Transition desirability in energy transition scenarios

Technical file #9

Information and recommendations for scenario producers

This document is part of a set of 12 technical files. These files have been produced by *The Shift Project* after nearly 2 years of research and experts consultations on the different aspects of energy transition and the future studies around these aspects.

Our project, "Power Systems 2050 – Guidelines for future studies on energy and power transitions," started in January 2018, involved approximately 60 experts through interviews and workshops, reviewed more than 300 works, including about 20 future studies. The objectives and approach of this project are discussed in the executive summary of the framework.

Several aspects of the energy transition are handled in these technical files. However, **on the energy supply-side only the power system has been studied**. The main reason for this choice is that we had to start from somewhere with limited resources, and the power system seemed to be a key system to study in the energy transition context, towards a low-carbon economy, as shown by the growing number of future studies focusing on this system. However, the guidelines we propose could be completed by analyzes on the other energy supply-side systems (the gas system, oil system, heat system and so on).

Each technical file tackles several aspects of future studies for the power (and energy) transition. Here is the complete list of the technical files produced during the project:

#	Technical file title
1	Future studies on energy transition
2	Energy transition models
3	Boundary conditions for energy transition scenarios
4	Long-term evolution of energy consumption in energy transition scenarios
5	Lifestyles and consumption behaviors in energy transition scenarios
6	Long-term evolution of the power system supply-side in energy transition scenarios
7	Power system operation in energy transition scenarios
8	Impact assessment in energy transition scenarios
9	**Transition desirability in energy transition scenarios**
10	Environmental assessment of energy transition scenarios
11	Economic evaluation of energy transition scenarios
12	Employment assessment of energy transition scenarios

Altogether, these files cover the fields described on the following map of the guidelines for future studies on the energy transition. The document you are reading covers the red-circled topics.

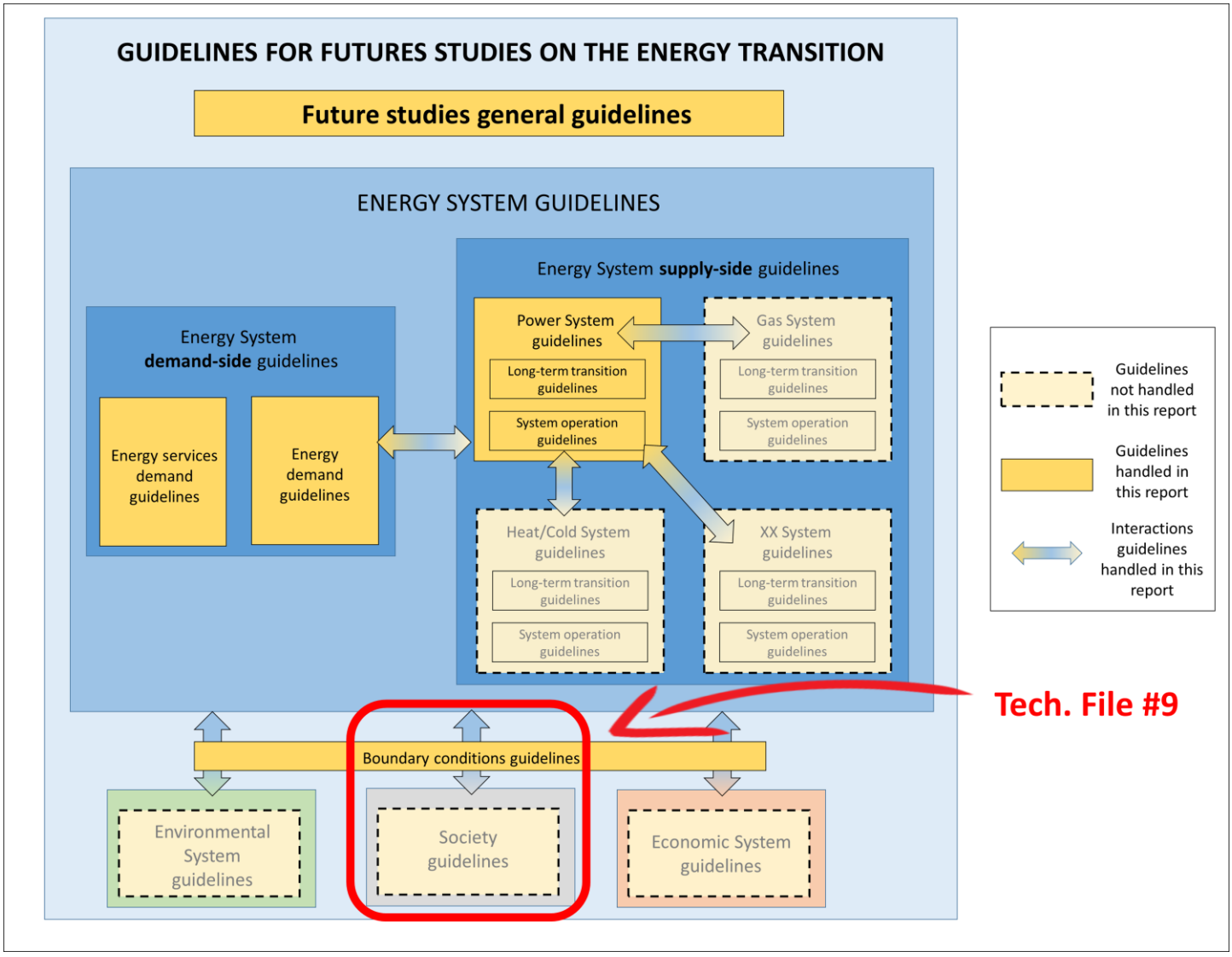

Table of content

Reading keys

Explanation box, containing key information for a better overall understanding of the subjects.

Recommendations to scenario producers:

These boxes contain the recommendations for scenario producers.

The word "should" means that scenario producers, if they are to follow the guidelines, must substantiate the corresponding point. The words "may" or "might" relates to suggestions, ideas to help the scenario producer respond to the point.

Questions in italic are examples of questions scenario producers might ask to substantiate the points. They are here in an illustration purpose.

Phrases in italic relate to words which are being defined and will be subsequently used in the framework.

Phrases which are highlighted in yellow refer to other technical documents of this series.

I. Discussing the multiple aspects of transition desirability

Desirability of the transition refers to the fact that a proposed transition is desirable for the different actors composing a society. In case a transition does not seem desirable by some actors and is imposed upon them by a transition planner, they can raise acceptance questions and generate conflict with the transition planner(s). Desirability usually appears to the world under its "negative" form, through visible conflicts or resistance, hence is sometimes called "acceptability issue". Acceptability and desirability really are two sides of the same coin: how people envision changes. A third term, appropriability, is sometimes coined to go beyond the dichotomy between individuals (or communities) and transition planners. A project is appropriable when the community concerned with the project can be part of the planning of the project on some aspects of it, typically how it will interact with the final technical system. A non-appropriable project is not properly understood, or not desired by those who will interact with it, so the project cannot be properly implemented.

As mentioned in the lifestyle section, social aspects are largely neglected in scenarios whereas proposed transitions may encounter great hurdles in the real world because of people possible reluctance towards these transitions or the way they are led. As suggested in this section, the concept of desirability may be useful to integrate these aspects in the design of future studies: by better understanding why conflicts emerge in the real world, scenario producers can better take desirability and acceptability considerations into account in their scenarios.

A. Transition projects may lead to four types of conflicts between the general public and projects holders

Literature on acceptance is large as far as installation of technology infrastructure is concerned. For our energy transition subject, this concept is extended to the desirability of a complete transition.

(ADEME, 2011) proposes a frame which describes the different types of conflicts which may emerge when a project is implemented. Such conflicts are observed in real-life situations for transition projects, such as the installation of wind turbines or the installation of new high-voltage power lines. These conflicts express different types of oppositions from individuals to a project taking place within a transition.

- The *uncertainty conflict* emerges when opponents are worried about the potential impacts of the projects on themselves, their local environment, their jobs and their ways of lives (as inhabitants of a territory and workers in a given sector).
- The *substantial conflict* emerges when opponents contest the nature of the proposed project in general (as citizens), such as a global policy for the energy transition planning.
- The *structural conflict* emerges when the proposed project comes from an illegitimate actor, that is, an actor which is considered as not representing the general interest.
- The *procedure conflict* emerges when opponents contest the way of leading the project, typically when transparency on the project is not ensured or when dialogue with stakeholders is poor. In this document, we instead consider that good consultation procedures prevent from the other types of conflicts to happen by raising the associated risks beforehand.

Academic studies on acceptance often focus on the causes of uncertainty conflicts. These causes do not fully explain acceptance behaviors, hence some authors interpret it as volatile, as if partly irrational (Bertsch, Hall, Weinhardt, & Fichtner, 2016). Taking into account the other types of conflicts may improve the overall understanding on acceptance.

(Schubert, Thuß, & Möst, 2015) focuses on the acceptance of an energy transition. According to them, three main aspects should be considered in assessing the acceptance, or desirability, of an energy transition:

- Economic aspect, such as the evolution of costs for different actors, wealth redistribution, employment
- Security of supply for the different actors
- Environmental compatibility and technology risks

These aspects actually fit in the conflict frame proposed above. In this section, we follow that frame to usefully inform and question the debates on desirability as they appear in future studies.

Other stakeholders than individuals can trigger conflicts: corporations can pressurize governments towards reducing as most as possible the possible transition burdens they could bear, such as sunk costs. More generally, who bears the burden of sunk costs is a key question for transition desirability.

The acceptance topic can also be seen through the lens of fostering and producing desirability through storytelling and narratives, which are strong drivers for behavior changes.

The next sections are based on the three different types of conflicts proposed by (ADEME, 2011), and transverse ways to avoid them (consultation procedures and storytelling), covering at the same time the three main aspects presented by (Schubert et al., 2015). Finally, we provide general considerations on the integration of desirability issues in scenarios.

Recommendations to scenario producers

A strategy about taking into account desirability and acceptance aspects should be made explicit. If these aspects are tackled, the aim of the strategy should be to show the social desirability or to highlight the conflict risks associated with the proposed transition. The following aspects should be considered:

- The different types of conflicts and transverse ways to avoid them this document handles should be considered while building scenarios.
- The population included in the desirability assessment should be precisely defined for each conflict: *does the conflict risk emerge from all the citizens of a country? All the inhabitants of a country? Only workers from a given sector?*
- The methodology (most probably qualitative) which has been used to assess conflict risks: expert judgement, stakeholders consultations…

B. Considering *uncertainty conflicts* (caused by the impacts of changes on individuals)

Uncertainty conflict is sometimes described as the NIMBY ("Not in my backyard") syndrome. However, some authors argue that this depiction leads to discard the reasons of discontent by judging them as "egoistic" instead of understanding and tackling them (ADEME, 2011). Furthermore, NIMBY syndrome applies to reactions to the installation of new infrastructure, whereas we include in uncertainty conflicts all the impacts of an energy transition at the individual level. For example, uncertainty about one's job within a transition belongs to this type of conflict whereas job issues are not usually included in NIMBY considerations.

1. Considering energy affordability when needed, energy security and energy quality: impacts on citizens

The greater public sees energy as a basic need. Indeed energy is explicitly discussed among the general public as a basic need because of its perceived role in ensuring survival, good health, a decent life, and ability to engage in expected patterns of life. This is particularly salient when considering the wellbeing of vulnerable groups (Demski, Thomas, Becker, Evensen, & Pidgeon, 2019).

Access to energy is seen as a basic right that should be guaranteed because people have no choice but to use it. When "there is no choice" energy demand is described as "constrained" (Martin & Gaspard, 2016).

In this regard, access to energy services should be ensured for all groups of people so they can fulfill their needs when they need it. Hence energy services should remain affordable. If energy price increases (for example through a carbon price), the service should remain accessible using less, or another form of, energy, through low-

consumption technologies or alternative technologies, or other forms of organization. In turn, access to these technologies should be ensured in a timely fashion so that basic needs are continuously fulfilled.

As **time-of use pricing** may result in high prices during peak times, it may lead to render energy unaffordable for some groups in society if they are not able to postpone their demand. Smart metering may not be accepted if reassurance that new pricing would **not compromise people's access to energy when they need it for essential services is not provided** (Demski et al., 2019). In economic words, constrained energy demand is barely elastic to price. Hence, on the short run, a price rise of constrained energy directly leads to a budget decrease for other expenses, as energy consumption does not decrease.

Along the same line of reasoning, **energy security of supply** is a key criteria for acceptance. Blackouts or power cuts are not accepted anymore in developed countries, neither by households nor by industries. Many of households' basic needs are enabled by power (food conservation, heating[1], cooking). For industries, power cuts prevent from working, which is not accepted especially in case of high unemployment rates. Some of societies basic needs are fulfilled through power: public lighting for individual security, health services, water system amenities and so on, require power to properly operate. The impacts of a lasting blackout in Western countries would be huge in the current state of affairs. To prevent the most catastrophic impacts of a blackout, infrastructure (such as hospitals, some power plants) are equipped with diesel generators or batteries to keep operating for a few days in case of a lasting power outage (Mark Elsberg, 2017). Réseau de Transport d'Electricité (RTE, the French power transmission operator) describes security of supply as a common good (RTE, 2017).

Similarly, **power quality** (a stable and neat tension and frequency wave) is an important criterion because it is needed for usual appliances to correctly work. Too low a power quality would be equivalent to a power cut.

Note that these acceptance issues could also be categorized in the substantial conflict category (that is, an opposition to a project for society level reasons), as people declare that lacking energy should not happen to anybody in the society they live in (Demski et al., 2019).

Recommendations to scenario producers

A scenario strategy about access to power uncertainty conflicts should be defined and justified. It should include considerations on the decision to study this subject or not. This choice depends on the Planning Question and on the study overall strategy. In case the subject is studied, the different aspects of it which are considered should be reported.

Considering those aspects may help to detect the situations in which conflicts about access to power could arise in some scenarios.

Hereunder are aspects of access to power uncertainty conflicts which may be reported about:

- Impacts on access to power generated by the transition: several aspects pertaining to access to power have been presented: affordability, time-of-use pricing and demand side management techniques, security of supply and quality of supply. For each of them, scenario producers should consider the following aspects:
    - Type of needs which are impacted: needs are characterized as "basic" when the corresponding demand is constrained; in other words, a basic need is one which people have "no choice" but to fulfill it. Scenario producers should take special care when decreasing the fulfillment of such needs. For example, they may substantiate why the described transition is accepted in their scenarios in which such a decrease happens.
    - Type of population which is impacted: different populations are differently exposed to the above-mentioned impacts because their needs may be different (e.g., some households may need to commute over long distances). Scenario producers may take into account the specificities of some populations (such as social categories or type of fabric they live in) when assessing the power accessibility impacts in their scenarios.

[1] Some rural households in Canada are equipped with individual diesel generators in case the power network undergoes failures during winter.

- Corrective measures or adaptation impacts: scenario producers may propose extra political measures in their scenarios to avoid conflicts risks related to energy access, such as wealth redistribution measures, wavers for specific populations, communication campaigns… Costs and impacts of such measures should be considered. Economic actors which face power accessibility problems may adapt by getting equipped with fuel-powered portable generators, batteries or any other solution. If they face power quality problems, they might adapt by getting equipped with protective devices. Such adaptation behaviors should be considered and their impacts (on total system costs, GHG emissions and so on) taken into account.

For example, such situations should be detected: a global increase of the power share in the budget of households or companies; a sharp increase of the power share in a given population's budget due to time-of-use pricing; a significantly lower security of supply; a lower quality of supply. In these situations, scenario producers should substantiate how risks of conflicts are kept low. This might involve extra measures, or adaptations by agents. This may imply, in turn, extra costs or consequences, which may be assessed depending on the study strategy.

2. Considering work structure changes: impacts on workers

Fast transitions require fast changes in the structure of the workforce. Workers may have to face unemployment and undergo trainings to acquire new skills. Some may have to move to different regions depending on where the efforts to achieve the transition are concentrated. Some fields of expertize may become useless, and the associated cultural and social status disappear, potentially leading to "cultural sunk costs", that is, situations in which individuals have invested money and effort in their education but this education loses value.

These situations may not be accepted by people as workers while they would be accepted as inhabitants, or vice versa (Bögel & Upham, 2018). Also see section on employment assessment, III.

Recommendations to scenario producers

A study strategy about taking into account uncertainty conflict about work structure changes should be made explicit. If the subject is tackled:

- Based on an employment assessment (see corresponding section), scenarios in which workers have to radically change their professional activity, face unemployment, move to different regions should explain what measures they assume to make it acceptable for them.
- The costs and impacts of these measures should be taken into account.

3. Considering infrastructure changes: impacts on inhabitants

The distance between places of dwellings and places of power infrastructure construction is key in local acceptance problems (Bertsch et al., 2016). This can be explained by local impacts on human ecology and by impacts on landscapes.

a. Considering impacts on human ecology

Most energy transitions within scenarios involve power infrastructure changes. These changes may happen close to dwellings and have impacts on individuals. In particular, power plants and power infrastructure or equipment have different local impacts for human life. For example, wind turbines generate noise (including infrasound), shadows, ice shedding (Scherhaufer, Höltinger, Salak, Schauppenlehner, & Schmidt, 2017). Smart meters have been shown to have (psychosomatic) health effects in France. Biogas infrastructure may generate smells. Fossil fuel power plants generate local air pollution, symbolized by smokestacks.

Some infrastructure represent local industrial risks which may lead to conflicts when being installed: nuclear accidents risks, explosion risks for gas installations (such as biogas production plants) (ADEME / OpinionWay, 2017), hydropower dam ruptures and so on.

Rejection may be explained in some cases by the "fear of the unknown". A study about acceptance of power installations in Germany notes that Power-to-gas technology faces a lower acceptability than other power installations and proposes that it is because this technology is still largely unknown among the general public (Bertsch et al., 2016).

Following the same line of reasoning, people living close to wind turbines, or to a nuclear plant tend to be more positive about these technologies than people who do not. This effect might be explained by a better knowledge, or more simply by a habituation, to the impacts and risks of the technology by people who live close to it, or by the inverse causation: people who think these technologies are not risky may be more willing to live close to them than people who do not.

b. Considering impacts on landscape

Renewable energy power plants take more space[2] and as such they modify local landscapes for more people than non-renewable fuel-based power plants.

Variable Renewable Energy Sources development may also require high voltage grid reinforcement. **Overhead lines** modify local landscapes and this is one reason why they are sometimes rejected: 30% of the high-voltage lines planned in the 2012 Ten Years Network Development Plan (TYNDP) of the European Network of Transmission System Operators for Electricity (ENTSO-E) have delays because of acceptance issues (EDF R&D, 2018).

As noted by a German study about acceptance of power infrastructure installation (Bertsch et al., 2016), landscape impacts are the main driving factor of local acceptance problems. This is confirmed by other studies showing the importance of landscape modification in acceptance (ADEME / OpinionWay, 2017; Scherhaufer et al., 2017).

Desirability issues due to landscape modification may be linked to the concept of place attachment and to what the installed infrastructure represents for this specific place (Bögel & Upham, 2018). Presumably, if the installed infrastructure is seen as an asset for the territory, or is associated with a desirable vision of the future for its inhabitants, or comes from a local initiative benefiting the territory, landscape impact will be judged favorably; on the contrary, if they are perceived as imposed by a centralized actor with no consideration on local interests, landscape impacts may be judged negatively. Hence landscape impact, seen through the lens of place attachment, may be associated – up to a certain point – to the other causes of conflicts, or desirability (such as structural conflicts, see section D.).

Recommendations to scenario producers

A study strategy about taking into account uncertainty conflicts about infrastructure should be made explicit. The following aspects should be considered:

- Infrastructure change: *do infrastructure changes in the scenario constitute motives for uncertainty conflicts because of human ecology and landscape modifications, depending on their location relative to dwellings and their specific impacts and perceptions within society?*
- Methodology to assess infrastructure change and impacts on inhabitants: *how are infrastructure and dwellings represented in the study? At what resolution?*
- If conflict risks are detected, producers should substantiate why the transition is still desirable in the scenario, for example by compensatory measures (wealth redistribution, communication campaigns…).

[2] Per unit of produced electricity (Smil, 2015).

C. Considering *substantial conflicts* (when citizens contest the nature of the proposed project in general)

Conflict may emerge because of the overall policy context of the project being implanted, and/or because of global impacts on society or the environment, no matter if the project is closely located to one's dwelling. This type of conflict is sometimes called the "Not in Anybody's Backyard" syndrome (ADEME, 2011).

1. Considering inconsistencies between policies and society incentives, and across policies

Austrian citizens reacting on wind power installation reported in a poll a lack of policy coherence and consistency across territory levels and policy measures. Providing a consistent global vision was deemed important: for example, the development of renewable energy would be seen as more desirable if it goes along the creation of charging stations for electric vehicles or with the refurbishment of street lighting (assumedly, for lowering its consumption) (Scherhaufer et al., 2017).

Individual comfort or discomfort generated by a transition is important (as described in the previous section), but is not enough to explain the emergence of conflicts. The way those discomforts are distributed over the population and economic actors highly matters and should be done with a sense of equity. For example, citizens may consider as important that companies bear a share of the efforts along with them. More generally, any energy transition policy may have impacts on social inequalities or may differently affect different population categories (owners of polluting cars, dwellers of energy inefficient buildings…). These impacts may lead to acceptance issues raised by the losers in the proposed transition (Martin & Gaspard, 2016). In other words, a global consistent vision should include considerations on equity within society as well as considerations on how to accompany those who lose the most or those who cannot fulfil their basic needs.

The overall consistency of the transition should be ensured across policies but also between policies and society incentives. In other words, if society incentives are not in line with policy incentives, risks of conflicts against policies increase. For instance, as long as driving a car belongs to a particular class and gender culture which is fostered and maintained by manly image through advertisement, the press, and gender interactions, car use cannot be altered significantly (Uzzell & Rathzel, 2010). In such a context, policies constraining the use of car are inconsistent with society incentives and may lead to substantial conflicts.

Recommendations to scenario producers

A study strategy about taking into account substantial conflicts for inconsistent policies should be made explicit. If the subject is covered, the following aspects should be considered:

- Methodology to detect inconsistent policy situations (internal inconsistency as well as inconsistencies with current cultural trends).
- Discomfort / effort distribution across the different economic actors and across the general population, with regard to the local culture and the risks of conflicts due to possible inequities.
- Possible measures to compensate / accompany those who lose the most during the transition and/or those who cannot fulfil their basic needs, as well as the associated costs and consequences.
- Alignment between society incentives and policy incentives: in case behavior trends (also see section on behaviors) are reversed through policies, substantiation that the reversal is consistent with society traits and incentives should be provided. *For example, how does the advertisement environment evolve during a significant transition from car to public transportation?*

2. Considering sunk costs (emerging with transition urgency)

Sunk costs is the part of the capital invested in an existing asset that has not been recovered when the asset is closed. Thus, sunk costs appear whenever an asset is closed before its economic lifetime. The asset is said to be "stranded."

Such situations can trigger conflicts depending on who handles the loss.

a. For society, sunk costs reveal an inconsistency between past choices and new objectives

From a system perspective (see section on economic evaluation), a power plant going stranded indicates that the decision to build the plant was an economically suboptimal choice. Indeed, it means the shutdown of the plant is now considered as the best decision despite the fact it could have still worked. Sunk costs arise when past choices are no longer compliant with society's current objectives.

A typical example is the premature shutdown of a coal power plant due to its high air pollutant and/or GHG emissions, through regulation, market or tax. In such a (still fictional) case, the past decision of building the coal power plant, based on economic criteria, is considered by society as obsolete in light of climate change considerations. Other examples include car ban in some cities. People owning a car in such cities may undergo a strong loss of utility from their cars, because they cannot use it anymore and because it loses monetary value on the market at the same time.

Stranded assets risk is therefore strongly linked to the time horizon choice of a study (see future studies section) and its social objectives, that is, to transition urgency. As explained in the corresponding part, a CGDD study (2016) (CGDD, 2016) shows how some choices with short-term vision can enable to efficiently reach short-term objectives but be counterproductive on the long-term (in other words, the short-term vision generates stranded assets and sunk costs). Doing the same optimization with a long-term objective in mind changes their result: in their case, much more energy carrier changes are made to avoid lock-in after the end-date of the optimization. Thus, when using a marginal abatement cost curve, they recommend to choose carefully the time horizon(s).

b. Considering stranded assets burden sharing

By definition, risk of stranded assets rises with the rate (speed) of a transition. This is a typical **transition risk**.

Thus, required changes to face 21st century challenges may put many assets in a stranded position. These sunk costs are a serious issue and well known debate, often cited as a key challenge of energy transition. Indeed, **someone has to bear these costs**: either the company operating the stranded asset (e.g. a coal power plant being shut down by law), households owning an asset (e.g. a car forbidden to access an area), and/or the State (in case a compensation is provided when the asset gets stranded, or if the State owns assets which get stranded). In any case, the decisions about the costs allocation (sometimes called "burden sharing") can raise serious **desirability issues**.

The perceived fairness of the burden sharing is key in its desirability.

Recommendations for scenario producers

Scenario producers should report about their strategies on stranded assets and sunk costs. Substantiation should be provided if the subject is not handled. If the subject is handled, the following aspects on sunk costs may be reported about:

- Total amount of sunk costs in the scenario (see section on economic evaluation). From a system perspective it gives the magnitude of acceptability issues arising from sunk costs. This can be reported in the storyline. *Is there any sunk costs in the scenario? Do they represent a large burden for society?*
- Burden sharing of the sunk costs. *Who loses money when an asset gets stranded in the scenario? The owner of the asset? The State?*

- Possible lack of desirability of the proposed transition due to sunk costs. *Regarding the burden sharing choices in the scenario, may the proposed transition feel unacceptable for some stakeholders?*
- Lock-in effects leading to sunk costs after the time horizon. *Are there significant sunk costs after the time horizon of the scenario?*

3. Considering global impacts on the environment

The environmental cause grows in European countries. Hence inconsistencies between the proposed transition and this cause may generate substantial conflicts. For example, in the context of the implementation of a wind turbines project, Austrian stakeholders considered that independently on the place of the project, the impacts on natural protected areas and on species such as birds and bats were important (Scherhaufer et al., 2017).

Hence environmental considerations can be at stake in the substantial conflicts emerging from a project, no matter if the project is installed closely to the respondents to a poll.

In the German case, importing more power from countries with high shares of nuclear and coal-based power generation could lead to acceptance issues. Indeed, such a transition would be inconsistent with the national objectives of phasing out coal and nuclear power (Agora Energiewende, IDDRI, 2018).

Such a transition may generate conflict whereas local impacts are not in Germany.

Such topics as climate change, impacts on protected areas and wildlife, nuclear waste generation and nuclear power potential industrial risks, or overuse of the underground (for Carbon Capture and Storage, gas storage, geothermal power production, underground power transmission lines, nuclear waste storage and so on) (Bertsch et al., 2016) may be evoked in substantial conflicts.

Most reference, or business as usual, scenarios may be subject to this type of substantial conflicts (due to global impacts on the environment), as shown by the growing concerns and social protests against projects favoring the status quo in energy systems based on fossil fuels.

Recommendations to scenario producers

A study strategy about substantial conflict on environmental impacts should be made explicit. If the subject is covered, the following aspects should be considered:

- Assessment on how global impacts on the environment happening in the scenarios (including reference scenario) could constitute motives for substantial conflicts.
- If such risks are detected, producers should substantiate why the transition is still desirable in the scenario, for example by compensatory measures (infrastructure adaptation, communication campaigns…). If such measures are implemented, their consequences in terms of costs and other impacts should be assessed.
- Horizon effects: when impacts are expected to grow after the time horizon (such as climate change effects), an explicit note about it should be made.

D. *Considering structural conflicts* (when projects are proposed and driven by non-legitimate actors)

1. More conflicts about public or private infrastructure building can be expected in Europe in the future

More than ever, policies and public projects are criticized through the lens of legitimacy. Expertize and scientific facts, which used to be trusted and perceived as legitimate, have lost their influencing power through several mechanisms, as illustrated by the French case (Merad & Trump, 2018):

First, the general public loses trust in the capacity of the government and in its will to sustain critical services and to represent the general interest. Several reasons may explain this trend: (a) large range of activities have shifted from the public to the private sectors including critical services (rail transportation, telecommunication, clinics, etc), (b) government reactions to past events[3] have been poorly framed and poorly understood by the public, leading to distrust towards government experts (c) public value of projects is sometimes not discussed nor even delineated, and (d) growing regulatory complexity increasingly prevents public understanding of how the system works and why it represents common values.

In addition, the corporate world has lost legitimacy to represent the general interest after cases of "doubt manufacturing" (such as in the Tobacco industry case, or climate change topic) in which scientists have been paid to publish 'product-friendly' scientific studies. Furthermore, such cases shed doubt on the whole scientific fact.

(Merad & Trump, 2018) conclude: "Coupled with a lack of "citizen culture" and a perceived opacity of the governance and management of common and public affairs, industrial lobbying and collusion with politics has introduced distrust in politics that has contaminated the administrative credibility and reliability of various regulatory agencies in France and abroad."

As a result, more and more decisions to create infrastructure projects, which are based upon a mixture of scientific, business and political negotiations are perceived as not based on the civil perception of evidence because decision agents have lost legitimacy to represent the general interest.

No matter the nature and content of the proposed projects constitutive of the transition, as long as they are carried by governments or corporations an increasing number of conflicts on their regards can be expected as a general trend, finding their roots in legitimacy issues. This situation asks scenario producers new questions about the actors driving the transition in their scenarios.

All scenarios to our knowledge assume the transition can be smoothly managed either by markets and corporations (in simulated agents models) or, supposedly, by the State (in benevolent planner models), without asking the question of the legitimacy of these agents. This is natural as most future studies are addressed to decision-makers (either economic or political), hence they do not think the organization or legitimacy of these agents: instead they provide recommendations to them by assuming their legitimacy to apply these recommendations.

One study (Foxon, 2013) proposes a scenario on the evolution of the PS supply-side driven mainly by local communities (among two other scenarios, one in which the PS is mainly driven by the State, and one in which it is mainly driven by corporations). In this scenario, local communities rely on new entrant, small energy service companies, or larger corporations which adapted to dealing with local communities. These companies work together with local authorities, housing associations and community groups.

Recommendations to scenario producers

Scenario producers should make their strategy about legitimacy issues explicit: *do their scenarios include considerations on this topic?*

If a trend in loss of legitimacy of traditional project holders (the State and large/medium corporations) exists in the considered geographical perimeter but is reversed in the scenario, the storyline should explain why.

Otherwise, impacts of the continued loss of legitimacy should be assessed: *is the governance of the transition modified and if so, what are the associated costs? Are transition projects modified? Do they cost more? Do they take more time to implement?*

[3] "For example, after Chernobyl (1986), the French authorities in charge of radioprotection endorsed a controversial position in the media that radioactive material from the Chernobyl disaster stopped at the French border (implying that no public health consequences would be borne by the French people)." (Merad & Trump, 2018)

2. Considering personal data management evolutions: impacts on citizens

Smart grids require more data about local power consumption, especially data about household's consumption. Data are collected by power distribution companies through automated smart meters (less costly than a human meter reader). This may lead to concerns by some people about the use of their data by these companies. This issue may be linked to a lack of legitimacy in the actors supposedly controlling the collected data.

Recommendations for scenario producers

A study strategy about structural conflict on personal data management should be made explicit. If the subject is covered, the following aspects should be considered:

- Assessment on how personal data management changes happening in the scenarios could constitute motives for structural conflicts.
- If such risks are detected, producers should substantiate why the transition is still desirable in the scenario, for example by compensatory measures (management of the data by other, more legitimate bodies, communication campaigns…). Impacts of these measures should be assessed.

E. Project implementation procedures, such as consultation, may help avoiding conflicts

In order to avoid some of the abovementioned conflicts, local consultation procedures can be followed within territories before projects are launched. Such procedures can lead to improvements in the proposed local projects and to time saving in their implementations. For example, fair revenue distribution may be defined to reduce envy and distrust (e.g. between land owners, residential population, project holders) (Scherhaufer et al., 2017); the proposed projects may be adjusted to avoid uncertainty conflicts (overhead high voltage power lines projects may be displaced, or altered into underground projects), etc.

Some scenarios assess the impacts of such procedures through sensitivity analyses, coined as "low acceptance" scenarios (ADEME, 2015; ADEME / Artelys, 2018). These scenarios assume that power mix modifications happen due to low acceptance, which in turn impact the total cost of the system. However, nothing is said on how the low acceptance situations have been detected in those scenarios. One can imagine consultation procedures are followed, leading to understand what should be changed about the proposed transition for it to be accepted, in turn leading to the described extra costs.

However, the costs of "managing" the low acceptance (for instance through organizing and running those local consultation procedures, in good cases) are not taken into account.

F. Storytelling is a way to increase desirability

Storytelling and narratives are known to change ideas and behaviors in readers or listeners. Stories are constitutive of a culture and of how human beings shape their imaginaries and their image of themselves and others. They are a way to safely explore alternate realities or futures, even highly uncertain or risky ones. They are a way to understand other views about those futures; as such they may change one's behaviors about those futures (Padre, 2018).

Future studies put into play scenarios, which are narratives about the future of energy systems and the systems surrounding them. They can be primarily addressed to different transition stakeholders:

Future studies which are primarily addressed to policy-makers or economic decision-makers (such as (Agora Energiewende/Öko-Institut, 2017; ANCRE, 2013; European Commission, 2011; European Commission, 2016; Lappeenranta University of Technology / Energy Watch Group, 2017; OECD/IEA, 2017; SFEN, 2018; IIASA, 2012) and many others) do not report their narratives under a storytelling form; they are usually reported as technical reports. Hence they do not use the powers of storytelling by "transporting" the reader into the described futures,

or by referring to values shared among their readers. A few exceptions exist, such as (ADEME, 2014; epe, 2019): they include narratives about lifestyles in which the reader can identify.

Future studies which are also addressed to the greater public (such as (Association négaWatt, 2013; Association négaWatt, 2017; Greenpeace, 2015; WWF, 2011)) typically integrate more storytelling elements (for instance, about the better quality of life their scenarios lead to, about their impacts on local places, local governance and local empowerment, better sociability, and so on, often illustrated by more pictures to wake imaginaries), and more references to values (solidarity, equity, autonomy…).

As a reaction to different narratives from corporate and public actors (who are increasingly losing their legitimacy, as explained above), civil society proposes a variety of counter-narratives based on different approaches to local or regional "energy democracies," which seek a form of local empowerment and propose alternative views on transitions, institutional changes and actions for change. "These energy democracies express differences in terms of social groups to be connected and empowered, theories of change and stability, form and specificity of institutional change, resistance to negative as well as promotion of positive agendas, and ability to work across scales" (Burke, 2018). Future studies addressed to the greater public may be seen as such counter-narratives. "In any case, transition narratives are stabilized through diverse social institutions including governments, businesses, sciences, the media and civil society, and in turn seek to influence and give rise to institutionalized change" (Burke, 2018). In other words, all narratives (including counter-narratives) are produced by a mix of these influences.

Narratives, or counter-narratives can be evoked in future studies as a way to foster desirability and action towards certain energy transitions. They can be produced and diffused by different actors and spread among different populations.

Co-construction of narratives is also known to foster public engagement and deliberation (Devine-Wright, 2011; Miller, O'Leary, Graffy, Stechel, & Dirks, 2015); as such, this process could be part of consultation procedures with civil society.

Recommendations for scenario producers

Scenario producers should make their strategy about conflict avoidance and desirability emergence explicit.

Energy transition scenarios in which acceptance issues may lead to conflict may propose, as a general tool, consultation procedures between local actors in territories where those risks arise.

By doing so, associated costs (linked to the organization and running of the procedure) and possible consequences (such as different choices of infrastructures) should be taken into account[4].

Cultural changes through narrative diffusion may be another way to foster desirability. If scenarios evoke such narratives leading to cultural changes, they should also explain why such narratives diffuse in society and who produces them (grass root or other actors), and the potential associated costs for narrative production and diffusion.

G. Better integrating desirability issues in scenarios

As previously argued, imposing elements of a transition through coercion might be extremely costly, would it be in terms of surveillance, propaganda and coercion means but also, evidently, in terms of health and social welfare. No scenario to our knowledge assumes such a coercion to accompany the described transition.

When desirability is explicitly considered, it is often seen as highly uncertain, leading to sensitivity analyses rather than being fully integrated in each scenario at the design stage ((ADEME, 2015; ADEME / Artelys, 2018) perform such sensitivity analyses). In the "high acceptance constraint" scenario from (ADEME, 2015), ground PV panels and on-shore wind turbines are constrained in terms of location: the land which is available for their installation is greatly reduced, assuming households would not desire them close to their houses. In (ADEME / Artelys, 2018),

[4] This recommendation sums up parts of previous recommendations, about the consequences of avoiding the different types of conflicts we presented.

the "low acceptability for ground renewables" scenario assumes an extra cost for these technologies. (European Commission, 2011) provides different scenarios which depend on public acceptance of nuclear technology.

(ECF, 2010) sees desirability issues as an uncertainty which can drive up costs significantly if the described scenarios are to be implemented. But the study does not provide any estimate of the impacts if these issues would turn true.

Sometimes though, some technologies are assumed to be unacceptable and as such are excluded from the study. For example, (Agora Energiewende, IDDRI, 2018) considers in all its scenarios that very large on-shore wind turbines will not be installed in France or Germany because of acceptance issues.

Other studies, such as (Agora Energiewende/Öko-Institut, 2017; Association négaWatt, 2014; Association négaWatt, 2017; Greenpeace, 2015) exclude nuclear power from their transformational scenarios. By doing so, they are not taking into account acceptance issues. Indeed, the technology is excluded in line with the driving questions these studies seek to answer: "What could be the energy mix without nuclear power?" is one of them. (Agora Energiewende/Öko-Institut, 2017) seeks to answer the question "How do costs of a fossil-based power system compare with those of a renewable-based power system?"

In all those cases where acceptability is explicitly considered, only uncertainty conflicts due to the building of new infrastructure are considered as a risk.

The different conflict risks we discussed have been presented in isolation from each other. However, in reality several of them can be present at the same time within a population, and interact with each other. Each micro change within a transition may be subject to different tensions, and these multiple and shared tensions may crystalize into a conflict. An illustration of such tensions is provided with the large-scale implementation of smart-meters in France (Danieli, 2018).

Recommendations to scenario producers

Here are some recommendations to properly include desirability issues in scenarios.

Conceptually, there are several ways to include desirability issues in scenarios:

- Desirability can be fully included in the study design, either by substantiating that all the transition elements which are implemented pose no desirability issue, or by detecting desirability issues and including in the results the consequences of these desirability issues. The consequences can be valued in terms of cost, CO_2 impacts and so on, depending on the adaptation by the various modeled actors to the transition elements they deem unacceptable. For example, households can get equipped with diesel generators if power security of supply is not ensured, which would lead to extra costs and, possibly[5], to emitting extra CO_2 emissions.
- As already done in some studies, desirability can be seen as highly uncertain and lead to sensitivity analyses. However, in scenarios in which acceptability is assumed to be low, the consequences of these acceptability issues should be described and their impacts assessed.
- Another way to handle the desirability issue is to provide *concrete*[6] assessment of the consequences of the proposed transition. Indeed, scenario producers cannot be fully informed about the possible desirability issues within complex and evolving populations and cultures. Beyond keeping in mind the recommendations presented above, a way to overcome these uncertainties is to be as concrete as possible about the evolution of lifestyles in the proposed scenarios (see section on lifestyles and behaviors). With concrete descriptions, scenario users can discuss the proposed lifestyles, and investigate their desirability. They can then provide feedback to scenario producers and to the rest of the scenario community so that remarks and knowledge be shared.

[5] Depending on the power mix

[6] See section on Future studies

Bibliography

ADEME. (2011). *La concertation en environnement* (p. 63).

ADEME. (2014). *Visions énergie climat 2030/2050—Quels modes de vie pour demain ?* (N° 8102; p. 132).

ADEME. (2015). *Un mix électrique 100% renouvelable ? Analyses et optimisations*.

ADEME / Artelys. (2018). *Trajectoires d'évolution du mix électrique 2020-2060—Synthèse*.

ADEME / OpinionWay. (2017). *Les français et l'environnement* (p. 5).

Agora Energiewende, IDDRI. (2018). *L'Energiewende et la transition énergétique à l'horizon 2030*.

Agora Energiewende/Öko-Institut. (2017). *Renewables versus fossil fuels – comparing the costs of electricity systems* (p. 41).

ANCRE. (2013). *Scénarios de l'ANCRE pour la transition énergétique*.

Association négaWatt. (2013). *Scénario négaWatt 2011—Dossier de synthèse* (p. 28).

Association négaWatt. (2014). *Scénario négaWatt 2011-2050—Hypothèses et méthode*.

Association négaWatt. (2017). *Scénario négaWatt 2017-2050 | Dossier de synthèse* (p. 48).

Bertsch, V., Hall, M., Weinhardt, C., & Fichtner, W. (2016). Public acceptance and preferences related to renewable energy and grid expansion policy : Empirical insights for Germany. *Energy*, *114*, 465-477. https://doi.org/10.1016/j.energy.2016.08.022

Bögel, P. M., & Upham, P. (2018). Role of psychology in sociotechnical transitions studies : Review in relation to consumption and technology acceptance. *Environmental Innovation and Societal Transitions*, *28*, 122-136. https://doi.org/10.1016/j.eist.2018.01.002

Burke, M. J. (2018). Shared Yet Contested : Energy Democracy Counter-Narratives. *Frontiers in Communication*, *3*, 22. https://doi.org/10.3389/fcomm.2018.00022

CGDD. (2016). *Trajectoires de transition bas carbone en France au moindre coût*.

Danieli, A. (2018). *La « mise en société » du compteur communicant. Innovations, controverses et usages dans les mondes sociaux du compteur d'électricité Linky en France*. Université Paris Est.

Demski, C., Thomas, G., Becker, S., Evensen, D., & Pidgeon, N. (2019). Acceptance of energy transitions and policies : Public conceptualisations of energy as a need and basic right in the United Kingdom. *Energy Research & Social Science*, *48*, 33-45. https://doi.org/10.1016/j.erss.2018.09.018

Devine-Wright, P. (2011). *Renewable Energy and the Public—From NIMBY to Participation* (earthscan). London - Washington, DC.

ECF. (2010). *Roadmap 2050—A Practical Guide to a Prosperous, Low-Carbon Europe* (p. 100).

EDF R&D. (2018). *Les systèmes électriques de demain—Un défi pour la transition énergétique*. Tec & Doc Lavoisier.

epe. (2019). *ZEN (séro émission nette) 2050—Imaginer et construire une France neutre en carbone* (p. 88).

European Commission. (2011). *Energy Roadmap 2050—Impact assessment and scenario analysis*.

European Commission. (2016). *EU reference scenario 2016 : Energy, transport and GHG emissions : trends to 2050.* Luxembourg.

Foxon, T. J. (2013). Transition pathways for a UK low carbon electricity future. *Energy Policy*, *52*, 10-24. https://doi.org/10.1016/j.enpol.2012.04.001

Greenpeace. (2015). *Energy [R]evolution—A sustainable world energy outlook 2015* (p. 364).

IIASA. (2012). Energy Pathways for Sustainable Development. In *Global Energy Assessment Towards a Sustainable Future*.

Lappeenranta University of Technology / Energy Watch Group. (2017). *Global energy system based on 100% renewable energy—Power sector*.

Mark Elsberg. (2017). *Blackout. Tomorrow will be too late*. Sourcebooks Landmark.

Martin, S., & Gaspard, A. (2016). *Changer les comportements, faire évoluer les pratiques sociales vers plus de durabilité* (p. 181). ADEME.

Merad, M., & Trump, B. D. (2018). The legitimacy principle within French risk public policy. *Science of The Total Environment*, *645*, 1309-1322. https://doi.org/10.1016/j.scitotenv.2018.07.144

Miller, C. A., O'Leary, J., Graffy, E., Stechel, E. B., & Dirks, G. (2015). Narrative futures and the governance of energy transitions. *Futures*, *70*, 65-74. https://doi.org/10.1016/j.futures.2014.12.001

OECD/IEA. (2017). *World Energy Outlook 2017* (p. 782).

Padre, J. (2018). The Science of Storytelling : How Storytelling Shapes Our Behavior. Consulté 12 septembre 2019, à l'adresse Media partners website: https://www.media-partners.com/blog/the_science_of_storytelling_how_storytelling_shapes_our_behavior.htm

RTE. (2017). *Bilan prévisionnel de l'équilibre offre-demande d'électricité en France*.

Scherhaufer, P., Höltinger, S., Salak, B., Schauppenlehner, T., & Schmidt, J. (2017). Patterns of acceptance and non-acceptance within energy landscapes : A case study on wind energy expansion in Austria. *Energy Policy*, *109*, 863-870. https://doi.org/10.1016/j.enpol.2017.05.057

Schubert, D. K. J., Thuß, S., & Möst, D. (2015). Does political and social feasibility matter in energy scenarios? *Energy Research & Social Science*, *7*, 43-54. https://doi.org/10.1016/j.erss.2015.03.003

SFEN. (2018). *Le nucléaire français dans le système énergétique européen*.

Smil, V. (2015). *Power Density—A Key to Understanding Energy Sources and Uses*. MIT Press.

Uzzell, D., & Rathzel, N. (2010). La contextualisation de la psychologie environnementale : La nécessaire évolution de la psychologie environnementale. In K. Weiss & F. Girandola (Éd.), *Psychology and Sustainable Development (Psychologie et développement durable)* (p. 247-277). Consulté à l'adresse http://epubs.surrey.ac.uk/805014/

WWF. (2011). *The Energy Report—100% renewable energy by 2050*.

Extra-references for understanding past transitions from a socio-historical point of view (in French)

Gras, A. (2007). *Le Choix du feu. Aux origines de la crise climatique*. Fayard (p. 281)

Jarrige, F. (2016). *Technocritiques. Du refus des machines à la contestation des technosciences*. Paris, La Découverte (p. 434)

Authors

Nicolas RAILLARD

Project Manager – nicolas.raillard@theshiftproject.org

Nicolas Raillard joined *The Shift Project* as a Project Engineer. A graduate from ISAE – Supaéro (France) and from the Georgia Institute of Technology (USA), he worked as a complex system strategy engineer in aerospace for 4 years. Having passed an Advanced Master in "Environment International Management" at the Mines ParisTech school (France) and Tsinghua University (China), he now applies his skills and qualifications to the low-carbon transition.

Valentin LABRE

Assistant Project Manager – valentin.labre@theshiftproject.org

Valentin Labre joined the *Shift* to work alongside Nicolas Raillard on the "Power Systems 2050" project. Its goal is to develop a methodological guideline on the scenarization of electric power systems. Valentin obtained an engineer's degree from the Ecole centrale d'électronique de Paris (ECE) and later achieved a postgraduate degree in "Energy, Finance and Carbon" from Paris Dauphine University. Before joining the Shift, Valentin had various experiences working in the energy field for companies such as Enedis (Public energy distribution) and GreenYellow (Decentralized energy solutions).

The Shift Project

The Shift Project, a non-profit organization, is a French think-tank dedicated to informing and influencing the debate on energy transition in Europe. The Shift Project is supported by European companies that want to make the energy transition their strategic priority & by French public funding.

Press contact : Jean-Noël Geist, Public Affairs and Communications Manager

+ 33 (0) 6 95 10 81 91 | jean-noel.geist@theshiftproject.org