
- Patents
- Venture capital/investor-funds/business angels
- Foundations/trust-funds/scholarships
- Social media increase small-scale microfinance

Targets
- Legal framework sets goals to help incentivise and steer initiatives
- Extending the length of patents/or broadening what can be patented

11.3 SERVICE ORIENTED BUSINESS MODELS

SCENARIO 1

Rationale
- Need to manage value chains and clusters of activities – local SMEs
- Need response to economic self-interest and new business model culture

Objective
- To reduce capital costs of obsolete technologies
- To build trust, transparency and partnerships
- To shift sources of profit and internalise externalities
- To develop new modes of consumption

Challenges	• Creating a new culture • Financing/banking • Establishing new economic actors and models • Transparency and trust • How to strengthen competition, and internalise externalities • How to open up innovation • Mobility and availability of skills • Public procurement as encouragement • How to allow emergence of alternative currencies • Managing co-opetition (cooperation and competition)
Actors/ stakeholders	• Investors, particularly private, need to put money into new business models • Likely to see new financial actors • Involvement of public and private actors needed
Targets	• Non-financial indicators of returns • Degree of collaborative consumption/economy

SCENARIO 2

Rationale	• Transition from current economic activities • Need to create non-price business models
Objective	• Enable new business models • Flexibility • Cover the whole spectrum of issues, multi-disciplinary • Adjust labour tax on old vs. new business models
Challenges	• How new business models deal with immigration • Current tax system and regulatory framework • Local exchange and trading systems allow exchange of services/skills without monetary compensation • Social innovation
Actors/ stakeholders	• Think-tanks and creators of innovation • SMEs, political/legal system • Collaborative incumbents
Targets	• Compensate ecological taxes with new business • Increase in eco-innovation clusters and new companies • Micro-finance start-up funding, more new jobs • Natural resources management as a new business model • Migration policy (skills)

SCENARIO 3

Rationale	• New business models 'inspired' by green taxation at the EU level are needed to become/stay profitable
Objective	• More circular models • Bring innovation profitably to market • Implement outcome oriented tools of green product policy (e.g. levels of emissions)
Challenges	• Capacity for organisation • Providing certainty and attractiveness for investors • Translating research and innovation into functional business models • Support start-ups

Actors/ stakeholders
- Government facilitates business, provide incentives, and introduces green product policy tax and flexible infrastructures
- Banks, industry and SMEs bring creativity
- Public-private financing
- Job flexicurity (flexible security)

Targets
- Net number of start-ups
- Level of bankruptcies
- Survival rate of SMEs after three years

SCENARIO 4

Rationale
- Play an important role towards making this scenario more sustainable

Objective
- Drive innovation towards sustainability while remaining profitable

Challenges
- Lack of networking/coordination
- Size/scale of projects – critical mass
- Rate of success/failure
- Start-up capital enables moving into the market quickly
- Encouraging entrepreneurship towards sustainability
- Weak government

Actors/ stakeholders
- Individuals through crowd-funding
- Entrepreneurs
- Industrial associations
- Some role for urban governance

Targets
- Policy to enable/facilitate new business models
- Internalise environmental costs into the balance sheet
- Social media to motivate

11.4 NATURAL RESOURCES MANAGEMENT

SCENARIO 2

Rationale
- Sustain national and global rate of use of natural resources (scarcity)
- Transparency

Objective
- A trans-boundary, ecosystem-based governance approach
- Valuing genetic biodiversity
- Optimise the use of resources

Challenges
- Adaptation to climate change and planetary boundaries
- Robust and shared tools for classifying, counting and accounting for natural resources
- Coupling of renewables with natural energy savings
- Pressure for resources is high -> management of scarce resources; value/responsibility is global
- Material flows
- Decreased personal footprint -> decreased quality of life?
- Corporate Social Responsibility (incl. investment, NGO, voting)

Actors/ stakeholders
- Interlinkages between ecosystems and regions
- Civil society
- Markets

Targets
- Resource indicators (degradation)
- Product labelling on material resource use
- Biodiversity indicators
- Life Cycle Assessment, cradle-to-cradle
- Green GDP
- Compensation mechanism for genetic biodiversity
- Good practice at local, EU and global level

SCENARIO 4

Rationale
- Lack of market incentive coupled with short-sightedness and individualism

Objective
- Preservation of stocks
- Rational use and protection of resources (e.g. from crime, from theft)

Challenges
- High demand for exploitation of resources
- Control over resources outside of the EU and inside (privatisation)
- Remediation and techno-fix
- Crisis management
- Reducing capacity of state to react, conflict
- Crime, land grabbing

Actors/ stakeholders
- Private finance
- Corporations and industry
- Business associations, state, and the EU

Targets
- Stocks and depletion rate
- Minimum standards
- Voluntary agreements
- Ecological thresholds
- Level of crime

11.5 EMPLOYMENT

SCENARIO 1

Rationale
- Policy needs to foster the inclusive shift from traditional jobs to social jobs and activities

Objective
- Provide job opportunities for unemployed people and youth, which allow the shift from social safety nets to economic nets

Challenges
- Need to close the loop between education and employment, to recycle human resources in traditional sectors for green jobs, mobilise young people, economic imbalances between and within the regions – regions cannot cope with everything alone (work at the national and European level)

Actors/ stakeholders
- Regions in the driving seat of the merged unemployment/employment/ education policy, cities networked
- New regional social model with a baseline income, regional currency, new kind of social jobs, openness of labour market

Targets
- Enhance smart specialisation, employment is green and shared, higher and enlarged salary bandwidth

SCENARIO 2

Rationale	• Social protection is an issue • Need to meet the needs of labour market • Manage evolving employability of people
Objective	• To maintain and create employment • Manage old vs. young workers • Make employability an obligation • Increase the 'green' skills of public administration
Challenges	• Flexibility and adaptability • Ageing and fast technological change • Low entrepreneurship • How to measure needs of labour market • Help cities know what skills they have • Company reporting
Actors/ stakeholders	• Labour offices • Government and cities work better together • Government takes care of quality highly social green jobs
Targets	• Number of green jobs • Definition of profiles • 'Feel good' factor • Employability level/check-up in companies

11.6 REGULATORY ACTION

SCENARIO 1

Rationale	• Regulatory leadership is at the regional level and initiatives come from citizens: regions ensure coordination of green efforts through direct democracy (Swiss model?)
Objective	• To design, implement and evaluate, in close collaboration with citizens, outcome-driven regulation which prioritises effectively between all environment-related issues
Challenges	• How to prioritise
Actors/ stakeholders	• Regions
Targets	• Indicators to monitor objectives, efficient resource management at regional level

SCENARIO 3

Rationale	• Provision of a stable regulatory environment with a long-term vision/ framework (non-static) • Replace norms and behaviour
Objective	• To reach sustainability targets and model/shape the markets for sustainability (not defined)

Challenges
- Reaching consensus between stakeholders
- Creating an even global playing field
- Removing barriers (e.g. non-market barriers)
- Removing obstacles (address market failures)
- Creating buy-in
- Internalisation of external costs (5-10 years)

Actors/ stakeholders
- Government to set vision and regulation in the short term
- Markets single out the 'top runner'

Targets
- Best practices and certifications
- Increase the level of standards mainly through market regulation
- Increased intelligence and foresight

SCENARIO 4

Rationale
- The lack of green fiscal framework requires a regulatory framework to move towards sustainability

Objective
- Guide/constrain consumers and economic behaviour
- Impose strict liabilities, internalise externalities and support the internal market

Challenges
- Coherence/harmonisation
- Implementation and adoption costly
- Need for leadership
- Knowledge-intensive industries
- State/governance capacity

Actors/ stakeholders
- Governments
- NGOs
- Legislators
- Regulatory authorities, European Commission
- Standardisation bodies
- Monitoring bodies

Targets
- Sector specific standards linked to environment and health impacts, e.g. codes of conduct/good practices
- Law

11.7 EDUCATION

SCENARIO 1

Rationale
- Will be a knowledge-based collaborative society
- Education needs to be coherent with R&I and new business models
- Education helps consensus building and long-term visions on sustainable development
- Need to increase governance capacity

Objective
- Raise environmental awareness among everyone to at least a minimum
- Implement lifelong learning philosophy
- Improve readiness for the future, and industrial training at all levels
- New educational models

Challenges
- People becoming unemployed, many of whom are skilled
- Mismatch of skills with demand
- Social equity
- Creating non-classic validation of experience

Actors/ stakeholders	• Public actors at all levels need to be involved • Also diverse private actors (companies, trade sectors, etc.) • There is also an enhanced role for media
Targets	• Increased level of general and scientific culture in primary and secondary schools • Increased degree of adaptation of skills • Increased mobility of workers and attracting talent • Mutual recognition

SCENARIO 2

Rationale	• Need to meet needs of labour market • Need for lifelong learning • Public education • Cultural policy, behavioural economy
Objective	• Make education adaptable • Foster lifelong employability • Make people sensitive to sustainability
Challenges	• Adopt a long-term outlook • Bring the school to employers • Make creation of new degrees faster to increase adaptability of profiles • Need to apply knowledge • Everyone must learn to learn
Actors/ stakeholders	• Ministry of Education must work with Ministry of Economy/Enterprise/ Environment, etc. • High-level educational institutions need to work more with companies
Targets	• Collaborative serious gaming – 'Google approach'; X % is 'creative' own time (innovation, experimenting, failure)

SCENARIO 3

Rationale	• Educate on opportunities within the fiscal framework – eco-entrepreneurialism • Sustainable eco-product and capacity development
Objective	• Get civil servants, industry (business) on track with the new fiscal framework • 'Intrapreneurialism'
Challenges	• Getting business schools to teach these topics, and subsequently increase understanding in the financial sector • Get teachers to work more collaboratively in schools
Actors/ stakeholders	• Governments provide enabling framework for other actors to realise opportunities • Governments can use competitions and prizes as a tool to encourage dissemination of ideas • Civil society (becoming more educated) • Provision of eco-entrepreneurial intelligence (e.g. universities) • Peer-to-peer learning
Targets	• Eco-innovative businesses started/annum • More organised networks, to support the 'chaotic' characteristics of the scenario, by access to e.g. knowledge

SCENARIO 4

Rationale
- Lack of public service

Objective
- Ensure basic set of core values and skills set

Challenges
- Public and private funding
- Neutrality of education
- Implication of massive open online courses (MOOCs)
- Inequality/competition in education
- Variations on quality of skills
- Short-termism
- Public scrutiny
- Instilling values/ethics
- Evaluation
- Specialisation
- Variations in quality of skills

Actors/ stakeholders
- MOOCs (sabotaged?)
- Foundations
- Private-sector funding of top 50 universities (Shanghai Composite Index)
- Self-learners/apprenticeships in private sector

Targets
- Promote independence and multi-disciplinarity
- Broader education profile
- General basis

11.8 TRANSPARENCY

SCENARIO 1

Rationale
- The high-level circulation of information between many different stakeholders requires a key organising principle in society to ensure transparent interactions that foster cooperation

Objective
- Policy-makers need to create and ensure trust through transparent governance models, especially in the field of natural resource management and business models

Challenges
- Total inclusiveness of all stakeholders, manipulation, abundance of information

Actors/ stakeholders
- Regions, companies, citizens
- Peer pressure as a solution to avoid manipulation, transaction procedures

Targets
- Feedback from stakeholders, level of political participation

11.9 ETHICS

SCENARIO 3

Rationale
- Managing the commons (biodiversity) and indirect effects (holistic view)

Objective
- Guiding civil society in the right direction
- Mandated reporting covering social, environmental and economic impact for listed companies

Challenges
- Collective action
- Transparency/provision of product/service facts such as working conditions

Actors/ stakeholders
- Tools to deal with misappropriation, going for the “quick green buck”
- Ethical franchising

Targets
- Moral framework for capitalism
- Reduced social dissatisfaction

SCENARIO 4

Rationale
- Individual is powerful and business is greedy
- Loss of competitiveness of EU eco-industries

Objective
- Encourage more responsible individual and corporate behaviour and more responsible research and innovation from the start for EU eco-industries to have added value by creating shared values

Challenges
- Corruption
- Speculation
- Price volatility
- Persuasiveness
- Agreed definition of ethics
- Short-termism
- Crime/criminality

Actors/ Stakeholders
- Financial institutions
- Customers/consumers
- Employees
- Role models/ethical leaders and organisations/ethical business models
- Media (private) influence
- NGOs/civil society, class actions through social media

Targets
- Link ethics to business profitability (labour rights)
- Local social sanctions (name and shame)
- Responsible investment
- Civil participation (for purely individualistic reasons) philanthropy
- Internalising externalities (accounting, fines, etc.)
- European ethics organisations (for CST, R&D, governance)

11.10 SOCIAL PROTECTION

SCENARIO 3

Rationale
- ‘Dog-eat-dog’ society
- Ensure social protection by the production of green products and services

Objective
- To ensure that some wealth is going back into society and to create sufficient individual insurance systems to replace/complement state social protection systems

Challenges
- Redefine role of business in society, and create a moral framework for capitalism
- Individual responsibility

Actors/ stakeholders
- Reduced role of government
- Increased role of rich philanthropic foundations

Targets
- Quality of life
- Investment in increased social resilience and equality
- Social impact and assessments

11.11 GOVERNANCE

SCENARIO 4

Rationale
- To encourage CSR and reach some public/private balance
- To distribute responsibility, benefits and power

Objective
- Good governance; governance needs and long-termism in finance
- International governance; social and environmental equity

Challenges
- Equity
- Participation/motivation
- Developing a comprehensive view

Actors/ stakeholders
- International, national, regional, and municipal government
- Media; supply chain actors
- Philanthropists
- Regulatory authorities (private?)

Targets
- Corporate platforms, intra-sector and cross-sector co-operation
- Multi-stakeholder platforms
- Coordinated approach

11.12 SYSTEMS INTEGRATION

SCENARIO 2

Rationale
- Need to develop a 'green' way of doing things
- The whole is bigger than the sum of the parts

Objective
- Create a coherent government programme (employment, environment, innovation, education)
- Create shared value between society – economy – environment (people – profit – planet)

Challenges
- Develop innovation and education through the whole value chain (from idea to use)
- Manage transaction costs

Actors/ Stakeholders
- Planning offices at all levels
- Industry

Targets
- Number of industrial symbioses

Table 4: *A summary comparative life-cycle view of the production and consumption system in the scenarios*

	Scenario 1 MULTIPLE CONNECTED INITIATIVES	Scenario 2 SHARED CIRCULAR STRATEGIES	Scenario 3 COMPACT GREEN INNOVATION	Scenario 4 LOCAL SELF-RELIANCE
RESEARCH, DEVELOPMENT AND INNOVATION	Resource and energy efficiency in processes, products from public R&D funding Business models around sharing, collaboration and low energy uses (but not LCA); integration, e.g. industrial symbioses Development and adaptation of infrastructures Technologies for resource recovery and remediation of environmental pollution/damage Eco-design, design for recycling Service-oriented business models, organisational innovation Creation of collaborative solutions	Large R&D efforts in resource and energy efficiency in processes, products, and infrastructures, both public and private Technologies for resource recovery and remediation of environmental pollution/damage R&D on the use of renewable biological raw materials for all purposes Eco-design, design for recycling now standard practice Service-oriented business models, organisational innovation developing under most favourable conditions Creation and fast adoption of collaborative solutions Where possible, companies sell high-quality life-cycle services instead of products. Status influence and fame (not material wealth); buy online	Strong push towards research and innovation in energy and resource efficiency Advice/consulting on resource/energy efficiency Innovation in business models and smart products Technologies for climate change mitigation and environmental remediation 3D-printing has enabled more local production More local solutions and business for making homes and neighbourhoods more resilient Towards a market-driven more-circular economy Better environmental management practices, retail, supply chain, energy efficiency Eco-design, design for recycling Where possible, life-cycle design of products	Resource efficiency in processes and products for cost cutting and business resilience. Most eco-industries in self-sufficiency, such as consultancy services for cost efficiency
EXTRACTION	Reuction in use of non-renewable resources Shift to renewable resources More secondary raw materials Shorter supply chains, more local sourcing Increase in urban mining	Steep decline in use of non-renewable resources Steep decline in extraction of non-renewable resources Shift to renewable resources More secondary raw materials Shorter supply chains, more local sourcing Increase in urban mining	Significant reduction in extraction of non-renewable resources Shift to renewable resources More secondary raw materials Shorter supply chains, more local sourcing Increase in urban mining	Decline in extraction of non-renewable resources Shift to renewable resources More secondary raw materials Shorter supply chains, more local sourcing

PRODUCTION	More industrial symbioses More distributed/small-scale manufacturing Waste reduction, waste separation Redesign/adaptation of products to service-based business models Shift to renewable resources	Major shift to renewables Durability, reliability and frugality of products are assets (in a services-oriented world). More industrial symbioses Process optimisation More distributed/small-scale manufacturing Waste reduction, very efficient material separation Frugal products Redesign/adaptation of products to service-based business models Major shift to renewable resources	As resources have become more expensive, industries have started to share resources, both in purchasing to have more power, but also in the sale of production residues to companies with a related but different resource need Production and distribution are more local and, when it comes to food, seasonal More distributed/small-scale industries that take advantage of consumers' increased interest in buying products that match their style and interests, both for looks and function More distributed/small-scale manufacturing Waste reduction, waste separation Shift to renewable resources Many companies have moved to offering eco-services, and eco-services dominate for public money. The demand for green services at individual or domestic level has been increasing steadily	More distributed/small-scale manufacturing Waste reduction Shift to renewable resources
CONSUMPTION	IT systems support shared consumption/use Shift to consumption of local products Sharing of equipment, capital goods Development of IT systems/social platforms in support of shared consumption/use	Local products Sharing of consumed objects, services Shift to consumption of local products Sharing of equipment, capital goods Development of IT systems/social platforms in support of shared consumption/use	Sharing platforms limited to products and services that are the most convenient and the most cost-cutting Private consumption remains the dominant pattern Shift to consumption of local products and seasonal food Sharing of equipment, capital goods Development of IT systems/social platforms in support of marketing	Shift to consumption of local products Sharing limited to what makes most economic sense from an individual perspective

END OF LIFE	In new service-based business models, end-of-life products remain in company ownership Decrease in volumes of waste Novel waste-collection processes Material/energy recovery techniques	Much less waste generated High-efficiency waste collection and treatment, sometimes relying on hand sorting In new service-based business models, end-of-life products remain in company ownership Material/energy recovery technology and techniques Industrial symbioses to close material and energy loops	Cash-back programmes for products containing valuable raw materials (e.g. electronics) have expanded. High material prices and relatively lower labour costs stimulate repair services Waste industry has become more high-tech: collection and sorting are more sophisticated resulting in an overall decline in volumes of waste	Decrease in volumes of waste Waste dealt with according to the market value of materials Novel waste-collection processes Material/energy recovery techniques

12. CONCLUDING OBSERVATIONS FROM THE STUDY TEAM

Systemic thinking matters. While this study set out to study the possible futures of EU eco-industries, it ended up generating in-depth discussions that led us to paint alternative visions of a sustainable EU economy. This evolution resulted from the desire of the participants in the study to push the understanding further and from the realisation that all the elements of interest for the industrial landscape are connected. As a result, it made sense to tackle the whole system and to explore issues such as geopolitics, governance, education, etc. which may have not appeared directly relevant at first sight.

Policy matters. To tread a path towards a sustainable EU economy, policy-makers and politicians will have to shoulder the responsibility of political change. This includes taking the economic goalposts beyond GDP, as it will become increasingly important to measure the quality of our stocks of capital and natural resources to ensure sustainability and not just flows through the economy.

The fiscal framework matters. The study sees a fiscal framework supportive of sustainability as a major driver for the overall sustainability of the EU economy. Such a fiscal framework would tend to increase virgin raw material prices and create a relative reduction in labour costs, resulting in a self-reinforcing circle of resource and energy efficiency, increasing and increasingly green employment, green construction and green infrastructure. For the two future scenarios which do not have a fiscal framework supportive of sustainability (taxes more or less like those of today), the 'green' economic signals would be weaker and result mostly from increasing raw materials prices in response to increasing global demand. In these scenarios, the evolution towards a green economy would result mainly from other forms of policy action or from collective actions from green-minded citizens, although this would be unlikely to compensate for the lack of fiscal incentives.

The definition of sustainable development is still relevant but might need to evolve in view of the size of the challenges facing us. In 1987, the Brundtland Commission defined sustainable development in 'Our Common Future' as: *"development that meets the needs of the present without compromising the ability of future generations to meet their own needs"*. In view of the degradations and unsustainable practices that have occurred since then, and of the global demographic trends, this definition should probably evolve towards: *"development that meets the needs of the present while improving the ability of future generations to meet their own needs"*. Simply reducing our own impact to accommodate 6 billion is simply not enough if 9 billion people have to live on this earth in 2050.

The period after the Second World War saw the EU go through an unprecedented period of largely industrial development that delivered very high levels of human development and well-being. This model of development was characterised by the intense consumption of cheap energy and natural resources coupled with increasing taxation on labour. This led to the export of labour-intensive economic activities to countries with cheap labour costs. This model of development is now revealing its limits with high levels of unemployment, unsustainable trends in materials and energy consumption, and limited further improvements in the well-being of European citizens. In some countries, well-being has even declined sharply since 2008.

Time has come to reflect on what future the EU should reserve for its citizens. Should it be a post-industrial society? This does not mean that there will be no industries in the EU, but that many will have a different character than that of the 20th century. The concept of Industry 4.0 has been invented to take full account of the contribution from digital technologies. Automation and advanced manufacturing technologies are used to boost industrial competitiveness and to reindustrialise the EU. This stands a good chance of success but is unlikely to generate the mass employment that old industry used to provide.

Should the EU be a post-consumption society? This does not mean that there will be no consumption, but rather that consumers will largely become users (e.g. pay for function and use) instead of buyers of products. This can offer the opportunity to create new industries and more jobs but requires a radical rethink of many existing societal, financial, legal and regulatory structures.

This study illustrates the fact that today's policy and societal choices will not only have a strong impact on the shape that EU industries will take in the future but also on the dynamics of the transformation.

This shows the importance of involving all stakeholders in discussions about the future and the importance of creating shared visions as this will have both profound implications for the shape of our industrial, social and environmental systems and a very favourable effect on the acceptance of change. Nobody knows or can predict precisely what the future will look like, but engaging in foresight exercises can help us articulate and prepare the future we want.

13. ANNEX 1 | REFERENCES ILLUSTRATING THE SCENARIOS

Scenario 1

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