Local and regional low carbon scenarios

methodology, challenges and opportunities

Low Carbon Societies Network

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PRESENTATION OF THE PROJECT ENCI-LOWCARB – EUROPEAN NETWORK ENGAGING CIVIL SOCIETY IN LOW CARBON SCENARIOS

The aim of the project ENCI-Lowcarb is to develop ambitious and socially acceptable low carbon scenarios for Germany and France. In an iterative discussion process between researchers and stakeholders the acceptance towards the elaborated scenarios is evaluated and broadened.

Also an "European Network on Low Carbon Scenarios" composed by CSOs (Civil Society Organizations) and researchers is created in order to establish a lively exchange on existing energy scenarios and best practices to meet the requirements of a low carbon society.

This publication has been put together by the ENCI-Lowcarb project.

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Introduction: the future is in our hands

"Here's the bottom line: Any expectations that ever-increasing supplies of energy will meet demand in the coming years are destined to be disappointed. Instead, recurring shortages, rising prices, and mounting discontent are likely to be the thematic drumbeat of the globe's energy future. If we don't abandon a belief that unrestricted growth is our inalienable birthright and embrace the genuine promise of renewable energy, the future is likely to prove grim indeed. Then, the history of energy, as taught in some late twenty-first-century university, will be labeled: How to Wreck the Planet."[1]

These are the last sentences of an article recently published. And yes, the author is right to draw a quite cheerless picture of our future. One could add that:

- The World Meteorological Organization (WMO) affirms that the first ten years of the XXIst century was the hottest decade since records began[2]

- Following an evaluation of the World Health Organization (WHO), the impacts of climate change had caused the deaths of over 150,000 people in 2000.[3]

- The global CO_2 emissions in 2010 achieved a new record of 30,6 Gt according to the International Energy Agency (IEA).[4]

And as if this last news wasn't frightening enough, national governments continue to play their "tit for tat" games during international climate negotiations, which are still slowed down by the casual free riders...[5]

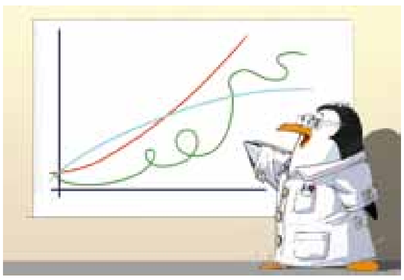
However, we do not want to conclude the introduction with these findings, because there are already many positive signs for change: national governments unilaterally adopting ambitious emission reduction targets[6], NGO networks mobilizing citizens on climate change issues and more and more local authorities adopting ambitious climate and energy actions plans at a local level.

What we need today is a "great transition"[7] – not only of the energy system but also of our governance structure, our system of values and our consumption patterns, and all this within the coming years, as the inertia of our current climate system is a physical reality...

An in-depth society-wide transition process has to emerge from the bottom up. Within this process local and regional energy scenarios are important tools that demonstrate potential and fix achievable future targets.

The publication you have in your hands highlights the methodological, political and practical aspects of local and regional scenarios.

Enjoy reading!
The project partners of the European project ENCI-LowCarb



1. Klare, Michael T. (2011) *The global energy crisis deepens*, European Energy Review.

2. WMO (2011) WMO *Statement on the Status of the Global Climate in 2010*, WMO-No. 1074.

3. WHO (2005) Climate and health Fact sheet, July 2005.
4. Article on www.iea.org IEA (30 May 2011) *Prospect of limiting the global increase in temperature to 2ºC is getting bleaker.*
5. WBGU (2010) *Climate Policy Post-Copenhagen: A Three-Level Strategy for Success*, Policy Paper 6.

6. UK: the UK government announced in May 2011 to halve their CO_2 emissions until 2025 compared with 1990 levels.

7. NEF (2008) *The great transition*. http://www.neweconomics.org/projects/the-great-transition / WBGU (2011) World in Transition – A Social Contract for Sustainability.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I. CREATION OF SUB-NATIONAL SCENARIOS

actors, motivations and objectives

8. RAC-F, Coordination-Sud (2010) *Copenhagen: Political Immobility Faced With Citizen Mobilization?* http://www.coordinationsud.org/Copenhague-face-a-l-immobilisme/
WBGU (2010) *Climate Policy Post-Copenhagen: A Three-Level Strategy for Success*, Policy Paper 6.

9. http://www.eumayors.eu/index_en.html

10. Cities for Climate Protection Campaign. http://www.iclei.org/index.php?id=11013

At present, the development of local or regional low carbon energy scenarios cannot hang the sign "business as usual" in its window.

But recently local authorities have been involving themselves more and more in international climate negotiations, just as national governments seem to have become increasingly reluctant to do so.[8] Initiatives such as the *Covenant of mayors*[9], or networks such as ICLEI's *Cities for Climate Protection Program*[10] are spreading, demonstrating the commitment of local authorities around the globe.

The signing of the *Covenant of Mayors*, for example, binds local authorities to meet or even exceed the European Union's 20% emission reduction objective by 2020.

Problems arise when cities adopt emission reduction objectives in response to political expectations, without the required prior technical and economic analysis of local energy efficiency and renewable energies potential, and unaware of the policy measures that are necessary to achieve the objectives. Seen in this light, it is clear that the development of harmonized tools becomes indispensable (for example, a standard framework for emission inventories ➲Chapter II.5).

The development of local and regional energy scenarios is a complex but important step in closing the gaps between objectives, potentials and policies.

11. http://www.rac-f.org/-Scenarios-Climat-Energie-.html / http://www.lowcarbon-societies.eu/

12. http://ec.europa.eu/clima/policies/package/index_en.htm

In recent years a multitude of national, European and global energy scenarios have been published.[11] As already stated, this is not the case at a local and regional level, at least for the moment. The reasons are practical, technical and political.

Local and regional entities are responsible for an important share of green house gas emissions and have the capacity, as well as the technical and economic capabilities, for climate friendly action.

1. It takes time, money and expertise to elaborate an energy scenario - not all local authorities have the necessary resources for these exercises.

2. Several technical obstacles have to be overcome: access has to be gained to local data which is costly and time-consuming (➲Chapter II.6); moreover, the evaluation of local renewable energy and energy efficiency potential is core information for an energy scenario, but requires specific knowledge of methodologies (➲ Chapter II.8).
In the absence of a legal obligation to elaborate energy scenarios, a political will - or a persuasive and committed person or association - is needed to overcome the obstacles along the way.

Climate and energy policy involves different governance levels: most directives, norms and strategic orientations are decided on a national or European level. Such is the case for the European climate and energy package[12], which fixes the overall objectives for emission reductions, energy savings and renewable energies for 2020 on a pan- European level. These objectives have been broken down during long, rough intergovernmental negotiations on national objectives by so-called *effort sharing*. But the national objectives still have to be reorganised into regional - and even highly local - objectives, coherent with identified national potential.

Means must somehow be found to overcome the potential incoherence between a politically driven decision that comes from the top, and the need for it to be put into practice, anchored and framed by proven local potential and limits.

An adequate mix of policy measures, able to respond to a specific local situation, should emerge from the bottom up, providing input from a local level within the global setting of overall national objectives.

This re-appropriation of the definition of locally anchored objectives is an important step in the putting together of scenarios.

Local and regional entities are responsible for an important share of green house gas emissions[13] and have the capacity, as well as the technical and economic capabilities, for climate friendly action. Whilst the degree of transfer of jurisdiction to local authorities varies greatly even within the boundaries of the European Union, their liability is clearly visible: in France local authorities are responsible for half of French emissions when indirect emissions are taken into account.[14] According to the International Energy Agency, two thirds of global energy in 2006 was consumed by cities; this figure is expected to rise to 73% in 2030.[15]
Roughly three-quarters of all carbon emissions from fossil fuel combustion, cement manufacturing, and wood use occur in these urban areas[16], and cities are responsible for emitting 80 percent of the world's total greenhouse gases.[17]

So it is crucial to ascertain how responsibility for those emissions is allocated, and how effective strategies can be adopted to abate this significant source of environmental impact, as continuing urbanization is an overarching trend. Scenarios are useful tools to establish a coherent relationship between emission responsibility and capacity for action.

Within any country, emission patterns can vary widely between cities, and there can be particular disparities between rural and urban areas. Specific action plans have to be adapted to these different situations by developing coherent sub-national scenarios within a central national strategy, as jurisdiction for electricity infrastructures and energy taxation (feed in tariffs etc.) lies mainly in the hands of national governments. Cities, urban areas, suburbs, and rural territories are specific types of settlement. Due to the unique characteristics of each place it is difficult to find a clear typology of emission profiles that could be generalized. Each sub-national territory has to build its energy and climate strategy on its specific characteristics. Needless to say, an exchange of knowledge and experience amongst sub-national entities is fundamental and crucial for success.

The development of local and regional energy scenarios is a complex but important step in closing the gaps between objectives, potentials and policies.

It is as important at a local level as it is on a national scale to take a step back and to observe the bigger picture. An energy scenario can bring coherence to local sectoral action, by showing interconnections and path-dependencies, on a time scale beyond the next election period. The development of a long-term vision forces people to look beyond daily business. In many ways the local level is considered being more a "re-actor" than an "actor" (energy prices, national infrastructure planning), but local authorities can also use their specific knowledge of the local situation in order to actively design the future.

The local and regional level is more suited to involve local actors in climate and energy policy than the national or European levels, due to the proximity factor. Even if it is not always easy to mobilize civil society and economic stakeholders to take part in the definition of the local climate and energy strategy, proximity gives a real advantage over the national, European or even global levels.

13. Local authorities are responsible for approximately 12% of GHG emissions directly via their decisions concerning procurement, equipment and their building stock and vehicle fleet. ADEME (2009) *Construire et mettre en œuvre un Plan Climat-Energie Territorial* / In 2006 the German public sector emitted 42,8 Mt CO_2eq corresponding to 4% of global German emissions or the total emissions of Switzerland. http://www.germanwatch.org/klima/b-einf.htm

14. RAC-F (2011) *Plan Climat-énergie territorial – l'engagement des territoires dans la lutte contre les changements climatiques.*

15. IEA / OECD (2008) *World energy outlook*, p. 179 / Dhakal, Shrestha (2010) Bridging the research gaps for carbon emissions and their management in cities, Energy Policy 38 (2010) 4753–4755.

16. Mitra, A P, C Sharma and M A Y Ajero (2003) *Energy and emissions in south Asian mega-cities: study on Kolkata, Delhi and Manila*, Proceedings of IGES/APN International Workshop on Policy Integration Towards Sustainable Energy Use for Cities in Asia, Honolulu, Hawaii, 4–5 February 2003. / Sovacool, Benjamin K. / Brown, Marilyn A. (2010) *Twelve metropolitan carbon footprints: A preliminary comparative global assessment*, Energy Policy 38 (2010) 4856–4869.

17. Schulz, Niels (2009) Delving into the carbon footprints of Singapore—comparing direct and indirect greenhouse gas emissions of a small and open economic system, Energy Policy 38 (2010) 4848–4855.

1. Local climate and energy policy in Europe - Are governments empowering local government to take action on climate change?

Many local authorities are enthusiastic about playing their part in meeting our carbon mitigation targets and have already put in place objectives and policies for emissions in their area.

Local authorities situated in contexts that historically favour bottom-up initiatives - with national governments that outline rather than design schemes - will always be one step ahead.

It would appear that local and regional authorities' involvement in climate action may have emanated from a disappointment at the lack of ambition shown by their respective national governments. This inertia is visible at an international – within the framework of the international climate negotiation – as well as at the European level, as the member states are still reluctant to strengthen the European objectives on emission reduction to -30% in 2020, despite the important mutual benefits[18] this step promises to bring.

This regular leadership void at a national level goes hand in hand with a rising voluntary commitment from local authorities.

Initiatives such as the Covenant of Mayors make for impressive reading in the community of local authorities: more the 2500 cities in Europe - more than 125 billion inhabitants - have already signed and are therefore committed to achieve at least the objectives of the Climate and Energy package.

But there is no uniform level of activity or success amongst national governments and local authorities (LA); some are front-runners, others are also-rans.

The question that arises is what stimulates local authorities to become active, to develop a local climate and energy strategy, to take part in a 100% renewable energy initiative[19], to become more and more indispensable actors within European projects[20] and to adopt emission reduction objectives that are even more ambitious than those of their own national governments?

On the whole, the front-runner LA's in Europe are still mostly situated in the Scandinavian or German-speaking countries (even if this picture is evolving), those with a *integrated*, *mature* environmental policy and a mostly federal structure, which indicates the delegation of an important opportunity for policy design to the local and regional governance levels.

In a decentralized governance system that historically delegates responsibilities and jurisdiction (according to the principle of subsidiarity), LA's will naturally get involved.

In a centralized governance system that organizes energy production and distribution management at a national level through strong semi-public agencies, the missing cultural and technical expertise (gained through the delegation of energy and climate issues to LA's) is reducing their scope of action.

This could explain why France is legally imposing the creation of local climate and energy strategies[21], whilst other countries like Germany and the UK create soft frameworks, with potential conditioned financial incentives to follow.

But national action is not necessarily perceived as an intrusion and can even have a positive effect on local energy and climate policy. The obligation to create a local climate and energy strategy is actually speeding up local commitment in France[22], as it leads to the recruitment of a new LA staff. These latest recruits are responsible for climate and energy questions and can push for strong objectives and ambitious local projects.

But nevertheless, LA's in different European countries have different powers and responsibilities. Local authorities situated in contexts that historically favour bottom-up initiatives - with national governments that outline rather than design schemes - will always be one step ahead.

18. Climate Action Network Europe (2011) *Why Europe should strengthen its 2020 climate action*. http://bit.ly/eO6FZy / PIK, Oxford, E3M, Université Paris 1, ECF (2011) *A New Growth Path for Europe - Generating Prosperity and Jobs in the Low-Carbon Economy*. http://bit.ly/hRg3fh

19. http://www.100-ee.de/

20. http://ec.europa.eu/energy/intelligent/projects/index_en.htm

21. Grenelle 1 Act: http://www.legifrance.gouv.fr/affichTexte.do?cidTexte=JORFTEXT000020949548&fastPos=5&fastReqId=69108086&categorieLien=id&oldAction=rechTexte

22. http://observatoire.pcet-ademe.fr/ The French observatory on local climate and action plans – created by the national state agency for environment and energy (ADEME) gives a regularly updated picture of the development of these local climate and energy strategies. It has to be underlined that even before the legal obligation LAs were already involved in climate and energy policy.

2. Nationally imposed but regionally anchored energy scenarios (Schémas Régionaux Climat Air Energie - SRCAE)

Meike Fink – Climate Action Network - France[23]

One of the outcomes of the French "Grenelle – process" (which started in 2007) is the Grenelle 2 Act[24] which provides for regional climate, air quality and energy plans (SRCAE). These plans comprise a framework that will facilitate the assessment of potential regional objectives, as regards reducing greenhouse gas emissions, adapting and developing local, renewable energy sources and improving air quality.

One of the drivers behind this initiative was the need for the French government to break down the national climate and energy objectives at a regional level, based on a realistic estimation of concrete regional potential. It also enables the national government to monitor compliance with the nationalized European targets of the climate and energy package.

The SRCAE are drawn up under the joint stewardship of the regional state representative (*Préfet de région*) and the President of the Regional Council (*Président du conseil regional*). In the spirit of the "Grenelle-process", thematic working groups composed of different groups of stakeholders will take part in this process.

The SRCAE also involve a time component, as emission reductions are forecast until 2050; we can, therefore, talk of a veritable obligation for the creation of energy scenarios for French regions.

The drawing up process of these plans in the 22 regions in France is, it turns out, highly complex, so it is worth having a closer look at the methodology, challenges and obstacles. The overall problem is that French regions are subject to two different approaches: regional governments are, on the one hand, legally bound to state obligations (top down), and, on the other hand, closely linked to their territory and its particular intricacies (bottom up).

The discussions around the creation of the SRCAE – steeped in controversy on matters of methodology - show the deeply grounded misunderstanding and lack of communication between state agencies/civil servants and local governments, which is typical of a highly centralized state system like France's.

Before the putting together of the SRCAE was decided in the summer of 2010, most French regions were already committed to the development of a bottom-up regional climate and energy action plan (PCER – *Plan Climat Energie Régional*), with no specific national provisions, but with a financial incentive to create such a plan. A stakeholder consultation process also accompanies the creation of these PCER, but their outcomes are not combined in order to reach a national objective, and consequently methodologies were not harmonized in advance between different regions.

In many regions, such as *Rhône-Alpes* or *Ile-de-France,* these two processes are overlapping. This situation is source of confusion and frustration. Firstly, both initiatives (PCER and SRCAE) are largely treating the same issues, and secondly, the same stakeholders are invited to express themselves twice on the same subjects but for different purposes.

As a consequence, and unfortunately, most actors are overvaluing the state induced process, since the SRCAE is associated with state agencies, in comparison to the more locally anchored PCER, which is entirely endorsed by regional government - even if the political importance is clearly higher for the second initiative.

This disparity between the regional government and regional state agencies is additionally reinforced by the available personnel: where there may be 1 or 2 employees working for the region to put together these plans, the state agencies often have five times more staff.

The overall problem is that French regions are subject to two different approaches: regional governments are, on the one hand, legally bound to state obligations (top down), and, on the other hand, closely linked to their territory and its particular intricacies (bottom up).

The underestimation of the importance of a regional initiative (PCER) is clearly a cultural problem induced by the highly centralized governance system in France.

23. www.rac-f.org

24. In 2007 a spate of 6 thematic roundtables gathering private and public players in environmental issues was organized by the French government in order to define French environmental Policy. It was the first time that such a wide range of stakeholders was associated with a legislative process in France. The expectations were high at the beginning but the evaluation made by some of the environmental NGOs, which participated in the process, shows the outcome did not meet the potential. http://www.rac-f.org/Grenelle-de-l-environnement-Le,1833.html / Grenelle Act II Article 68 http://www.legifrance.gouv.fr/affichTexte.do?cidTexte=JORFTEXT000022470434

25. IPCC (2006) *IPCC Guidelines for National Greenhouse Gas Inventories*. http://www.ipcc-nggip.iges.or.jp/public/2006gl/index.html

However, and despite the traditionally difficult relationship between state agencies and regional governments, it is interesting to witness for the first time the common responsibility for an initiative. Hopefully this is the first step towards a more collective public policy.

The discussions around the creation of the SRCAE – steeped in controversy on matters of methodology - show the deeply grounded misunderstanding and lack of communication between state agencies/civil servants and local governments, which is typical of a highly centralized state system like France's.

Nevertheless, the whole SRCAE process is methodologically unsatisfactory as regards its overall objective, which is to enable the French government to evaluate compliance with the European climate and energy objectives based on an analysis of regional potential.

A precondition for achieving comparable results amongst the French regions (with 22 different subjects) would have been to elaborate a common methodology (with at least a standardized method, according to the IPCC's guidelines[25]), for example, concerning the scope of emission inventories: the state government has failed to provide clear guidance on this issue and is only retroactively trying to guide decisions in a common direction. No official standardized methodology has yet been defined by the French government. It has merely been indicated that the emission inventories should "only" cover territorial GHG emissions (excluding, for instance, indirect, up-stream GHG emissions) so that the risk of double accounting is limited ex ante. (➲ Chapter II.5).

It could be said that the state government fell into its own trap: in not wanting to impose too many methodological constraints (in anticipation of regional resistance to national top-down decisions) it bowed out just when its presence was needed. Insufficient anticipation of the necessary time to prepare a detailed methodology can also be blamed. It amounts to a political decision taken without respecting the minimum time delay for the preparation of its technical implementation.

The planned combining of the results is endangered: no SRCAE will be directly comparable to another, and much analytical effort will be necessary to decrypt comparable elements. **To merge the outcomes of studies on energy efficiency potential put together in different regions using different data sets and hypotheses will be highly complicated and time-consuming.**

The unanswered question remains: why did the state government decided to mix both initiatives (PCER and SRCAE), which led to unnecessary complication and mutual distrust, instead of developing a technical framework with clear methodological limits and a precisely defined objective?

Unfortunately, at least for the moment, it seems that all involved actors will remain unsatisfied by the results, the typical outcome of poorly chosen compromises.

One legal condition linked to the SRCAE contains a clause of compatibility of the local energy and climate strategies (PCET) with the SRCAE. This clause again demonstrates the continuing ignorance of local climate and energy policies within the national agencies. Ambitious local climate policy has been in evidence for several years now, and an important number of PCET's have already been adopted which are not compatible with the methodology of the SRCAE, which itself has still not ultimately been defined.

Local authorities do not have the personnel and economic capacity to rerun a process that already exists.

Another methodological challenge is the inclusion of air quality in the SRCAE's remit. As it was one of the later decisions taken in the process, this element is insufficiently integrated in the practice as a result. The air quality policy works with different time schedules to climate-and energy policy: 2015 is the key year (not 2020), in order to comply with another set of EU regulations. In addition, the principles of the emissions accounting methodologies are not identical: whereas air quality modelling takes into account local geographic characteristics (the urban or rural nature of the area...), these criteria have no incidence on GHG emissions modelling. In general, both subjects have been treated in different frameworks until now. It is definitively a positive step that they have been linked within the SRCAE[26], but a

26. For example, concerning the link between the use of biomass for heating and air pollution.

deeper knowledge exchange in light of the differences in methodology and time scales between both subjects would have been helpful.

Another surprising element is the absence of a set of harmonized indicators for the tracking and evaluation of the SRCAE.

Even if the overall assessment of the creation process of the SRCAE is for the moment mainly disappointing, the mere participation in such a common project allows us to see its limits, its potential evolution, and enables all parties to suggest improvements.

Nevertheless the structural problem remains: such co-chaired initiatives can only be successful if both actors are on a par with each other. This would necessarily imply more decentralization and a transfer of jurisdiction to the local level, accompanied by the necessary capacity building on both sides.

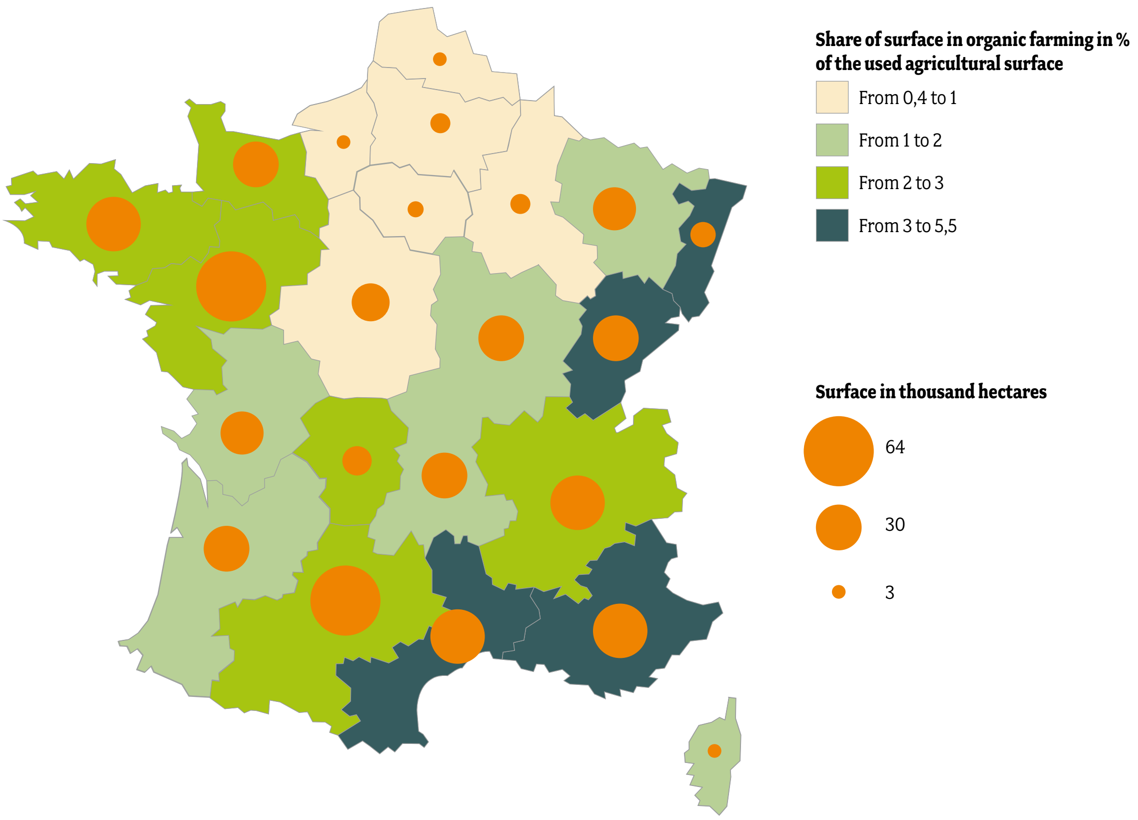
For the moment it is difficult to draw definite conclusions as not all SRCAE have yet been launched, but it seems to be the example of a state imposed initiative disconnected from the veritable needs, existing realities & capacities of the sub-national level.

(...) co-chaired initiatives can only be successful if both actors are on a par with each other. This would necessarily imply more decentralization and a transfer of jurisdiction to the local level, accompanied by the necessary capacity building on both sides.

A final uncertainty looms large on the horizon, concerning the presidential election in 2012: will the new president pursue these types of regional activities?

Figure 1 - Organic farming in France – regional differences

Source: Bio TPE (2009)



3. Different actors – different objectives and different methodologies?

27. négaWatt (2006) *Scénario négaWatt 2006 pour un avenir énergétique sobre, efficace et renouvelable* www.negawatt.org

28. A lot of scenarios exclude CCS because it is still considered as non proven technology : Prognos, öko-Institut, WWF (2009) *Blueprint Germany – a strategy for a climate safe 2050* / Center for Alternative Technologies – CAT (2010) *zerocarbonbritain* http://www.zerocarbonbritain.org/

A whole range of different actors - local authorities, non-governmental organizations (NGOs) and research institutes - develop sub-national energy scenarios. Their motivations and objectives are not always the same but can nevertheless often be complementary.

For instance if regional governments are legally obliged to develop regional energy and climate scenarios as is the case in France (➲ Chapter II.2), the methodology and the constraints of the scenarios will be framed by the national government. For example, a general re-consideration of the national energy production choices such as nuclear energy or CCS (carbon capture and storage) is ex ante excluded from the exercise. As regional governments do not necessarily share the opinion of national governments, it can even be desirable for regional authorities that a regional citizen initiative develops an alternative scenario beyond national constraints, or that a research institute analyzes a whole range of different pathways with a scientific eye.

Different objectives require different means. Methodologies and scenario tools are as varied as the objectives of organisms that initiate the creation of energy scenarios.

NGO's are not, in general, interested in a 'business as usual' scenario; they have a stake and want to defend it by using energy scenarios as an argumentation tool. They are aiming for ambitious targets; their choices are oriented according to their specific interest (nuclear phase out[27], no CCS[28],

ACTOR	OBJECTIVE	METHODOLOGY
LOCAL OR REGIONAL AUTHORITY	**LEGAL OBLIGATION** - Compliance - Development of a step by step practical action plan coherent with the emission reduction objective - Get concrete indications about what are urgent actions - Definition of the optimal strategy between the limiting cost factor and having an ambitious emission reduction target - Breaking a long term strategy or objective down into short term actions **NO LEGAL OBLIGATION** - Development of a scenario as a part of a communication strategy / within the development of a low carbon image - Elaboration of a strategy that is attractive for the electorate	In the case of a legal obligation fixed by the state government, local authorities have to apply a harmonized or semi-harmonized methodology. Limits like an obligation of additionality for emission inventories, in order to avoid double accounting, will point in the direction of the methodology needed. In the case of a voluntary exercise, pre-existing expertise, the range of available tools - and their costs and political considerations - will orient the methodological choice of local authorities. Overall, local authorities have to be supported by specialized consultancies because not all knowledge necessary for the development of energy scenarios is available internally.
NGO	**NO OFFICIAL SCENARIO** - Showing how to reduce emissions on a sub-national level - Creation of a lobbying tool for the attention of local politicians and economic actors - Mobilization of the local population **EXISTENCE OF AN OFFICIAL SCENARIO** - Definition of an alternative strategy to reach more ambitious emission reductions and other normative objectives (nuclear phase out, higher energy independence, 100% renewable energy production) - Critique of national top-down decisions impacting the local level - for example: national emission-related technology choices (Carbon capture and storages projects, nuclear waste deposals, shale gas projects) - Highlighting of not energy-related negative impacts or co-benefits of climate and energy strategies: social impacts as job creation[1] or losses or fuel poverty	NGOs are often without the financial resources and methodological expertise to develop a scenario on their own. The methodological choices will be guided by political considerations and pragmatic limits (in terms of available resources). As NGO's fix a number of constraints before starting the exercise (nuclear phase-out, 100% renewable in 2050 etc.), bottom up models are normally the most suitable approach.
RESEARCH INSTITUTE	- Development of new methodologies, tools or models - Comparison of different possible pathways and their impacts - Analysis of feasible technical and / or economic alternative strategies	Research institutes use their own models and methodologies; the set of assumptions will eventually be made mutually with project partners.

-40% GHG emissions in 2020[29], 100% renewable energy[30] etc.). NGO's aim to prove that local / regional politicians are not ambitious enough or that the current path will lead to disastrous situations. Often, they are promoting a win-win situation, 100% renewable energy scenarios, for example, which lowers energy prices (due to lower operational costs in the long run) and increases local, non-displaceable employment[31].

Another objective is to raise awareness on issues that concern life style changes and consumption patterns, which are often neglected in official strategies because local governments are afraid of negative reactions. An **NGO** scenario will more likely take into account indirect emissions linked to individual consumption of imported products, in order to understand the impact of individual behaviour outside the normally considered area.[32]

Example of regional energy scenarios developed by NGOs: Virage énergie (France) **Chapter III.1**

Research institutes are interested in verifying or falsifying hypotheses, or in applying a methodology under new circumstances. Their priority is to lead an analysis on observations and evaluations without aiming for a specific target and without excluding ex ante possible solutions based on ideological considerations. Research institutes often develop and use a proper scenario tool or model, which they wish to develop further. They also respond to public calls for tenders, which already include a well-defined research question.[33]

Different examples exist where research institutes or consultancies have collaborated with NGO's to form energy scenarios (generally at a national[34] or even a European level[35]).

In this case it is interesting to compare the communication strategies of both actors: in the case of the European scenario[36], commissioned by the NGO Friends of the Earth – Europe (Foe-E), and executed by the Stockholm Environment Institute (SEI), two different reports have been produced, aimed at different people and objectives but using the same

Figure 2 – Front covers of the same publication designed by an NGO and a research institute

set of results. Whereas the report of the SEI is a scientific report with a detailed description of the methodology and results, the publication of Foe-E is an information and lobbying tool with a far more eye-catching layout:

Local or regional authorities have a more pragmatic approach. Their aim is to find a realistic, technically and economically feasible way to meet their climate and energy targets (either imposed by the national government or in line with a voluntary initiative) within the limits of their powers and capacities. One particular challenge is to take the appropriate, no-regrets decisions within the short-term thinking of election periods as a first coherent step of a long-term project.

The selection of tools and methodologies for the emission accounting, for example, depends on internal expertise and on other parameters, such as clauses of additionality or governmental prescription etc.

Often, no complete scenario is developed but only specific issues like the development of renewable energies or the refurbishment of public building stock are highlighted.

The communication potential of sustainable energy strategies is an important issue for local authorities: the concept of "positive energy regions" or "100% renewable energy regions"[37] (à Chapter II.10) is spreading. Today, sustainable energy strategies have increasingly become a key element of positive, future-oriented images.

Example: SRCAE – Scémas Régionaux Climat-Air-Energie **Chapter II.2**

29. Friends of the Earth Europe and SEI (2009) *Europe's Share of the Climate Challenge.* http://www.climateshareeurope.org/

30. WWF, Ecofys (2011) *The Energy report – 100% renewable energy by 2050.* / Federal environmental agency (UBA), Fraunhofer Institute for Wind Energy and Energy System Technology (IWES) (2010) *Energy goal for 2050 : 100% renewable electricity supply.*

31. Les 7 vents du Cotentin, Réseau Sortir du Nucléaire (2006) *Un courant alternative pour le Grand-Ouest.* http://www.7vents.fr/ This study developed by 2 NGO's with the support of an energy consultancy argues against the planned construction of a new nuclear power plant, showing the advantages of the investment of the same amount of money in local renewable energies in terms of job creation and economic development.

32. NGO's can also decide to deliberately copy the same hypothesis as used by an official scenario in order to show that it is possible to obtain different outcomes with the same theoretic framework. Example: Virage énergie Nord-Pas-de-Calais: http://www.virage-energie-npdc.org/?lang=en

33. EWI, GWS, Prognos (2010) Energieszenarien für ein Energiekonzept der Bundesregierung / Several scenarios commissioned by the German environmental ministry testing the economic impact of different nuclear phase out scenarios.

34. Within the European project ENCI-Lowcarb (2009-2012) German and French low carbon scenarios will be co-created by NGO's and research institutes: in Germany the Potsdam Institute for Climate Impact Research and Germanwatch and in France the CIRED and the Climate Action Network France – www.lowcarbon-societies.eu

35. Energynautics, Greenpeace (2011) *Battle of the Grids.*

36. Friends of the Earth Europe and SEI (2009) Europe's Share of the Climate Challenge http://www.climateshareeurope.org/ or http://www.thebigask.eu/40percentstudy/the_40percent_study.pdf

37. deENet: 100%-Renewable energies project in Germany: http://www.100-ee.de / CIPRA (2010) Energy self-sufficient regions.

II. LOCAL AND REGIONAL LOW EMISSION SCENARIOS

methodological and political aspects

The second chapter of this publication on local and regional low emission scenarios focuses on methodological aspects - concrete obstacles such as limited of data availability, guiding concepts like the "100% renewable energy region" - and the political implications of certain methodological choices, such as the perimeter of the emission inventory.

These aspects are presented in the form of articles and are highlighted by the presentation of case studies or specific tools.

The **methodological choice** for the development of scenarios has an immediate influence on the results, or at least the form of the results. If a decision is taken not to analyze the economic impact of certain technology choices, due to a lack of resources or accessible tools[38], then that aspect will not be included in the scenario. To choose a method according to the objectives, resources and data availability is an essential step.

For example, decisions on "technical aspects", such as the scope or perimeter of the particular emissions, have a methodological and a political impact; if the scope of emissions goes beyond the analyzed area by including indirect emissions, a change in consumption patterns and imports has to be considered.

An important aspect of scenario creation is how the **objectives** are fixed, be it emissions or energy consumption reduction. As will be explained, this decision might lead to the creation of a **carbon or emissions gap** (the gap between the fixed objective and the reduction that is realistically achievable with political measures). In an attempt to avoid this gap, an objective fixed on the basis of potential emission reductions would be preferable, but this outcome often does not rhyme with an ambitious and politically advantageous target.

As **every territory has its own particularities,** generalizations are difficult, and the more the emissions pattern diverges from the average the more important it is to find specific solutions adapted to the local situation. For instance, the presence of a large industrial complex or an international airport in a scenario has to be weighed against the capacity of action of the local authorities on these emissions.

Energy sufficiency in the sense energy consumption reduction due to behavioral changes is an ambiguous element of energy strategies: on the one hand NGOs, politicians etc. stress the importance of value changes but on the other hand it is not clear how these changes can be stimulated... This explains why many scenarios exclude ex ante behavioral changes from their assumptions. Nevertheless scenarios often include sufficiency implicitly by for example a reduction of individual mobility without labeling it sufficiency but also without explaining this reduction by other measures.

The concept of **100% renewable energy regions** is fashionable; more and more local authorities subscribe to this objective – relying on the development of local potential for renewable energy and energy efficiency. Concrete examples have already proven that this aim is achievable.

These different methodological and political aspects of scenario creation will be highlighted in the following chapters.

38. For information on existing tools please refer to: http://www.energycommunity.org/ COMMEND (COMMunity for ENergy environment & Development) is an international initiative designed to build a community among energy analysts working on energy for sustainable development. The website includes access to LEAP (one modeling tool), information on other relevant software tools, and an online resource library as well as technical support.

1.

Energy scenarios – methodologies and typologies… or how the form determines the content!

Meike Fink (Climate Action Network France)[39] and Ruben Bibas (CIRED)[40]

39. www.rac-f.org
40. http://www.centre-cired.fr/

Scenarios at a local, national or European level are policy tools which help to define future strategies. They can take various forms. How can the relevance of a specific scenario be evaluated in the face of such diverse methodologies?

It is important to establish a list of criteria for comparing the strengths and weaknesses of different approaches in order to enable a more transparent interpretation of scenario results. One objective of scenario exercises is to build a framework for reflection around long term energy and climate policy targets. A scenario can deal with aspects of the economy, energy, environment, natural resources. A scenario can analyze specific aspects like energy technology choices, the economic impact of a specific energy transition, the political measures that are necessary to achieve a defined emission reduction objective, or the interaction of all these elements. The tools and the methodologies that are chosen have to be adapted to the aim.

> A scenario can analyze specific aspects like energy technology choices, the economic impact of a specific energy transition, the political measures that are necessary to achieve a defined emission reduction objective, or the interaction of all these elements.

Depending on the nature of the exercise, information can be derived externally (as a parameter of reference) or internally (as a result of a model being established). For example, within certain modelling exercises the economic development (GDP) is the outcome of a simulation, the result of a model run. Other models use the information on GDP development as a basic (exogenous) assumption, constituting an input for the exercise.

EXPLORATIVE, NORMATIVE OR OPTIMIZING

An essential distinction can be made through the method that is applied. **Explorative approaches** only fix starting hypotheses to orient future choices (for example, the evolution of km passenger per year), and then potentially set a target for emission reductions or an energy consumption limit. The trajectory (GDP development, technology choices etc.) is calculated subsequently. This type of scenario responds to the question: “What if…?”.
Normative approaches propose desirable alternatives. Targets (and possibly intermediate objectives) are fixed through a conviction born from technical feasibility (100% renewable energies in 2050, nuclear phase out…).
Optimization strategies will choose among all existing alternatives the one closest to the formally fixed criteria (for example, in terms of GDP development).

BOTTOM-UP, TOP-DOWN OR HYBRID APPROACHES[41]

41. For more information on different model types: Crassous R (2008) Modéliser le long terme dans un monde de second rang : application aux politiques climatiques, Thèse de doctorat (Sciences Economiques) – Chapter 1.

The modelling exercise imposes a second level of distinction concerning the nature of models that are used. Historically, two families have emerged in the field of prospective energy modelling. On the one hand the engineers’ models, referred to as **bottom-up**, which are based on a precise representation of the energy production and transformation (including exogenous hypotheses on the availability of resources), and the evolution of final energy services. On the other hand, the macro-economic models, referred to as **top-down,** deal with economic mechanisms, such as the reaction of energy demand to the variation in energy prices, for example. These models are often criticized for their intangible, less detailed, or even absent representation of the energy system and technology options due to their assembled nature. Top-down models represent economic mechanisms, whilst bottom-up models ignore the role of the economic system in the evolution of prices, and in how budget constraints are influencing the division of system technologies.

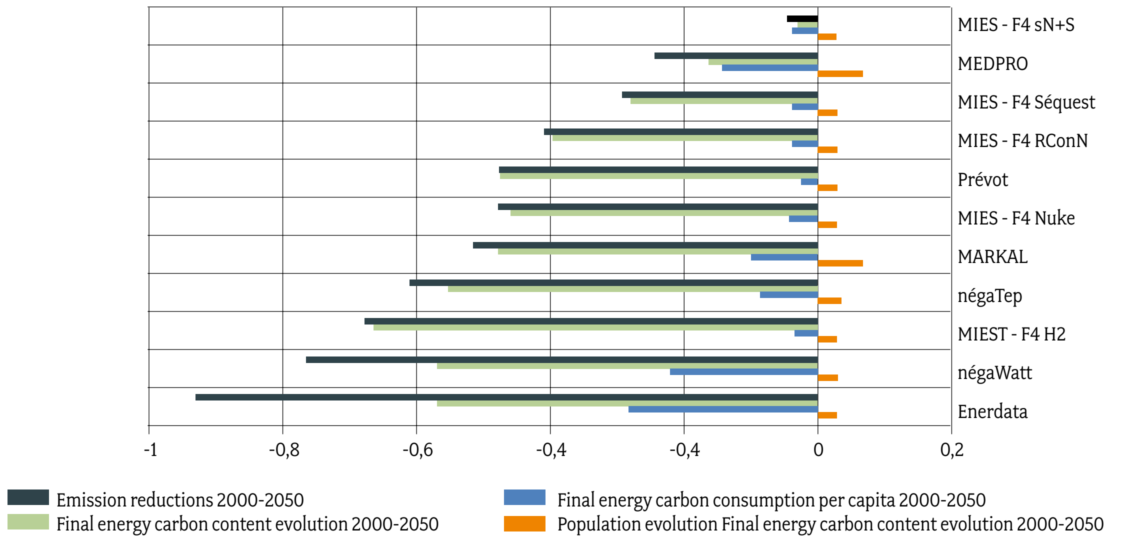
Based on the concept of these two models, a third form has emerged, referred to as **hybrid models**. These models attempt to merge the advantages of both approaches by integrating a detailed representation of the energy system in an orbiting economic system (investment strategies, price signals…).

There can sometimes be confusion between a scenario exercise and a future **vision**. A vision only describes an energy production and consumption situation at a specific point in time, but does not claim to expand on the trajectory and the political measures that must accompany further development.

At a local or regional level the most appropriate scenario methodology is to choose a normative approach combined with a bottom-up modelling tool, represented by the green area in the table.

	BOTTOM-UP	TOP-DOWN	HYBRID
Explorative	LEAP, WEM, TIMER	GEMINI-E3	IMACLIM
Normative	Most Excel based tools		
Optimization	Markal	RICE	REMIND

Figure 3 – Comparison different methodologies



Source: Mathy, Sandrine / Fink, Meike / Bibas, Ruben (2011) Quel rôle pour les scénarios Facteur 4 dans la construction de la décision publique ?, Revue Développement durable et territories.

Figure 4 – Variation of emission reduction potentials for the housing sector in different French scenarios

REALITY IS COMPLEX…

In order to imagine the future of our world we have to simplify reality so as to analyze it with a scenario tool. This transposition is inevitably coupled with a loss of information. For this reason the analysis of a scenario must distinguish between explicit hypotheses (such as demographic evolution) and implicit hypotheses, whose levels of impact are much harder to analyze, and are introduced by the simple choice of one specific model.

Scenarios often appear to be veritable black boxes, whose modus operandi is difficult to understand outside of the initiated community (modellers, institutions and clients). This might limit the acceptability of scenarios and the possibility of influencing democratically defined future visions developed by models.

An objective of future scenario exercises has to be to facilitate the understanding of hypotheses by non-experts, to gain greater transparency as regards to the bias induced by the choice of certain methods and information sources.

FOR MORE INFORMATION

The Recipe[42] project compared the results of 3 different hybrid models, all of which were subject to the same emission reduction objectives: Imaclim-R, Remind and Witch. Even if they belong to the same model category, their trajectories and transition strategies vary considerably.
But despite their differences, some common conclusions can be drawn for all of them:
- An efficient, less costly climate policy is only possible if lock-in situations are avoided and actions are not delayed.
- A complete transformation of the energy system is needed.
- All strategies include a rapid decarbonisation of the electricity sector and ceasing of investment in fossil thermal power plants (without Carbon capture and storage).
- Transport is considered to be the most challenging sector.
- Costs of emission reductions depend in the long term on the evolution of energy efficiency and the reduction potential of the transport sector.

Despite the important diversity of methodologies, the complexity of models, the multitude of hypotheses and the dispersion of results, the most important challenge is to overcome the potential risk of inaudibility or even mistrust concerning the results of modelling exercises.

Different results concerning the same question are difficult to explain – especially if results are limited to a description of a technology choice without giving the details of the underlying hypothesis. Differences concerning the market penetration of different technologies can reveal justifications of a quite different nature: purely technological, economic, political or methodological.

A comparison of 11 French scenarios[43] shows the inherent ambiguity of scenario exercises.
For example, the emissions reduction in the housing sector in 2050 varies from a division by 1.1 to a division by 8.1 (-10% to -88% respectively), depending on the analyzed scenario, yet this discrepancy cannot be explained with the available information.

In these conditions it is not surprising that scenarios often appear to be results of veritable black boxes, only understandable to an enlightened circle of experts with limited legitimacy.
It is important, though, to be clear about the limits of scenario exercises, and to admit that the prior choice of a certain model, methodology and hypothesis introduces a certain bias into the exercise. In order to put together a democratic citizens' scenario, it is vital to adopt the rule of transparency and to not deny the potential bias induced by methodological choices.

42. Edenhofer, O., C. Carraro, J.-C. Hourcade, K. Neuhoff, G. Luderer, et al(2009) *RECIPE - The Economics of Decarbonization Results and insights from the RECIPE model intercomparison.* http://www.pik-potsdam.de/research/research-domains/sustainable-solutions/research-act-intl-climate-pol/recipe-groupspace/working-papers

43. Mathy, Fink, Bibas (2011) *Quel rôle pour les scénarios Facteur 4 dans la construction de la décision publique ?*, Revue Développement durable et territoires. (fondé sur un rapport du projet ENCI-LowCarb www.lowcarbon-societies.eu).

2.
How to define an appropriate emission reduction and energy consumption objective?

In 2008, with the adoption of the European climate and energy package, every country in the European Union agreed to a legally binding emissions reduction objective for 2020. The EU climate and energy package bundles 3 overall European objectives for 2020, of which unortunately only the first two are legally binding.

1. A reduction in EU greenhouse gas emissions of at least 20% below 1990 levels
2. A 20% share of renewable energy sources in the EU energy consumption
3. A 20% reduction in primary energy use compared with projected levels, to be achieved by improved energy efficiency.

3*20 – the European objectives for 2020

These objectives have been broken down after long and intense negotiations and lobbying in national objectives by the so-called effort sharing.

Following to this decision member States with relatively high per capita gross domestic product (GDP) have to reduce, and those with low per capita GDP may even increase their GHG emissions. To further ensure a fair contribution of each Member State to the implementation of the Community's commitment to achieve at least a 20% reduction of greenhouse gas emissions by 2020 compared to 1990, no country is required to reduce or allowed to increase its greenhouse gas emissions in 2020 to more than 20% below 2005 levels. This Effort Sharing decision addresses the sectors, that are not covered under the EU ETS[44], such as buildings and road transport.

The IPCC's (Intergovernmental Panel for Climate Change)[45] 4th Assessment Report, published in 2007, asserted that Annex I (developed) countries need to reduce GHG emissions by approximately 25-40% below 1990 levels by 2020, and by 80-95% by 2050, in order to ensure a stable progression, and provide a "reasonable chance" of averting warming beyond 2˚C above pre-industrial temperatures.

The EU has offered to increase its emissions reduction to 30% by 2020, as part of a genuine global effort.[46] -30% would at least be situated within the necessary reduction pledge proposed by the IPCC. But even if the present day is particularly well suited to a raised objective, without major negative economic or social impacts, and indeed leading to some positive co-benefits[47], the EU remains reluctant. Even if investment costs for obtaining -30% are higher than for a 'business as usual' case, studies show that the additional co-benefits would easily exceed climate expenses.[48]

These examples highlight the political dimension of setting an emission target that unfortunately often outweighs scientific findings...

Also the international climate negotiations are faced with a tricky situation: countries are committed to the 2°C objective – this commitment has been officially expressed and signed by 114 states within the Copenhagen agreement49 - but the numbers are not backing up this objective. Only if a large majority of nations is actively involved in compulsory climate policy can the overall aim be achieved. The poor outcome of the last international climate conferences indicates that governments are becomingly increasingly reluctant to adopt binding climate strategies. Real ambition is missing because national governments are afraid to take the first step by risking a negative impact on their economy, and, as any action is dependent on initiative and compromise[50], the negotiations get stuck.

Nevertheless, several member states have unilaterally lifted their national objectives:
Germany has fixed an emissions reduction objective of approximately -40% by 2020 (-32,8% is the German objective defined by the EU climate and energy package), 55% by 2030, 70% by 2040 and 80-95% by 2050. Germany aims at reaching an 18% share of renewables in its final energy consumption, which is coherent with the existing EU objective, and aims for the electricity sector to be composed of approximately 35% renewable energy by 2020, and even 80% by 2050.[51]

44. The European Emission Trading System (ETS) covers emissions from installations such as power stations, combustion plants, oil refineries and iron and steel works, as well as factories making cement, glass, lime, bricks, ceramics, pulp, paper and board. http://ec.europa.eu/clima/policies/ets/index_en.htm

45. http://www.ipcc.ch/

46. European Council decisions in December 2008 http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:200 8:350:0072:0092:EN:PDF / Commission staff working document, accompanying the Analysis of options to move beyond 20% greenhouse gas emission reductions and assessing the risk of carbon leakage. Background information and analysis, part I {COM(2010) 265 final}.

47. Climate Action Network Europe (2011) *Why Europe should strengthen its 2020 climate action*. http://bit.ly/eO6FZy / PIK, Oxford, E3M, Université Paris 1, ECF (2011) A New Growth Path for Europe - Generating Prosperity and Jobs in the Low-Carbon Economy http://bit.ly/hRg3fh

48. ibid.

49. http://unfccc.int/meetings/cop_15/copenhagen_accord/items/5262.php

50. When the European climate and energy package was adopted, the EU leaders also offered to increase the EU's emissions reduction to 30%, on the condition that other major emitting countries in the developed and developing worlds commit to do their fair share under a global climate agreement. http://ec.europa.eu/clima/policies/package/index_en.htm

51. Energy Concept 2050 - Milestones and Assessments. http://www.bmu.de/english/energy_efficiency/doc/46721.php

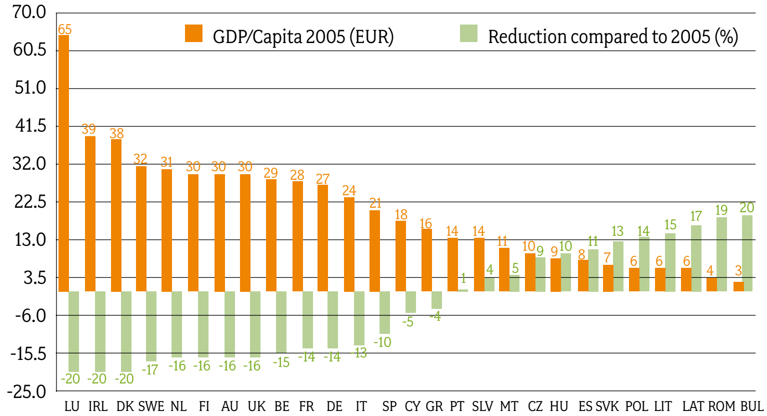


Figure 5 - "Effort sharing" for the non ETS sectors

Source: Climate Action Network Europe

Sweden: aside from the 40% emissions reduction target, Sweden is also setting a 50% target for renewable national energy generation by 2020 (49% is the Swedish objective of the EU climate and energy package). By that year, Sweden will also be phasing out the use of fossil fuels for heating. Sweden aims at becoming a zero net emitter by 2050.[52]

The **UK** has fixed an emissions reduction objective of approximately -34% by 2020 (-30% is the UK objective defined in the EU climate and energy package), -50% by 2025 and -80% by 2080.[53]

National governments are responsible for achieving these targets and are therefore dependent on the degree of commitment of local and regional authorities, especially in federal states where an important part of the jurisdiction is delegated to a local level. This delegation of responsibilities for tackling climate change - by the national government to decentralized democratically elected constituencies - is making local activity a key element for success. More and more local authorities are voluntarily joining movements like the "Covenant of Mayors[54]", a commitment by signatory towns and cities to go beyond the objectives of the EU energy policy for the reduction of CO_2 emissions, through enhanced energy efficiency and cleaner energy production and use.

The following are examples of local and regional climate objectives going beyond the European and national objectives – they also highlight the difficulty of comparing local climate strategies as no common framework exists for fixing a baseline years:

Vaxjö, Sweden - has the objective to become fossil free. The goals for Fossil Fuel Free Växjö are that the CO_2 emissions per capita shall decrease by 55 percent by 2015 and by 100 percent by 2030, compared to 1993.[55]

London, UK - The Mayor of London proposes a CO_2 emissions reduction of approximately -60% by 2025 on the basis of 1990 figures.[56]

Porto, Portugal – Porto has adopted a CO_2 emissions reduction target by 2020 of approximately -45% compared to 2004.[57]

Vitoria–Gasteiz, Spain - Vitoria-Gasteiz has adopted a 26% CO_2 emissions reduction objective to be achieved by 2020, compared to 2006 figures. [58]

100% renewable energy regions in Germany: The project 100%EE has listed regions and administrative districts in Germany with ambitious renewable energy objectives.[59] For example, the Lüchow-Dannenberg district aims at achieving 100% renewable energy by 2015 for electricity, heat and mobility.

Even if local governments cannot replace national action, it is a promising sign that more local authorities are recognizing the urgency of climate action in their policy, thereby setting a good example to their respective governments.

How can an appropriate and feasible emissions reduction and energy consumption objective on a regional and local level be set?

There are different approaches on how to fix an emissions reduction target on a sub national level; the choice strongly depends on the nature of the body initiating the project, and on the information that is taken into account.

An important parameter is actual climate science evidence. Scientific literature demonstrates what the maximum acceptable per capita green house gas emissions are, in order to respect the climate equilibrium. Calculating the impact of several emissions reduction objectives - with differing likelihoods of respecting the maximum global warming limit of approximately 2°C[60] - provides a scientifically based starting position for decision-making. Following to Meinshausen (2009) if the global GHG emissions in 2050 (in CO_2equivalent) are reduced to 18 Gt CO_2eq - meaning that all of the 9,3 billion inhabitants will have an emission right

52. Swedish government (2009) A sustainable energy and climate policy for the environment, competitiveness and long-term stability. http://www.sweden.gov.se/content/1/c6/12/00/88/d353dca5.pdf

53. http://www.decc.gov.uk/

54. www.eumayors.eu - 1903 European local authorities have already signed the Covenant of Mayors.

55. Vaxjö Kommun (2010) Fossil Fuel Free Växjö.

56. Climate Change Mitigation Strategy of London (2010) Delivering London's energy future - the Mayor's draft Climate Change Mitigation and Energy Strategy for public consultation.

57. Covenant of Mayors (2010) Sustainable Energy Action Plan – Porto.

58. Covenant of Mayors (2010) Vitoria-Gasteiz Plan against Climate Change 2010-2020.

59. http://www.100-ee.de/index.php?id=100eemap

60. Meinshausen, M., N. Meinshausen, W. Hare, S. C. B. Raper, K. Frieler, R. Knutti, D. J. Frame and M. R. Allen (2009) *Greenhouse-gas emission targets for limiting global warming to 2°C* Nature 458(7242): 1158. http://sites.google.com/a/primap.org/www/nature

about 1,9 tCO_2eq - the danger to exceed a global warming over 2°C is limited to 12-45%.[61]

This means for a city whose inhabitants are emitting 11,2tCO_2eq (like in San Francisco) an emission reduction about -83% would be necessary.

If the risk of exceeding 2°C shall be limited or the more ambitious objective of 1,5°C shall be respected the emission constraint become even more challenging.

Often, a decision made on a national or local emissions reduction objective is dissociated from the rest of the world. Even if a city in Greece has no influence on the decisions of North America, India or Sao Paulo, it is important to at least position the emissions reduction objectives in a global context.[62] If we do not want to exceed 2°C global warming, we have to respect globally the remaining emission budget.

NGO actors will generally aim at emission reductions that are coherent with the best probability of avoiding climate change. Their reasoning is mainly based on the precautionary principle and the concept of common but differentiated responsibility, meaning that industrialized countries have to take a significantly bigger leap in reducing emissions than developing countries, who are yet to step up to the western development parameters.[63]

Local and regional authorities will, according to their political allegiances and economic situation, be in favor of more or less ambitious emissions reductions, but coming up with a sub-national climate target always takes place within a national legal framework. Local entities do not have the same jurisdiction as national governments and cannot act on all emitting sources. In contrast to NGO's, local authorities have to base their decisions on realistic feasibility analysis, especially where they are legally committed to do so.

To avoid local authorities biting off more than they can chew, by fixing an ambitious emissions reduction target without the capacity and potential to achieve it, all climate and energy strategy should start with an analysis of the local potentials for renewable energies and energy efficiency. A list of feasible political measures and an estimation of the emissions reduction they can achieve should then complete this analysis. **Only the combination of both potential and political measures will enable an appropriate reduction objective to be set.**

Emissions reduction objectives can be calculated following different approaches and based on different emission scopes (Chapter II.5):

- Setting of an ambitious objective on direct emissions of the local / regional administration only (procurement, vehicle fleet, public buildings…)[64]

- If the initial emission inventory is based on the carbon footprint methodology[65] further interaction with the local population is necessary to fix an objective, as the main emitting area will be the consumption of households. The consumption of French households represents 75% of the total national emissions, on the basis of carbon footprint methodology.[66] It is difficult to forecast behavioral changes; this should be done jointly with the general population.

- Aiming at the a sustainable per capita emission in 2050 in coherence with the globally remaining emission budget (contraction and coherence – every human has the same emission budget in 2050 that means industrialized areas have to reduce their emissions drastically meanwhile developing countries can increase their emissions)

- Forecasting on the local level: the addition of local emissions reduction potentials due to specific climate actions leads to a maximal achievable reduction objective.

- Backcasting at a local level: the setting of an objective whose achievability is tested retroactively. The potential gap between the locally feasible emission reductions and the emission reduction target has to be bridged by additional local emission reduction actions or eventually off-setting, both of which incur additional costs. The same problem emerges when a national target is directly applied to the local level without taking into account local specificities and potential.

61. ibid. ,page 1161

62. WBGU - German Advisory Council on Global Change (2009) Solving the climate dilemma: The budget approach Solving the climate dilemma: The budget approach - Special Report.

63. Heinrich-Böll Foundation, SEI, Ecoequity, Christian Aid (2007) *The right to develop in a climate constrained world.* http://www.ecoequity.org/docs/TheGDRs-Framework.pdf

64. In 2006 German public administration was directly responsible for only 4% of the total national emissions (Germanwatch). The impact of such a climate strategy, which is only focusing on these emissions, will be very concrete, feasible and highly symbolic, if fairly limited.

65. www.carbonfootprintofnations.com

66. Commissariat général au développement durable (2010) *CO_2 et activités économiques de la France Tendances 1990-2007 et facteurs d'évolution, Études et documents* - Numéro 27.

3. Backcasting and forecasting

There exists a broad and useful distinction of scenario exercises: whether they are based on forecasting or backcasting. While both procedures extrapolate trends into the future, the starting points are very different.

- **A forecasting process starts with the current situation and predicts possible future paths.**
- **A backcasting process starts with the current situation and an end point, and then describes the path between both temporal points, often on the principle of trial and error in order to make them meet.**

As backcasting exercises voluntarily fix the future outcome, they can be described as normative approaches, while forecasting is more exploratory.
Forecasting and backcasting are both useful techniques for strategic future planning.
They are 2 sides of the same coin; the optimum outcome of a local climate and energy strategy would be to make them fit together. That means finding a set of realistic and economically feasible actions to reach the optimum objectives fixed by the backcasting.

The starting point for NGO's is often the definition of a scenario's constraints and its normative objectives:
- Fossil fuel phase out by 2030[67]
- 100% renewable energy by 2050[68]
- Nuclear phase out and -75% of CO_2 emission by 2050[69]

These scenarios represent conscious decisions to exclude ex-ante certain possibilities from the portfolio of future aims. They are therefore normative, and carriers of political messages.

But it is not only NGO's that use this approach. Local authorities fiercely motivated to tackling climate change in their area are fixing ambitious targets without the prior reality check on feasibility. **This can result in the creation of the so-called "emission or carbon gap" (Chapter II.4) between the local climate and energy action plan (if it exists) and the emissions reduction target. As a result, even if all the possible emissions reductions from the implementation of the action plan are combined, the target is not reached. Either the action plan or the target has to be changed.**

Even so, this does not mean that ambitious objectives cannot be achieved even if they appear challenging.

Research institutes will adopt a methodology, which is coherent with the research question. The same approach will not be suitable for exploring model limits and for defining the least cost pathway for reaching an acceptable climate target. Another objective can be to highlight crucial points by comparing different approaches and strategies, in order to determine the most robust strategies.[70]

In general, national research institutes seem to be less interested in scenario exercises at a local level, as the scope of their models tends to focus on the national and international scene.

67. Vaxjö Kommun (2010) Fossil Fuel Free Växjö. http://www.vaxjo.se/upload/76637/Fossil%20Fuel%20Free%20V%C3%A4xj%C3%B6%20-%20the%20story_2010.pdf

68. WWF, Ecofys (2011) The Energy report – 100% renewable energy by 2050

69. Virage énergie NPdC - http://www.virage-energie-npdc.org/?lang=en

70. The economics of decarbonization, 2009, Edenhofer, O., C. Carraro, J.-C. Hourcade, K. Neuhoff, G. Luderer, et al (2009) RECIPE - The Economics of Decarbonization Results and insights from the RECIPE model intercomparison. http://www.pik-potsdam.de/research/research-domains/sustainable-solutions/research/ClimatePolicies/recipe-groupspace/working-papers/recipe-synthesis-report

Figure 6 – Backcasting and forecasting

4.

Emission or carbon gap – objectives need to undergo a reality check

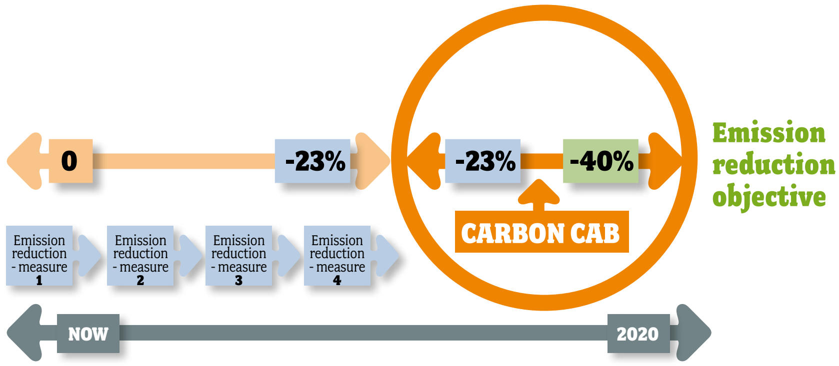


Figure 7 – Emission or carbon gap

The "carbon or emission gap" concept illustrates the discrepancy between ambition and reality. Governments and local authorities are increasingly adopting climate and energy objectives backed up by numerous studies demonstrating, for example, how 100% renewable energy or -80% emissions reductions are technically and economically feasible.[71]

But these decisions are rarely based on a well-grounded analysis of the means required.

In order to achieve a 75% reduction in emissions, an action plan with concrete measures has to be implemented, including an evaluation of the emission reductions that can be achieved by each measure. If the set of measures is designed after the objective is fixed, there is a serious risk that a "carbon or emission gap" will emerge between the target and the objective, by adding up the cumulative impact of all the measures. Crucially, this endangers the overriding goal, which is to avoid the impacts of climate change.

While 77% of German cities have voluntarily adopted emission targets, and 80% of these cities are engaged in at least basic emission reporting, only a quarter of them are on course to reach their targets. All of the 'successful' cities are situated in Eastern Germany, and their emission reductions can essentially be explained by the industrial decline of the 1990's after German reunification.[72]

Governments are faced with the same problem. French environmental legislation has established several climate and energy objectives for 2020, which are not achievable with the political measures currently in place. One such objective is the proposed reduction of approximately 38% of the final energy consumption of existing building stock.[73]

A recent evaluation of the emissions reduction potential of the existing set of measures clearly showed the discrepancy between the means and the aim; this is the existing carbon gap.[74]

It is important that the methodology used for the evaluation of the emissions reduction potential of different political measures be transparent. The effectiveness of political measures depends on multiple economic, administrative and social factors, and the assessment of the importance of each of these criteria is subject to qualitative estimations.

In modeling exercises the carbon gap is often bridged by a carbon price, in order to deflect the emission trajectory by a price policy. This procedure ignores the social and economic problems linked to higher production costs, and is above all blanking the problem of political acceptability.

It was calculated by the consultancy firm[75] that France needed a carbon price of roughly 120€ t/CO_2 to be able to satisfy the initial objective.[76]

It is essential that a strong link is established between climate targets and the corresponding means. If this has not been done prior to fixing the objective - where specific political ambitions (signing the Covenant of Mayors) or obligations (European Climate and Energy package) necessitated the decision - it is important to catch up and overcome carbon gaps, to add some credibility to future low carbon strategies.

71. An overview of low carbon scenarios: http://www.lowcarbon-societies.eu/index.php?id=24

72. ICLEI (2010) Project - Covenant CapaCITY

73. Grenelle Act I: http://www.legifrance.gouv.fr/affichTexte.do?cidTexte=JORFTEXT000020949548 / Louis-Gaëtan Giraudet, Céline Guivarch, Philippe Quirion (2011) Exploring the potential for energy conservation in French households through hybrid modeling.

74. CITEPA (2011) Scénarios prospectifs : Energie – Climat – Air à horizon 2030 - Estimations des émissions de gaz à effet de serre et de polluants en 2020 et 2030.

75. Enerdata

76. Enerdata (2011) *Scénarii prospectifs énergie - climat - air de référence concernant la France dans un cadre européen et international à l'horizon 2030.*

77. www.rac-f.org

5. Local emission inventories - what information is taken into account? The dissent on local emission inventories – between harmonization and simplification

Meike Fink Climate Action Network – France[77]

As the importance of local authorities in climate change mitigation action is incontestable, and their position as actors in international climate negotiations is increasingly acknowledged, the development of harmonized reporting tools will be of particular interest. The standout reason is that no harmonized framework for the emissions accounting of cities has yet been adopted universally[78]:

"In order to be considered as credible actors, local authorities must collectively be able to demonstrate that they are able to make, and reach, credible, transparent and measurable GHG emission reduction commitments. This indicates that inventories that are detailed, transparent and comparable are not only necessary, but essential." [79]

It is also important that local action can be linked to regional, national and international climate policy – by using compatible emissions accounting tools.

This section will briefly describe the technical elements that distinguish different accounting methods and explain why an ostensibly technical subject also involves underlying political and normative choices. This link between technical and political aspects will be illustrated by the example of the French *Ile-de-France* region.

Local authorities are putting together emission inventories in order to cope with different objectives, the most basic being to "have an information tool to provide a profile of the sources of anthropogenic GHG emissions through the identification and quantification of emissions"[80], and to track progress towards emissions reduction targets.

An emission inventory provides the basic information, the starting point for future emissions reduction commitments; it orients emissions reduction policy by its information on the allocation of emissions between sectors. The methodological choice will often be defined by the context. If the local authority needs an inventory only for internal use, the choice is not limited by external criteria; it has to be considered, however, that the choice will determine the structure of future inventories due to the necessity of tracking emissions reduction over time, which is only coherent if the same methodology is used. But the methodological framework can also be prescribed by an external legal obligation, or be recommended by a voluntary initiative like the Covenant of Mayors[81], to enable comparability with other inventories in the same framework.

Amongst other reasons for the compulsory use of inventories is, for example, "the existence of national-government programs and carbon-finance-based programs."[82] The attribution of state subsidies and the access to national and international carbon finance programs like the JI (joint implementation) or CDM (clean development mechanism)[83] can be dependent on the utilization of a specific methodology. In general these methodologies aim at additionality and comparability and are thus excluding indirect emission in order to avoid the risk of double accounting.

As we will see later, by limiting the emissions scope to direct emissions, the consideration of consumption-induced emissions is ex ante excluded.

As no unique inventory framework has been universally accepted, more and more cities are developing at least two parallel inventories84, as they are taking part in a multilayered patchwork of mitigation programs using different inventory approaches.

This can be problematic especially for small local authorities, as regards financial resources and working time.

EMISSION BOUNDARIES

First of all, the emission boundaries of the inventory have to be defined. This has an impact on the complexity and significance of the inventory, and the difficulty in obtaining the necessary emission data.

The perimeter of a GHG inventory can be a single mitigation project, the direct activities of the local authority, the territory as a geographic area, the inhabitants of the area, the tourists in the area, etc.

If the aim is the construction of an action plan based on this inventory, this exercise becomes more challenging the more the perimeter is widened. Numerous actors in the area with different competences and jurisdictions must be considered, whilst only a single organization or a few

78. The International Panel for Climate Change (IPCC) and the UN framework Convention for Climate Change (UNFCCC) have a unified inventory methodology for states; but not for the sub-national level. There are several internationally applied inventory frameworks for the local level: GRIP (2010) Greenhouse Gas Regional Inventory Protocol. www.grip.org.uk / ICLEI (2009) International Local Government GHG Emissions Analysis Protocol. http://www.iclei.org / Covenant of Mayors Energy Action Plan (SEAP) (2010) Baseline Emission Inventory. http://www.eumayors.eu/IMG/pdf/seap_guidelines_en-2.pdf

79. Cochran, Ian (2010) A Use-Based Analysis of Local-Scale GHG Inventories, CDC Climate research working paper n° 2010 – 7; page 1.

80. ibid; page 5

81. http://www.eumayors.eu/

82. Cochran, Ian (2010) *A Use-Based Analysis of Local-Scale GHG Inventories*, CDC Climate research working paper n° 2010 – 7; page 9.

83. Christa Clapp, Alexia Leseur, Olivier Sartor, Gregory Briner, Jan Corfee-Morlot (2011) Cities and Carbon Market Finance: Taking Stock of Cities' Experience with Clean Development Mechanism (CDM) and Joint Implementation (JI), OECD / CDC Climat Recherche.

84. The French region Île-de-France has 3 different emission inventories: (2010) *Plan regional pour le climat: Livre vert.*

Figure 8 – Emission scope 1

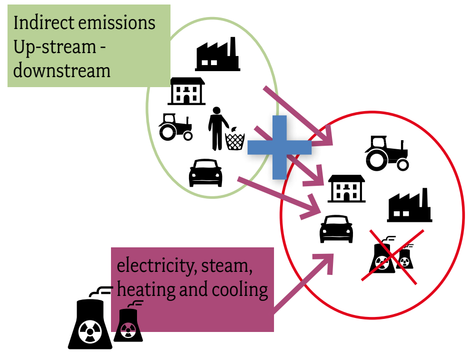


Figure 9 – Emission scope 2

people will be responsible for the emissions stemming from a single project.

EMISSION SCOPES

The World Resource Institute and the World Business Council on Sustainable Development's Greenhouse Gas Protocol[85] for corporate emission accounting proposed three principal emission scopes. These 3 different scopes differ from each other over the inclusion or not of extra territorial direct, indirect and up-stream emissions.

Scope 1 includes the direct emissions from the chosen perimeter.
Scope 2 includes the indirect emissions stemming from the production of electricity, steam, heating, and cooling used by the chosen perimeter but produced elsewhere.
Scope 3 corresponds to indirect, up-stream and embodied emissions of goods and services consumed or used in the project or within a territory (carbon footprint approach).
The local footprint approach (-> Chapter II.5.1) is based on a different way of accounting; in simple terms, it takes all upstream and downstream indirect emissions into account from products consumed within the analyzed perimeter, minus the direct and indirect emissions of products which are exported. Hybrid approaches try to enrich the Carbon footprint approach with local production data.

The choice of the scope will depend on the information that is available, the necessity to avoid the risk of double accounting, and on the attribution of responsibility to different actors and institutions for GHG emissions.

Scope 1 is only taking those emissions into account that are directly produced within the concerned perimeter. This accounting method introduces a methodological bias as it excludes all embedded, up-stream and down-stream emissions. If the inventory is action-oriented, the local authority will have more power to influence direct emissions than those of upstream production chain stages in remote areas. Another important argument is that widening the scope induces a high degree of uncertainty, automatically raising the risk for double accounting.[86]

The main ideological difference between scope 1 and 3, however, is the attribution of responsibility: Scope 1 is a production-based approach whereas scope 3 is consumption-based.

As previously explained, as regards jurisdiction it is a lot easier for local authorities to formulate climate policy on scope 1 and 2 emissions, as they concern the more controllable emissions inside the perimeter in question (emissions resulting from their direct actions). To act on indirect emissions induced by consumption choices would require a re-evaluation of life style patterns, a debate on international trade and the relocation of production and waste management. Consumption choices remain; however, in the hands of individuals, and the constant availability of products from all over the world is facilitated by international trade. As a result, local authorities are left with little or no room to manoeuvre; their ability to act on these emissions is fairly restricted, and is often limited to measures to incentivize behavioral change in the general population, as it concerns policy areas over which they have no direct control (international trade, national energy policy, etc.).
Moreover, authorities do not have easy access to the information on how products and services made elsewhere are used. Managing this information is therefore complex.
Nevertheless, in some circumstances, excluding indirect emissions can conceal an important part of the overall emissions totals:

CO_2

+34% Direct CO_2 emissions: **6,7t CO_2** par capita[87]
Direct and indirect CO_2 emissions (scope 3): **9t CO_2** per capita[88]

CO_2eq

+58% Direct CO_2ec emissions: **8,3t CO_2eq** per capita[89]
Direct and indirect CO_2ec emissions (scope 3): **13,1t CO_2eq** per capita[90]

Figure 10 – French emissions in 2008 following to different accounting methods

85. WRI/WBCSD (2004) Greenhouse Gas Protocol.
86. An example of double accounting: City A imports electricity manufactured by city B. If city a re-imports these emissions in scope 2 and city B reports them in scope 1 (direct emissions), adding together the emission totals of the two cities will result in a larger total than truly exists.
87. Own calculation based on national statistics (INSEE), emission accounting (CITEPA).
88. Commissariat général au développement durable (CGDD) (2010) *CO_2 et activités économiques de la France – Tendances 1990-2007 et facteurs d'évolution*, Études & documents. http://www.stats.environnement.developpement-durable.gouv.fr/uploads/media/Namea.pdf
89. Own calculation based on national statistics (INSEE), emission accounting (CITEPA).
90. http://www.carbonfootprintofnations.com/content/calculator_of_carbon_footprint_for_nations/

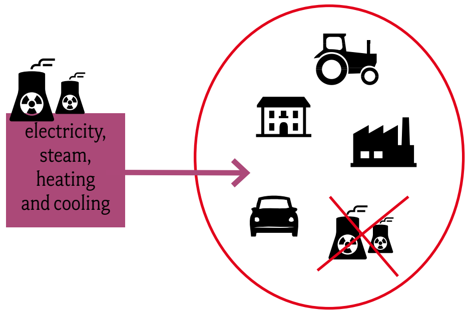


Figure 10 – Emission scope 3

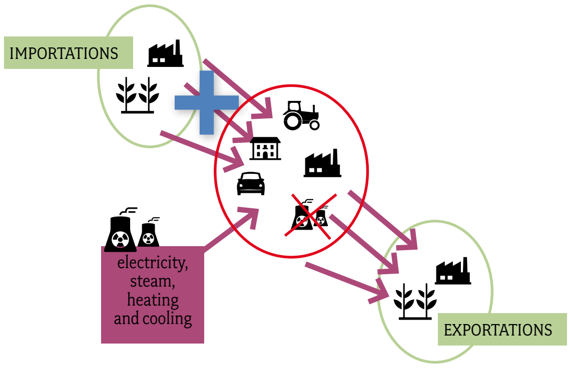


Figure 11 – Carbon footprint approach

MISSIONS, SECTOR BOUNDARIES AND TIERS

Emission inventories can focus on CO_2 emission only or include all 6 principal **GHG** included in the Kyoto Protocol.[91] This has to be clearly indicated.

An important concern is the **break-down of emissions per sector and the definition of sector boundaries**. The IPCC common reporting framework, first established for the reporting needs of national governments, was updated in 2006[92] and proposes a method of sorting and reporting GHG emissions into 5 categories:

Energy (including Transportation); Industrial processes and product use; Agriculture, forestry and other land use; Waste; and Other. Each category is split into a number of sub-categories corresponding to specific sources, classified by type of activity.
"These sectors were defined by the IPCC for national inventories. Yet, for local inventories these categories may be less useful. Local governments do not always have an agricultural sector, nor do they commonly have an energy sector as such. (...) In some cases local governments report their emissions to a third party and use the sector definitions of the relevant reporting guidelines. In other cases the local authority may define sectors according to data availability and practicality. It is therefore questionable whether sector specific results of inventories that do not follow the same reporting principles can be compared."[93] There are approaches[94] to attempt to overcome these contradictions and establish common sector definitions, but, nevertheless, the need for breaking down emissions remains specific to each local situation.

If the "**emission factor approach**" is used, GHG emissions are quantified by multiplying the emissions of a specific activity data by the corresponding emission factor. 3 different levels of accuracy have been defined following to IPCC terminology: Tier 1 to 3.

Tier 1 are default emission factors proposed by the IPCC, which are the least accurate estimations.

The more accurate **tier 2** approach requires country specific emission factors, which take into account measured but average national data.

The tier 3 approach is taking into account concrete local information: operation conditions, the age of the equipment used to burn the fuel, control technology, operating conditions, the fuel type used and combustion technology. For many local territories, obtaining the necessary information to cope with a tier 3 approach might be too complex. As it is time-consuming, costly and complex, tier 3 factors will mainly be calculated for emission sources highly specific to and important for the chosen perimeter.

As tier 3 factors are often not available, this gap can be bridged by a different solution of downscaling of top-down statistics or modeling approaches – often applied to the transport sector. "These approaches can introduce additional uncertainty into the final results as the margin of error increases. As such, the question of data quality demonstrates that a major difficulty in formulating inventories is finding a balance between accuracy and cost and the time necessary to produce the inventory."[95] Emission factors have to be updated regularly as the environment evolves – it is important that this option is available and conducted in a transparent manner.

REPORTING FORMAT AND OUTLOOK

In the absence of harmonized methodologies, several organizations have tried to fill this gap and have developed frameworks and reporting tools. Bleischwitz (2009) compares 6 different local GHG inventory tools and finds important differences in scope and consistency with the international IPCC standard.

The access to some of these inventories is membership based[96], or dependant on participation in a training session[97], which is not coherent with the principle of overall transparent accessibility. As more and more European cities create emissions inventories of varying qualities and

91. The Kyoto Protocol includes the following gases: CO_2, N2O, CH4, SF6 (sulphur hexafluoride), HFCs (hydofluorocarbons) and PFCs (perfluorocarbons).

92. http://www.ipcc-nggip.iges.or.jp/public/2006gl/index.html

93. Nikolas Bader, Dr. Raimund Bleischwitz (2009) *Study Report - Comparative Analysis of Local GHG Inventory Tools.*

94. WRI/WBCSD (2007) *Measuring to Manage: A guide to designing GHG accounting and reporting programs*, Chapter 4.

95. Cochran, Ian (2010) *A Use-Based Analysis of Local-Scale GHG Inventories*, CDC Climate research working paper n° 2010 – 7; page 18.

96. Eco-region, Climate Alliance - http://www.klimabuendnis.org/co2-monitoring0.html?&L=0

97. Bilan carbon®, Ademe - http://www2.ademe.fr/servlet/KBaseShow?sort=-1&cid=23674&m=3&catid=23675

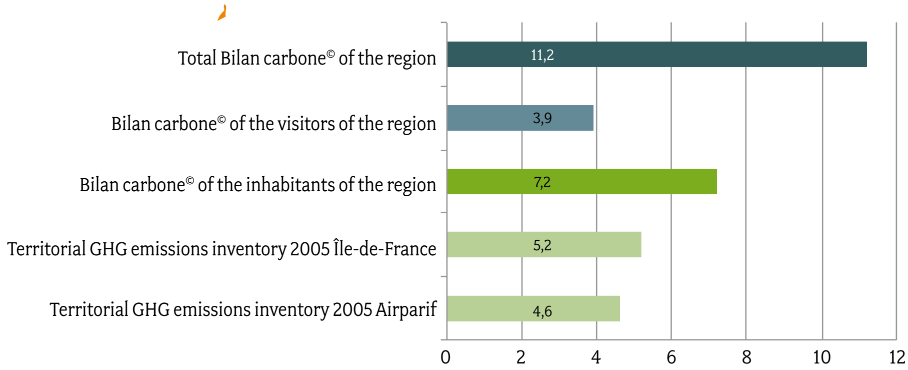


Figure 12 – Emission inventories of the region Ile-de-France (France) (in t CO_2ec)[105]

depth of information, a legal or financial incentive may be needed to persuade cities to use a new harmonized inventory framework.
Until recently, mainly associative networks (Climate Alliance[98], ICLEI[99]) worked on this question of harmonized standards[100]. Now UNEP[101], World Bank, C40[102] and the aforementioned associative networks are working together to develop a common harmonized methodology based on their experience with inventory frameworks.

There is not one organization that has the jurisdiction and credibility to unilaterally adopt a new framework; the challenge is to find a compromise that corresponds to the needs and powers of local authorities, is transparent (applies the principle of MRV[103]) and gives access to financing.

It is highly probable that the compromise will produce a framework based on a production-based approach, including the direct emissions (Scope 1) and a consumption-based approach (principally scope 2). In order to link local, national and international levels more efficiently, the IPCC combined reporting framework seems to be the most suitable – at least as a guidance principle – even if it not all categories are necessarily useful for local authorities. [104]

However, it is important that Scope 3 emissions are not forgotten, even if, for the moment, treating them coherently is out of many local authorities' reach. Scope 3 emissions will probably only be included as an optional element, as on the one hand it is difficult to obtain the necessary data in a sufficiently detailed manner, and, on the other hand, to influence trends of consumption is often perceived to be above the jurisdiction of local authorities. This is a critical aspect as, at least for local authorities in industrialized countries, an important share of the overall emissions is due to the importing of indirect emissions.

CASE STUDY - REGION: ÎLE-DE-FRANCE (FRANCE)

Several emission inventories have been developed for the French *Île-de-France* region (Figure 9) with results varying considerably, due to differing variables concerning the scope and perimeter.

The difference between the Scope 1+ 2 inventories (Airparif – 2005 and Inventaire GES Ile de France – 2005) and the *Bilan Carbone*© (Scope 3) shows the importance of indirect, embedded upstream emissions. The per capita emissions of regional inhabitants increase approximately 20% if these emissions are taken into account.[106]

One particularity of the region is the high number of tourists and the existence of 2 international airports. The difference between the per capita emissions of the *Bilan Carbone*© of the inhabitants in comparison to the global inventory including tourists is a rise of approximately 37%.

What are the implications of this information for the definition of regional climate and energy policy?

The emissions that are induced by international tourism represent a high percentage of the overall emissions; is it reasonable to exclude these emissions from the emission baseline because acting on them is politically and technically difficult? It should not be ignored that the region is also benefitting economically from this situation.

In the respect of harmonization and avoiding of potential double accounting, policy should be based on the Scope1 and 2 inventories, but to only focus on these emissions is to conceal an important share of the regional climate impact. This situation raises the difficult question of who is responsible for air travel emissions – the area and the population where the airport is located (economic value of tourism), the individual travelers (personal responsibility) or the private airlines/companies (profit from airlines operation)?

Airlines will soon be included in the European carbon market, which will result in a shift of the burden away from the territories where the airports are located and towards the private companies.
But it is always worthwhile to discuss the political implications of the attribution of reasonability and capacity for action – certainly in order to create accurate emission inventories, but, even more so, in order to design ambitious and effective climate policy.

Climate responsibility does not end at the border of a territory!

98. http://www.climatealliance.org/

99. http://www.iclei.org/

100. Bleischwitz, Dr. Raimund / Bader, Nikolas (2009) Study Report - Comparative Analysis of Local GHG Inventory Tools.

101. United Nations Program for Environmental Protection.

102. http://www.c40cities.org/

103. MRV - Measurable, Reportable and Verifiable

104. Cochran, Ian (2010) A Use-Based Analysis of Local-Scale GHG Inventories, CDC Climate research working paper n° 2010 – 7; page 31.

105. Source: Ile de France (2010) *Plan regional pour le climat: Livre vert*

106. ibid.

1. Local inventories – production versus consumption based approaches

Jan Minx, Technische Universität, Berlin – 2010

Comprehensive energy and greenhouse gas emission data is still relatively sparse and difficult to compare at a local level. Nonetheless, with the recent momentum of city related climate change research and local climate policy initiatives, a number of organizations and researchers have proposed methodologies of how to compile local emission inventories and have started generating new data.[107] As regards system boundaries, most of these approaches are consistent with the emission scopes as defined under the "The Greenhouse Gas Protocol" (World Resources Institute and World Business Council for Sustainable Development 2004)[108], and there is a general recognition that an assessment beyond the territory (scope 1 emissions) is highly relevant at the local scale. Firstly, the extension of systems boundaries to scope 2 and 3 emissions allows a wider set of policy questions to be addressed and therefore provides new opportunities for local decision makers to act.

Secondly, there is a recognition that benchmarking the climate performance of local areas purely based on scope 1 emissions is problematic, because small areas are much more trade dependent than larger areas. A higher trade dependency of an area means that activities outside the territory are more relevant for performing the various activities within the territory and failure to consider these activities might therefore jeopardize a benchmark on equal terms.

These approaches are rooted in a bottom-up methodology, they work at the product and technology level and apply a set of emission factors to (mainly) physical input data in the quantification process. In most cases – though not necessarily - there is a focus on *local production* activities and their supply chain, while final energy consumption is also fully considered.

A second methodological approach is rooted in environmental input-output analysis.[109] These studies usually try to assess the global greenhouse gas (GHG) emissions released in the production of goods and services *finally consumed* within a local area. Methodologically, the local area can be depicted explicitly within the world economy at a sectoral level, taking into account all the regional, national and international trade activity. Environmentally extended input-output analysis is a top-down approach, which works at a sectoral level, depicts exchange processes in the economy in monetary terms, and combines these with emission factors.

One fundamental difference between the two approaches is their initial focus (and therefore the policy question they answer). Input-output based studies only assign emissions to a territory when they are related to final consumption activities. This is relevant, for example, when we want to ascertain the differences between urban and rural lifestyles, or when we want to understand local lifestyles in the context of the available infrastructure. They are also helpful for comprehensively addressing multi-level governance issues, as data from different spatial scales can be integrated consistently. Input-output based approaches have more comprehensive system boundaries[110] but less detail than bottom-up methodologies. Bottom-up approaches are usually more helpful when the focus is on product and technology specific assessments, or procurement (local governments' own activities) related issues, or the role and structure of the local economy (and its supply chain).

Some authors have attempted to combine the strength of the two in a hybrid accounting approach by integrating product and technology specific data with macro-economic input-output models[111]. Methodologically, such an approach is the most flexible in responding to different policy demands within one consistent accounting framework.

107. ADEME (2007) Bilan Carbone - Companies and Local Authorities Version: Methodological Guide, Paris, ADEME. /Carney, S., Shackley S. (2007) The greenhouse gas regional inventory project (GRIP): Designing and employing a regional greenhouse gas measurement tool for stakeholder use, Energy Policy 37(11): 4293-4302. / Covenant of Mayors (2010) How to Develop of Sustainable Energy Action Plan (SEAP) – Guidebook, Brussels, Publication Office of the European Union. / ICLEI (2009) International Local Government GHG Emission Analysis Protocol: Version 1.0 October 2009 / Kennedy, C., J. Steinberger, B. Gasson, Y. Hansen, T. Hillman, M. Havraì nek, D. Pataki, A. Phdungsilp, A. Ramaswami and G. V. Mendez (2009) Greenhouse Gas Emissions from Global Cities, Environmental Science & Technology 43(19): 7297-7302. / Kennedy, C., J. Steinberger, B. Gasson, Y. Hansen, T. Hillman, M. Havránek, D. Pataki, A. Phdungsilp, A. Ramaswami and G. V. Mendez (2010) Methodology for inventorying greenhouse gas emissions from global cities, Energy Policy 38(9): 4828-4837 / Lenzen, M. and G. M. Peters (2009) How City Dwellers Affect Their Resource Hinterland - A Spatial Impact Study of Australian Households, Journal of Industrial Ecology forthcoming. / Lenzen, M. and G. Treloar (2003) Differential convergence of life-cycle inventories towards upstream production layers, Journal of Industrial Ecology 6(3-4): 137-160. / Peters, M. Lenzen, A. Owen, K. Scott, J. Barrett, K. Hubacek, G. Baiocchi, A. Paul, E. Dawkins, J. Briggs, D. Guan, S. Suh and F. Ackerman (2009) Input-Output Analysis and Carbon Footprinting: An overview of UK applications, Economic Systems Research 21(3): 187-216. / Stockholm Environment Institute (2007) The Right Climate for Change: Using the Carbon Footprint to Reduce CO_2 Emissions at the local level.

108. World Resources Institute and World Business Council for Sustainable Development (2004) The Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard, Washington D.C., USA and Geneva, Switzerland, WRI and WBCSD.

109. Stockholm Environment Institute (2007) The Right Climate for Change: Using the Carbon Footprint to Reduce CO_2 Emissions at the local level. / Lenzen, M. and G. M. Peters (2009) How City Dwellers Affect Their Resource Hinterland - A Spatial Impact Study of Australian Households, Journal of Industrial Ecology forthcoming. / Minx, J. C., T. Wiedmann, R. Wood, G. Peters, M. Lenzen, A. Owen, K. Scott, J. Barrett, K. Hubacek, G. Baiocchi, A. Paul, E. Dawkins, J. Briggs, D. Guan, S. Suh and F. Ackerman (2009), Input-Output Analysis and Carbon Footprinting: An overview of UK applications, Economic Systems Research 21(3): 187-216.

110. Lenzen, M. and G. M. Peters (2009) How City Dwellers Affect Their Resource Hinterland - A Spatial Impact Study of Australian Households, Journal of Industrial Ecolog Lenzen, M. and G. Treloar (2003) Differential convergence of life-cycle inventories towards upstream production layers, Journal of Industrial Ecology 6(3-4): 137-160.

111. Ramaswami, A., T. Hillman, B. Janson, M. Reiner and G. Thomas (2008) A Demand-Centered, Hybrid Life-Cycle Methodology for City-Scale Greenhouse Gas Inventories, Environmental Science & Technology 42(17): 6455-6461. / Larsen, H. N. and E. G. Hertwich (2009) The case for consumption-based accounting of greenhouse gas emissions to promote local climate action, Environmental Science & Policy 12(7): 791-798.

6.

Gathering local data to set up scenarios on energy and climate issues

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112. http://www.raee.org/

Photovoltaic installation

113. www.eumayors.eu/

Through various networks or initiatives, such as the Covenant of Mayors[113], more and more local authorities are committed to energy consumption and GHG emissions reduction objectives on their territories in order to tackle energy and climate issues.

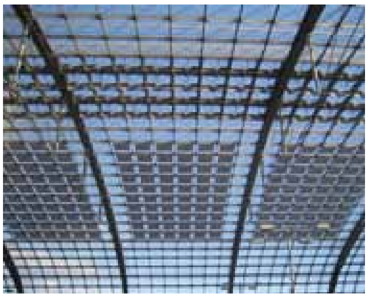
Beyond all policy commitment, effective actions are to be identified and set up, based on the potential of the territories (potential improvements in energy savings and rational use of energy, or renewable energy production). For this purpose, it is necessary to gather detailed and monitored data, as top-down national statistics are often irrelevant at a local level. However, local authorities often face considerable difficulties in gaining access to specific and detailed local data on energy production and consumption, GHG emissions, or the vulnerability of the territory to climate change.

The following obstacles are often cited:

- Data gathering is time-consuming: this may be the case, but much of the time is used to clarify the data requirements and to identify organizations to supply the data.

- High quality data is not easy to get: there are many facets to data quality: relevance, accuracy, completeness etc. A data request should, therefore, always be accompanied by a demand for a detailed description of the data.

- Confidentiality of data: where energy consumption within industry is concerned, or where highly detailed data is needed, confidentiality issues arise. The importance of these issues should not be played down, but discussions with the owners of the data often allow solutions to be found. Based on its experience in assisting local authorities in implementing their energy and climate strategies, the



regional energy agency in the Rhône-Alpes region can provide the following advice:

Firstly, clarify the scope of the data you are looking for:

- Depending on what you are taking into account (direct and/or indirect emissions, green house gas (GHG) emissions due to land-use and land-cover change or not, etc...), the data gathering has to be carried out in a different way, and the organizations to contact are not the same.

- The spatial area considered is equally important: a local authority may have to consider working on a larger territory where required. Working on larger territory is often a means to access more data, as there are fewer issues of confidentiality.

Secondly, involve all the territory's partners on energy and climate - such as ene rgy providers and distributors for instance – when putting together scenarios. These partners will more readily accept providing data if they know the specifics of the request and how the data will be used.

Thirdly, consider this exercise as part of a continuously improving and repeated process

Hopefully, legal frameworks at national and European levels will evolve continuously to facilitate the availability of local data to local energy and climate policies.

At a European level, European Regulation No 1099/2008[114] of the European Parliament and of the Council of 22 October 2008 on energy statistics is still one of the only texts that mention the need for data availability for statistics on energy. The INSPIRE European Directive[115] has also introduced some new requirements.

In France, a legislative text is currently being discussed to make local energy consumption data available for the creation of local sustainable energy action plans at local and regional levels. (➲ **Chapter I.2**)

The regional energy observatory in Rhône-Alpes has for example access to various sources of data on installed **photovoltaic systems:**

- For a long period, the only way to assess the installed capacity of photovoltaic systems in a local territory was to count and analyze the financial subsidies attributed locally. Due to the success of this technology, the regional council and other entities did not have the capacity to support all new installations.

- A second source of data was then provided to the regional observatory: it was the list of people who receive official permission to install PV systems. However, this procedure of binding certification is no longer compulsory, making this data incomplete if not redundant.

- A third source of data emerged: the exact number of installed PV systems in each municipality of the territory. The organizations in charge of electricity distribution provide this data. But again the information from these organizations has its limits: often they cannot provide data on the total installed capacity in each commune, or even total energy production.

These three data sources therefore have to be merged in order to assess not only the number of systems by commune, but also the installed capacity and the electricity production as well.

114. Regulation (ec) n° 1099/2008 of the european parliament and of the council of 22 October 2008 on energy statistics http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:304:0001:0062:EN:PDF

115. Inspire directive: http://inspire.jrc.ec.europa.eu/

7. How to deal with special emission sources in local CO_2-balances? [116]

Benjamin Gugel, Institute for Energy and Environmental Research (IFEU)[117]

116. References: European Commission (2010) How to develop a Sustainable Energy Action Plan (SEAP) – Guidebook. / Deutsches Institut für Urbanistik (2011) Leitfaden kommunaler Klimaschutz.

117. http://www.ifeu.org/index.php?seite=english

118. www.eumayors.eu/

Local CO_2-balances are the easiest way of measuring the effects of local climate protection initiatives. The Institute for Energy and Environmental Research based in Heidelberg, Germany, has over 20 years experience in calculating local CO_2-balances. In this period, a method of calculating local CO_2-emissions has been developed and perfected.

The territorial principle method is based on the energy consumption of all energy-consuming sectors (private households, commerce, industry, transport) in the territory of a local authority. The emissions due to electricity production and the heat consumed by those sectors in the area are included in the CO_2-balance, regardless of the location of the production. This method is in line with the Covenant of Mayors[118] method of calculating the baseline emission inventory. (➲Chapter: II.5)

In recent years CO_2-emissions calculating has had to deal with special local cases. We have tried to embed these cases into the method of the territorial principle. The following cases shall be discussed by looking at previously calculated examples:

1. Airport inside the local authority's territory (e.g. Frankfurt)
2. Big industrial enterprise inside the local authority's territory (e.g. Ludwigshafen am Rhein)
3. Refinery inside the local authority's territory (e.g. Karlsruhe)
4. Old ineffective coal power plant with cogeneration of heat and power (e.g. Karlsruhe)

1. In recent decades the **International Airport** of Frankfurt has developed into an industrial city district. Currently the airport is the third largest in Europe. In light of the fact that the airport is still growing, the question of how to apply the territorial principle to the airport itself and the flight movement was open to discussion. **Approach:** The energy consumption of airport buildings, equipment and facilities are included as part of the buildings and facilities; the mobile combustion of flight movements, however, is excluded. **Explanation:** Local CO_2-balances should take into account the administrative boundaries as well as the local possibilities of influencing the emissions. In the transport sector the main range of local action is the local transport system, including urban road and rail transportation. This does not include supra-regional transportation systems, such as long-distance travel (by car, railway or plane) or off-road freight traffic (railway, ship).

2. The **BASF company** is the largest chemical company in the world and is based in Ludwigshafen am Rhein. The Ludwigshafen site encompasses 2000 buildings in an area of over ten square kilometers and has developed into the world's largest integrated complex. The energy consumption of the complex accounts for approximately two thirds of the energy consumption of the whole industry in the state of Rhineland-Palatinate. **Approach:** There are two issues to consider. Firstly, CO_2-balances are based on local energy consumption. This does not include the non energy-related consumption and transformation of fossil fuels in the chemical industry. Secondly, heavy industry, which is involved in the European Emissions Trading Scheme, is not considered in the method of the Covenant of Mayors. With this in mind, the entire BASF site is excluded from the local CO_2-balance of the city of Ludwigshafen am Rhein. **Explanation:** At present, local climate protection action is focused on energy consumption. The emissions of the non-energy related use of fossil fuels are included in the product life cycle assessment - LCA´s (e.g. plastic). The exclusion of the BASF site in the local CO_2-balance is due to the minimal influence exerted by the local authority.

3. The **Miro Refinery** in Karlsruhe, Germany, is the biggest refinery in Germany. With a capacity of 15 million tons of fossil fuels, the main products are petrol and fuel oil for heating purposes. The energy consumption of the refinery is more than double that of the city of Karlsruhe. **Approach:** With regards to the BASF example, all non-energy-related usage of fuels is excluded in the CO_2-balance. Furthermore, all energy consumption at the refinery is also excluded. Instead, the energy used for transforming fossil fuels to refinery products is allocated to the LCA of the final products (e.g. petrol). **Explanation:** By allocating the energy consumption to the LCA of fuels, double counting is avoided, when, for example, calculating the emissions of local transport with LCA-emissions factors.

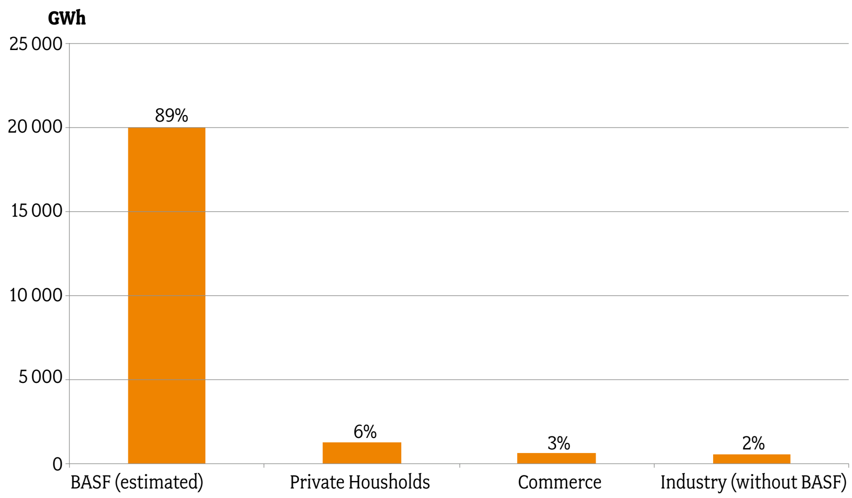


Figure 13 – Relevance of big industry sites for CO_2 - balances (e.g. Final energy consumption Ludwigshafen 2008) Source: IFEU 2011

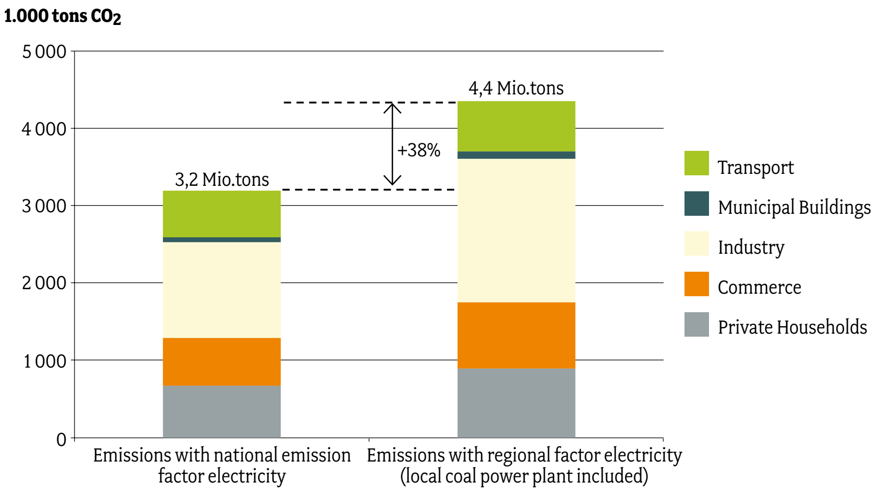


Figure 14 – Different results by using different emission factors for electricity Source: IFEU 2011

4. An older **coal power plant** is located in the Rheinhafen-area of the city of Karlsruhe. Renovated in the 1970's and early 1980's, today it produces electricity and district heat in a combined heat and power (CHP) process. The production efficiency is significantly below the German average. **Approach:** For calculating the local CO_2-balance of electricity consumption, the German emissions factor is used. For calculating the emissions caused by consumption of district heating, an emissions factor calculated by the allocated emissions of the coal power plant is used. **Explanation:** In Germany almost 100% of electricity production is fed into the national grid; the local energy production emissions are allocated by calculating the national emissions factor for electricity. A double counting of the electricity producing facilities does occur. Furthermore, the same approach is applied when considering the local electricity production of renewable energies. A different picture emerges if calculated with a "regionally" produced and used energy source such as district heating. All allocated emissions of the CHP-process take place in the local consumption of local district heating.

These four examples show that special situations for local authorities should be re-evaluated in local CO_2-balances on a case-by-case basis. The allocation of CO_2-emissions should be seen in terms of the influence of the local authority (big industries, flight intensity) and methodological aspects (allocation of electricity or refinery products). Above all, transparency and consistency in methodology are strongly recommended. Moreover, the examples show that a comparison of CO_2-balances of different cities is difficult. For a more detailed analysis, further information would be required. The Climate City Benchmark provides this for Germany.[119]

119. http://www.benchmark-kommunal-er-klimaschutz.net - An expansion of the Climate City Benchmark for European countries is planned.

8. Local energy efficiency and renewable energy potentials

Sévrin Poutrel, Burgeap (www.burgeap.fr)

HOW TO ESTIMATE ENERGY EFFICIENCY AND RENEWABLE POTENTIALS AT A LOCAL SCALE?

-88 to -91%, -61 to -74%, +17 to +40% correspond respectively to GHG emission reductions set by the European Commission as an objective for the residential and service sectors (i) and transport (ii) by 2050; (iii) the increase of energy prices in 2050 within the Low Carbon Cities project of the French Ministry of Environment in case of a regionalization of the objectives.
In other words: there are big potential in terms of a sustainable energy use (sufficiency + efficiency + renewable energies) and these potentials must be exploited in light of the present social, economic and environmental situation. The central question is, how does one plan their efficient use?

For this reason, assessing the existing potential is essential for (1) mobilising decision makers (2) defining a strategy (3) implementing (4) and monitoring them. In this article we will present these four steps, considering the local area.

DEFINING CLEAR "POTENTIALS" TO AID DECISION-MAKING

Beyond defining net/gross potentials – not developed here – the notion of "potential" refers to at least three elements:
a) Technology: of existing infrastructures, local resources, possible changes in life-styles...
b) Economy: with the underlying question of economic feasibility.
c) Policy: in relations with (i) social acceptability, (ii) stakeholders interests.
Whereas this first aspect has been clearly laid out above, the other two aspects are more difficult to analyze.

Economically speaking, since energy costs and their associated taxes are hard to predict, accompanying scenarios always contain an element of guesswork; thinking in global-cost approaches, though necessary, is a complex task. Moreover energy efficiency and renewable energy markets that are only just emerging are putting all modeling based on actual energy costs into question. The evolution in price very much depends on the architecture of key branches, the level of financial subsidies and the short-term strategies of companies and bankers. There is a clear relationship between the economic feasibility and the political influence on markets.

The political aspect is even more difficult to analyze, because of the effect of short-termism as dictated by the limited lifetime of political mandate. Also these issues are relatively new in the political arena and not yet considered as priorities for local decision makers. The way roles are divided up between different local, inter-municipal and regional governance levels makes it even more difficult for local decision makers to feel a sense of responsibility over energy and climate issues, especially in France.

In view of these economic and political uncertainties, it would seem that tackling fuel poverty and climate change will require a paradigm shift.
Thus, within the current implementation of Local Climate-Energy Plans (PCET)[120], it is essential to exclude the economic assessment and calculation of budget constraints from the first stage of the analysis, at least whilst decision makers are being mobilized and medium and long-term strategies are defined (objectives 1 and 2 of the assessment). For these two objectives, the role of the technician (responsible municipal agent or external consultant) is to concentrate exclusively on the technical feasibility of energy efficiency and renewable energy measures. Decision makers should not adopt strategies in light of uncertain economic situations but in despite of them.
When assessing potentials, economic constraints should only be considered during the third stage, when the action program is concretely defined while considering the necessary action coherent with the strategy.

"POTENTIAL" WITH REGARDS TO WHAT?

The objectives of local climate and energy plans have to be seen in the light of the Energy-Climate Package, and the European Commission's "3x20" targets which refer to 20% GHG emission reduction in relation to 1990 levels, 20% energy savings in relation to a business as usual scenario and 23% of renewable energy in 2020's final energy mix.

Defining future objectives (2020) in relation to the past (1990) illustrates the complementarity of these two steps used in defining "potentials":
• Developing a climate/energy balance that allows one to identify the most energy-consuming sectors is essential

120. Mandatory for municipalities with over 50.000 inhabitants: LOI n° 2009-967 du 3 août 2009 de programmation relative à la mise en œuvre du Grenelle de l'environnement.

because it represents a reference in the past. Within this first step the scope of the study has to be defined which implicitly limits or broadens the share of potentials that is taken into account (e.g. in what way is it possible to act on transportation emissions using only tools that map journeys, giving no information on the why people are travelling?)

- Between 'mapping' approaches and methodologies, we consider that using a wider scope like the Bilan Carbone®[121] is preferable because it can better evaluate potentials by taking into account the structure of energy service demand (heating, mobility, activities…). This method is also the most compatible to the negaWatt[122] approach – above all energy sufficiency and efficiency to reduce initial demand in order that energy needs can mostly be covered by renewable energies.

- Forecasting is the best tool to identify and quantify the margin for action in terms of energy savings and GHG emissions reductions targets within a framework for a mid and long-term strategy. However, the so-called "business as usual scenario" (BAU) introduces a bias via the sometimes vague definition of the limit between already decided or adopted measures and new initiatives. This bias often raises questions indirectly linked with the competence of the local authority (for example: should the application of the French thermal regulation on buildings be considered in the business as usual scenario, since it is a national responsibility? Or should it be excluded from the BAU as it needs to be anchored and pushed on a local scale?) In an output-focused process where action and final results are the most important, we think it is preferable for a BAU scenario to only take currently observed trends into account, in order to question not only the responsibility of each individual, but also to discuss the means needed to optimize actions at every level.

Concerning the 3x20 objective, it is clear that every local authority will not have the same amount of work. Between a region that has had a sharp rise in population, one that has a falling population and a very dense city such as Paris will clearly have different responsibilities. As a result, it seems preferable to express overall targets in per capita objectives, knowing that a 20% emission reduction at the national level from 1990 to 2020 is the equivalent of a 30% emission reduction per inhabitant in relation to 2000.

ASSESSMENT METHODS – HOW TO DEFINE A LOCAL STRATEGY (STEPS 1 AND 2)

A regional strategy needs to be fully understood by both technicians and local governments in order to be efficiently adopted: this is why scenarios should always be co-developed. Developing a common vision is the best way to increase awareness and to mobilize citizens and stakeholders on the issue of a local energy and climate strategy.

The principle of a forward-looking approach is to build a reference scenario and alternative desirable scenarios; the gap between these scenarios allows us to test the impact of different political measures, and then to quantify their energy efficiency and energy saving potentials and the resulting GHG emission reductions.

The choice of the method for the calculation of local potentials is strategic – different methodologies have to be analyzed - but it is also determined by the data available and on the resources dedicated to the exercise:

- For a city of more than 50 000 inhabitants, there are sufficient data and skills to start a detailed scenario exercise, which means the impact of different political initiatives (building refurbishment, urban planning, investments and regulation of transport…) can be measured. Tools that are based on a detailed segmentation and representation of the building stock, and that integrate a model of the transport sector (using data, collected bottom up – such as through surveys) are desirable. The scenarios and the evaluation of energy saving potentials should be modeled, based on an explicit representation of the products "DEMAND x EFFICIENCY (of equipments, installations etc.) x ENERGY (energy supply mix)". Tools that are capable taking into account the dynamics and inertias of each sector are desirable. But the main challenge for these kinds of exercises will be to put together a whole set of arguments to convince potential investors and funders.

- In the case of smaller communities, detailed data is generally not available, and resources are few and far between. A simplified scenario tool, based on downscaled regional statistics is normally enough to raise awareness on important issues and capable of showing the range and strengths of actions to get decision makers on board (for example: doubling the number of building renova-

121. The Bilan Carbone® method: http://www2.ademe.fr/servlet/KBaseShow?sort=-1&cid=23674&m=3&catid=23675

122. www.negawatt.org

tions being undertaken, actions to increase the number of people per journey in cars, etc.). The objective is not to design complex financial tools, but to gather and mobilize local actors to make small-scale action plans (actions on behavioral change etc.).

IMPLEMENTING THIS STRATEGY ON A LOCAL LEVEL (STEP 3)

Putting all this into action is by far the most complex step of local energy and climate action plans. The basic principles of a strategy can be defined by a steering committee on the basis of the information coming from the local scenarios but downscaling them into operational action plans must in line with the way of working of local authorities.

The assessment of the different potentials of each action should distinguish between:
- One-off actions, such as creating a defined number of new parking spaces
- Sectoral actions, which act as an overall guide for the services concerned within local authorities, such as how often public transport is used.
- Inter-sectoral policy: at the crossroads of several services, for example of the usage of the road infrastructure and commuting distances
- Overall issues, that are "supra-sectoral", which refers to issues such as equity, social justice and economic development.

Ideally, the methods used to measure the impact of political measures and to evaluate energy efficiency potentials should be implemented transversally, linking those different levels of action.

The assessment of the impacts of one-off actions and/or sectoral actions is relatively simple; ratios, technical data or tools such as "Bilan Carbone®" would suffice.

A common framework that can be used to assess inter-sectoral politics has not yet been adopted. This issue is currently being dealt with in various research projects that aim to estimate the efficiency potential of urban planning including energy and climate objectives (for example, the use of transversal tools that are enable one to exchange information on land use, transportation and energy...).[123]

ASSESSING AND REDIRECTING THE STRATEGY DURING ITS IMPLEMENTATION (STEP 4)

Various reference frameworks, methods and databases that monitor the implementation of local climate and energy action plans are available[124]. In France, the Environment and Energy Efficiency Agency (ADEME) is currently working on this topic. These initiatives have shown that monitoring is only possible if the local authority plays a role in defining the operational indicators that match their own working practices. Collecting such 'best-practices' is useful presenting a set of possible indicators.

WHO IS INVOLVED?

Some of the simpler tools or methodologies can be used directly by technicians at the local authority level.
Other more complex tools demand more technical support and sometimes it will be necessary to outsource the whole job of modeling to a specialized consultancy.[125]

In any case, scenarios will only be able to truly evaluate local potentials if the scenarios are co-elaborated by all the services of the local authority. This means, of course, that the technician in charge of the climate and energy action plan at the local authority should actively take part in the whole process in order to check the considered measures make sense at a local level.

AND IN THE FUTURE...?

In spite of the diversity of tools developed by research centers or consultants, some very important questions still need further research:
- Interaction between transportation and land use
- Development of renewable energies in an urban context
- Development of district heating or cooling linked with renovation projects
- Embedded emissions of goods and services

Research projects on these subjects are being developed throughout Europe. The main issue will be the capacity of the research teams to translate these complex and long-term interactions into clear and concrete guidelines that can lead to effective political decision-making.

123. In France CERTU (Centre d'études sur les réseaux, les transports, l'urbanisme et les constructions) and ADEME (French Environment and Energy Management Agency) have developed a transversal tool (GES-Urba), and other research projects should soon bring new pieces of answers (for example the ANR/ASPECT-2050 project)

124. For example: The "Benchmark on local climate policy" IFEU and Climate-Alliance http://www.ifeu.de/english/index.php?bereich=ene&seite=climate_partnership http://www.benchmark-kommunaler-klimaschutz.net/ The tool "climate-compass" of the Climate-Alliance: http://www.climatealliance.org/544.html

125. Here are some examples of tools and reference frameworks that are useful when developing an energy balance, a scenario and/or when monitoring local climate and energy programs:
•Germany : GEMIS (Öko Institute)
•Denmark : CO_2 Calculator
•France: Bilan Carbone® (ADEME), UrbaGES (Certu-ADEME), ProspEner (ICE), Ariadne (Ecole des Mines de Paris), SceGES (Energies Demain), IMACLIM-R (CIRED)
•United Kingdom: SynCity (Imperial College), Urban Integrated Assessment Framework (Tyndall Center)
•Switzerland: EcoRegion

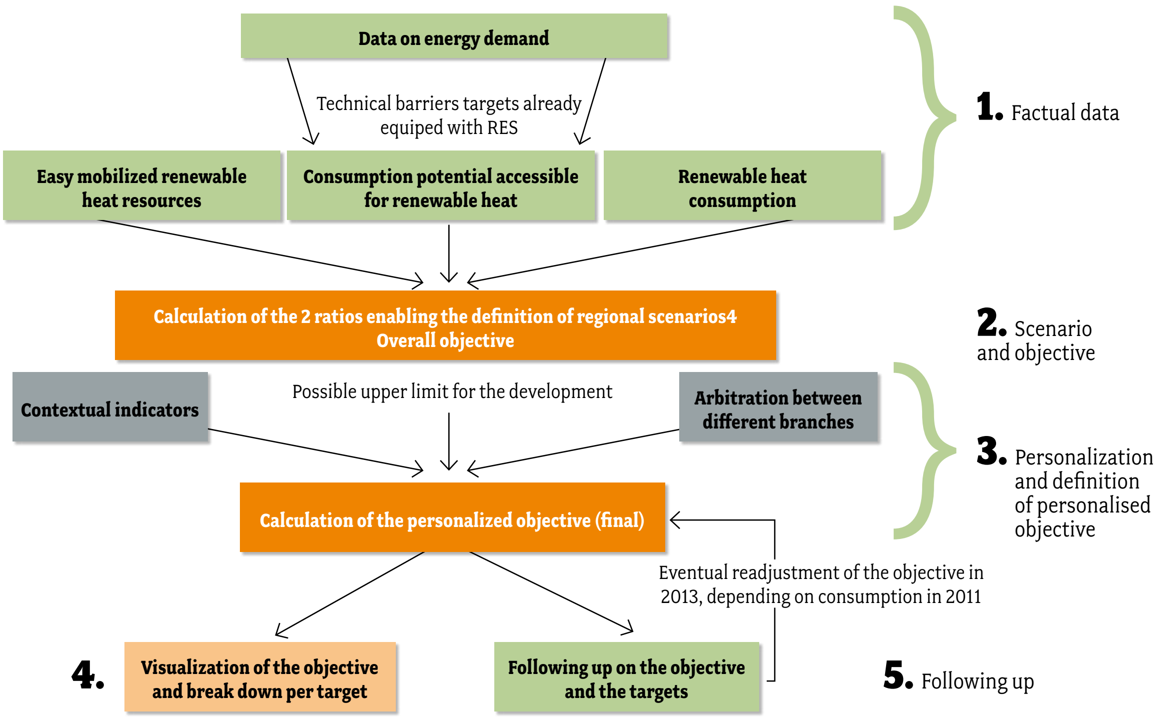


Figure 15 – Presentation of the structural elements of the tool Step 1, 2 and 3 enable to calculate the objectives

1. A tool for the regionalization of national renewable heat production targets

Jeanne Frangié, GALLILEO Business Consulting[126]

In France, heat represents about one third of final energy consumption. The necessary supply could be easily produced from renewable sources: wood, solar or geothermal, but today the majority is still produced by fossil fuels that emit greenhouse gases.

ADEME (French Environment and Energy Management Agency)[127] decided to develop a tool to help local and regional authorities to better evaluate their renewable heat potential, and in doing so accelerate the replacement of fossil fuels for heat production.

Gallileo Business Consulting, a market research and consultancy firm that specialized in the environmental sector, has developed a tool to help regionalize national targets on renewable heat production.

Wood – a renewable energy source

126. Tel.: + 33 1 55 64 68 00 / jeanne.frangie@gallileo.fr

127. ADEME (French Environment and Energy Management Agency) public agency under the joint authority of the Ministry for Ecology, Sustainable Development, Transport and Housing, the Ministry for Higher Education and Research, and the Ministry for Economy, Finance and Industry.

Wood – a renewable energy source

THE MAIN PRINCIPLES OF THE TOOL

- **The tool shall be universally accessible, with no restrictive use** (no specific software or special computer training is needed). The tool is therefore based on Excel spreadsheets.
- **Only factual data from national statistics available in a regionalized form is used**
  - Gallileo did not produce its own data but identified relevant and usable data
  - The tool enables a comparison of the country's regions. The data from the different regions comes from the same sources.
  - The harmonization of the data is the strength of the tool, but it also hampers it, insomuch that a certain amount of more specific and detailed data only exists at a regional level; this information is not directly integrated into the tool. However, the user can customize the tool.
- **The tool was developed in the spirit of transparency.**

The calculation tabs are detailed and can be changed by the user. This has the effect of increasing the number of tabs, but makes the tool more transparent. It also allows users to complete and correct statistics.

The tool uses an approach based on the market mechanisms of supply and demand:

1. The supply is the sum of resources that can be mobilized for the production of renewable heat, including available biomass for wood energy, sunshine hours for solar thermal heat production, and groundwater or the existence of geothermal or deep geothermal energy potential.

2. The demand consists of the regional heat consumption and theoretical access to renewable heat, based on criteria of technical feasibility and accessibility.

In France, heat represents about one third of final energy consumption. The necessary supply could be easily produced from renewable sources: wood, solar or geothermal, but today the majority is still produced by fossil fuels that emit greenhouse gases.

THREE METHODOLOGICAL STEPS

1. Identification and collection of data to establish an inventory for supply (available resources) and demand (potential heat consumption)

A consistent literature review, an analysis of national statistics, and a series of studies on specific energy and heat consumption have been carried out. This research helped establish an inventory of heat demand (heating and hot water) of the residential, tertiary and industrial sector, as well as of the demand for processed heat for industrial services.

2. Identification of contextual indicators that may impact regional targets

The objective was to provide a dynamic approach, capable of adapting the current situation of supply and demand to new evidence.

Interviews with experts from different sectors, and with the four Regional Directorates at ADEME involved in the process of developing the tool, helped to identify the contextual factors that may directly and indirectly impact whether the renewable heat targets for each sector are reached. Contextual indicators can either accelerate or slow down the attainment of regional objectives. **Example:** the mechanization rate of forest operations. 47 contextual indicators were identified.

3. The calibration of the "mechanics" for calculating targets

The ratio between supply and demand helped to identify four scenarios.

4. A double validation: a Steering Committee composed of national experts and pilot regions

The outcome will be inserted into a control panel that will

- monitor the level of achievement year by year
- update indicators and targets
- alert the user to deviations from targets
- follow the achievement of the national target by summing up data from regional tools.

A one day training program was provided to the regional administrations in France in order to teach them how to use the tool.

9. Energy Sufficiency – The hidden key?

Yves Marignac, négaWatt association[128]

128. www.negawatt.org

The world is struggling with the costs and impacts of the ever-rising consumption of energy. This is by no means a new story. But recently, there has been a growing awareness that we need to rethink our energy future in order to meet long-term constraints. Despite a delayed reaction, even international institutions like the International Energy Agency (IEA) now acknowledge that *the world primary energy demand trend in the Reference Scenario is not a sustainable one.*[129] But how could we curb this trend while still meeting basic needs? And how does this apply to national and local policies, taking account of different situations?

The answers might be found in energy scenarios. Their role has drastically changed over the past few decades. Once considered as a simple tool to forecast the most probable trends or to discuss options, they have now become an important tool to discuss how we meet these long-term constraints. Energy scenarios both define what a sustainable energy future looks like, and provide a practical path to reach this vision. They are essential in building achievable roadmaps to reach ambitious goals.

It is little wonder therefore that energy scenarios have proliferated in recent years, with public agencies, industrial lobbies and environmentalist groups alike producing their own prospective work to influence policies at the international, national or regional level. The scenarios differ considerably in what they are putting on the supply side: some scenarios favour the development of carbon capture and sequestration, others support the goal of a "nuclear renaissance", and a growing number position renewable energies as the dominant resource in a few decades time. But there is one key thing that every "sustainable" scenario – in the sense of a sufficient mitigation of carbon emissions – has in common: the implicit or explicit acknowledgement of the importance of demand side management.

Reducing our energy consumption – compared to "business as usual" levels – is the leading potential that we can tap into at every level, to build a sustainable energy system. Lets use the IEA example again and the alternative scenarios that it has developed since it acknowledged that pursuing former trends is not an option. In one of them, which supposedly corresponds to stabilizing greenhouse gases concentrations at the upper acceptable limit,[130] the IEA considers the following options: the redeployment of a nuclear fleet provides 9% of the needed reduction of greenhouse gases emissions, the introduction of CCS some 14%, the development of renewables around 23%. This leaves a total of 54% of the reduction out of reach of supply side policies. In other words, they rely on energy efficiency providing over half of overall emissions reductions.

This result is even more striking since the IEA scenario, as shown above, is actually supportive of nuclear and CCS, with objectives of almost doubling the world nuclear capacity by 2030, and deploying CCS for 15% of the world's coal and gas power generation. Other scenarios, like those of international environmental NGOs, plan for a much stronger shift to renewable energies.

In July 2010, Greenpeace International published its third Energy [R]evolution report, introducing a more ambitious scenario targeting an 80% reduction in world CO_2 emissions by 2050 as compared to 1990. The scenario is based on a "dramatic reduction" of energy consumption, which the report points to as a "crucial prerequisite for achieving a significant share of renewable energy sources in the overall energy supply system". This share reaches 80% in the advanced scenario in 2050, compared to 13% today.[131] WWF's energy scenario, based on a report by Ecofys, pushes the same principle further to achieve a vision of 95% of supply by renewables in 2050.[132]

> **But there is one key thing that every "sustainable" scenario – in the sense of a sufficient mitigation of carbon emissions – has in common: the implicit or explicit acknowledgement of the importance of demand side management.**

These scenarios rely on considerable cuts to energy consumption. Greenpeace's scenario assumes that energy savings will account for close to a 90% reduction in the world final energy demand in 2050 compared to a trend based on IEA's Word Energy Outlook. Demand reaches a peak between 2020-2030 but then it stabilizes to remain only 7% higher than that of 2007. In WWF's scenario, the world final energy demand is even lower by 20% in 2050 than in 2010.

Reducing energy consumption is the main driver of a sustainable energy future. But how does this meet the need for development in emerging and developing countries, and the right to further progress in developed ones? The intense energy consumption that fuelled the industrial revo-

129. International Energy Agency (2008) World Energy Outlook.

130. This refers to the link between greenhouse gases concentrations by 2050 and the mean global warming to be expected by 2100, and the objective to keep the increase below +2°C set by the Intergovernmental Panel on Climate Change (IPCC). The IEA scenario refered to is the « 450 Policy scenario », which corresponds to stabilizing concentrations at 450 ppm (part per million) by 2030.

131. Greenpeace International (2010) Energy [R]evolution: A Sustainable World Energy Outlook.

132. WWF (2011) The Energy Report – 100% Renewable Energy by 2050.

The intense energy consumption that fuelled the industrial revolution, based on coal, and the post-World War II economic development, based on oil created a world where energy = development = comfort. It is now assumed that high energy consumption is essential to improving well-being, a fossilized assumption that needs rethinking.

133. With the exception of industrial production in developed countries, where the potential for activity savings by reducing waste, increasing re-use, and improving materials efficiency is considered.

lution, based on coal, and the post-World War II economic development, based on oil created a world where energy = development = comfort. It is now assumed that high energy consumption is essential to improving well-being, a fossilized assumption that needs rethinking.

As individuals and as a society, it is not energy we need as such: homes, travel, food, light, warmth, technology etc: these are the essential things to sustaining life. We consume energy to construct and use the infrastructures and equipments that we need. Therefore we shouldn't think in terms of energy but rather in terms of "energy services", which describe the services actually delivered through energy consumption. The WWF report, for instance, emphasizes that, although its scenario is based on an overall decrease in energy demand, the actual level of activity per unit of energy increases. WWF's report chooses indicators representative of what we think of as "living standards" or "comfort levels": industrial production volumes, residential floor space or passenger kilometers all increase per capita between 2010 and 2050.[133]

It is therefore essential that we deeply rethink the relationship between energy and services. The energy consumption of an individual, a group, a country or the world is the product of two factors: the level of energy services and the amount of energy needed to provide one "unit" of energy services. There are two ways to reduce energy consumption, often described as "efficiency" and "sufficiency". The first one aims to increase the level of energy service that could be obtained from a given quantity of energy by reducing losses and improving the efficiency of processes at all stages, from production to appliances. The second one is to reduce the amount of energy services needed by cutting wasted uses of energy to keep only those who are actually sufficient for our comfort.

Let's make this a little more concrete and apply this to a typical energy service such as lighting. What we need is a certain amount of light in a given space, measured in lumen. A usual way to think about this is to start with the supply-end of the energy chain and consider the options for producing the electricity needed to provide light. Various energy sources are available (thermal plant, nuclear power, hydro, wind, etc.) with various conversion factors, also depending on the characteristics of the specific power productuion unity. After some losses due to the transport, electricity reaches the consumer. How much electricity is used to light a bulb depends on the type of appliance. The usual incandescent bulbs have typically an electric power consumption of 40 Watts to provide 400 lumens (compared to 12 lumen for a candle with the equivalent "power"); high efficiency lamps like compact fluorescent bulbs use 8 to 10 Watts to produce the same amount of lumen, and light emitting diodes (LED) use even less. Another technical improvement lies in improved lighting features meaning that less light is absorbed by the design of the lighting itself.

Energy efficiency refers to any technical improvement that reduces energy losses at any stage, from generation, transport and distribution, to conversion in appliances. Addressing this in a comprehensive way is essential, but leaves an important potential untouched, although it is vital to tap into it: energy sufficiency. Sufficiency deals with the clever use of lighting. This means a lot more than just turning the lights off in an empty room, which is the most obvious example of a fully wasted "energy service". Sufficiency starts with making a smarter use of daylight to reduce the need of artificial lighting, which mostly lies in the design and use of buildings, and also the technical possibility, e.g. in offices, to adjust artificial light throughout the day according to the level of natural light. Sufficiency lies in tailoring luminosity to specific needs: for instance, a focused light on a desk, when working, better fits the need than a bright light in the whole room. One can also adjust lighting intensity, taking into account that they commonly exceed recommended levels, from a devision by two on average in offices to a lot more in heavily lighted places such as supermarkets.

This logic of reducing and tailoring energy consumption to specific and measured energy services applies to every aspect of energy use. The solutions sometimes fall at the individual level, such as the temperature of houses (where turning down the thermostat by one degree can save up to 10-15% in energy consumption), or at the community level, for instance reducing the commuting distance between home and working place etc.

There are **three areas** in which sufficiency is really fulfilled. The first one is **the definition of well-tailored energy needs,** which goes with choosing the appropriate equipment with the right size. It is absurd, for instance, in a city, to use a car to go only a few hundred meters. But even for longer distances, the times when a 1.4 ton car would carry one passenger of 60-90 kg at 50 km/h or less should be long gone. The second one is **how we use energy**, which goes with being smart and efficient with appliences. This includes how to use them, which in the case of a car means driving more gently and slowly, when to use them, and also how long to use them before replacing them. And finally, **organisational practices**, like car-sharing, offering user-friendly services, using rented cars and in general incorportating sufficiency into collective infrastructures.

On a global scale, we must reduce energy needs to such an extent that we cannot only rely on being more energy efficient. Whereas efficiency is the key to a sustainable development in the regions of the world that are not yet developed, developed countries that consume exorbitant amounts of energy, sufficiency is important for two reasons. First, it's the easiest, fastest and cheapest (since most of the time it doesn't cost anything) way to reduce energy consumption, which is the priority of any sustainable energy policy. Second, contrary to efficiency which deals with technical matters (and which is about increasing the ratios of delivering energy for our uses, not about questioning these uses), sufficiency addresses the societal issue of our overall consumption.

The French Government published a very impressive study in 2010 that dealt with the difference between geographically measured and consumption based greenhouse gas emissions in France. The former accounts for all emissions emitted within the French territory, regardless of the beneficiary. This is the usual way to gather emissions statistics as to be declared, for instance, under the Kyoto Protocol. The latter tries to identify all emissions corresponding to consumption within France, regardless of where the gases are emitted: this includes the emissions created for imported goods (and excludes, of course, the emissions on the national territory to satisfy the needs of other countries).[134] Based on 2005 alone, it shows that the real greenhouse gas "footprint" was 40% higher than emissions calculated on a geographical basis.

This means that the emissions which go with the current lifestyle of the French are not 8.7 $teqCO_2$ per capita, as measured on the national perimeter, which is already about four times higher than the average sustainable level of emissions per capita worldwide, but reach some 12.0 $teqCO_2$ per capita. It is even likely that, given the evolution of the French commercial balance and the increase of trade, this situation has worsened over recent years.[135]

The question now is: how do we include this need for sufficiency in energy scenarios? How can we represent the role of energy sufficiency in energy roadmaps: how much should we cut, in which sectors, and for which uses? The answers to these questions are not so obvious.

First of all, most official energy scenarios are based on economic modelling. Whilst reassuring for politicians, it largely fails to represent the kind of change in decision-making that is needed for a real energy transition. Economic models describe the behaviour of economic players, including energy producers and consumers, under hypothetical rules that imitate a perfect market and the regulations and taxes that can influence it. The trajectories they represent are the sum of optimized short-term decisions, which actually don't match the trajectories needed to meet long-term constraints. These models fail in particular to represent sufficiency: consumers are driven by the growth of their purchasing power, and society needs GDP to continue increasing. Some of the models even include the so-called rebound effect, which assumes that the money saved through energy efficiency by end-use consumers will automatically be reinvested in other goods or services that will consume the equivalent energy or more. For instance, a family who buys a very efficient fridge and thus saves money on their energy bill will use that saved money to fly away for holidays, canceling out an energy saving activity with one that consumes a lot of eregy.

On a global scale, we must reduce energy needs to such an extent that we cannot only rely on being more energy efficient. Whereas efficiency is the key to a sustainable development in the regions of the world that are not yet developed, developed countries that consume exorbitant amounts of energy, sufficiency is important (...)

Even voluntary retrospective scenarios using economic models, which focus on long-term constraints, fail to represent energy sufficiency. The 2050 roadmap of the European Climate Foundation, a scenario showing a path towards an 80% reduction of greenhouse gas emissions for EU-27 by 2050, illustrates this.[136] The model that it uses is exclusively supply oriented. Therefore, it does not represent energy demand in an appropriate way, which is mainly addressed through a sectoral assessment of energy intensity (the amount of energy required per euro of value added). The rationale of their scenario is that improvements in energy intensity, by implementing maximum energy efficiency, largely offset

134. Commissariat général au développement durable (CGDD) (2010) CO_2 et activités économiques de la France – Tendances 1990-2007 et facteurs d'évolution, Études & documents.

135. Marignac, Y (2010) Evolution des émissions françaises de gaz à effet de serre : une baisse en trompe l'œil, technical note to Greenpeace France.

136. European Climate Foundation (2010) Roadmap 2050: a practical guide to a prosperous, low-carbon Europe.

137. Virage Energie Nord-Pas de Calais (2008) Energies d'avenir en Nord-Pas de Calais – Quelles solutions au dérèglement climatique.

138. Enerdata (2005) Etude pour une prospective énergétique concernant la France, Direction générale de l'énergie et des matières premières (DGEMP) Ministère de l'économie, des Finances et de l'industrie (Minefi).

growth in energy demand driven by economic growth. Their scenario sees a 10% increase in energy consumption betwen 2010 and 2050 while the gross domestic product (GDP) doubles over the same period, meaning that energy intensity is on average 50% lower by 2050 compared to 2010. The methodological choices, deliberately *assuming no fundamental change in lifestyle*, results in a weakness in the so-called description of an "energy transition". The consequence is that the roadmap highlights action on the supply side, even though the scenario, to compensate other uses of fossil fuels, aims for a 100% decarbonization of the power sector, with renewables consisting of a share ranging from 20% to 60%, the rest being covered by a half-half mix of nuclear reactors and thermal plants equipped with carbon capture and sequestration (CCS).

Scenarios that rely on energy modeling are better adapted to showing the ways that sufficiency can reduce energy consumption, where total consumption and matching energy production are represented first and foremost before their economic consequences are accounted for.

Easier said than done! The Energy [R]evolution scenario pushed by Greenpeace, for instance, is ambitious in reversing the trend of energy consumption, but it still relies to a large degree on savings through energy efficiency: highly efficient electrical and electronic devices, improved heat insulation and building designs, highly efficient vehicles, etc. Their scenario does include some sufficiency, when it mentions, for instance, a better use of daylight to reduce the need for lighting, or *changes in mobility-related behaviour patterns*. But it mostly describes energy efficiency improvements. The transport sector is the only one where the scenario explicitly points to a reduction of energy consumption, assuming a relative reduction in volume of passenger transport and freight transport in comparison to the Reference Scenario – which are not however specified.

The interesting thing is that these reductions are no longer decribed in terms of energy but in terms of passengers per kilometers per annum (p.km/a), or tons of goods per kilometers per annum (tkm/a). The modelling of sufficiency, as it adresses the level of services, needs such service-related indicators. The Ecofys scenario for the WWF Energy report, which contrary to the ECF approach emphasizes the need for change in lifestyle and introduces some *critical lifestyle choices*, proposes a *conceptual approach to forecasting future energy demand* which separates the two factors of energy intensity and activity. Energy consumption is the product of a quantity of service, for instance in p.km/a, and the quantity of energy used on average to provide this service, for instance in kWh per p.km/a.
The WWF scenario proposes to model world energy demand in two steps for each of the sectors identified as having a high energy demand – industry, buildings, transport. As a first step, the scenario describes the evolution of the level of activity of the sector, based on the indicators of services mentioned above. It then discusses the evolution of the energy intensity of the sector to deliver this level of activity. This highlights that reducing these services plays a significant part in the demand trajectory, although these services, while not following the high growth trend of a base-line case, increase in the scenario betwen 2010 and 2050. However, these relative reductions of activity are only described at a very global level and are not as yet very detailed.

Can we every really accurately model energy sufficiency on a global scale? **One very common criticism of voluntary-based energy scenarios is about their lack of realism. This calls for a cautious approach of modelling, where the projected evolution of production and consumption can be supported by suggestions of political measures or incentives to tap into identified potentials.**

This cautious approach is exemplified in the scenario, which 'Virage Energie Nord-Pas de Calais' published for the Northern region of France in 2008.[137] This scenario proposes a reduction in energy consumption compared to a reference "business as usual" scenario. These reductions, for most of the sectors, rely explicitly on energy efficiency and do not represent a change in lifestyle. The scenario uses some of the hypothesis of a national official scenario prepared by Enerdata and published in 2006 by the Government that tries to reach a 4-fold reduction of French CO_2 emissions by 2050.[138] This official scenario does not include sufficiency and plans for a stabilization of industrial production, an increase of mobility and no change of lifestyle. The methodological choice to use this as the basis for the Virage Energie scenario, as the report points out, therefore *constrains the scenario when it comes to proposals about energy sufficiency*. It is included in some sectors, like a *reduced need* in the local production of steel, but not in a systematic way.

This systematic approach to sufficiency is what the négaWatt scenario, developed by an independent group of experts, tries to develop as part of a sustainable energy path for

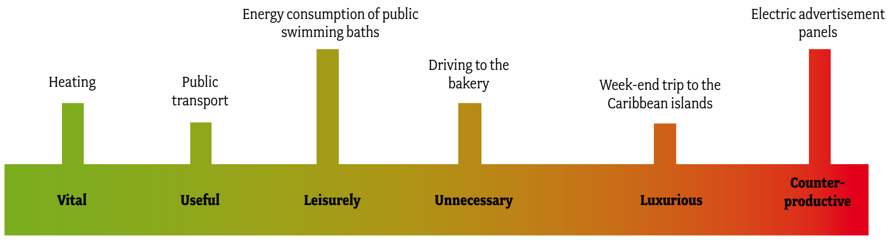


Figure 16 - Scale of necessity of energy services

France between now and 2050. A first version was published in 2003, and subsequently updated in 2006,[139] and a new and completely revised version will be published in 2011. The scenario proceeds with an aggregated, demand-oriented bottom-up energy modelling and tries to represent, for each sector and use, the respective role of sufficiency and efficiency in the relative reduction of energy consumption, which reaches 67% in primary energy by 2050 compared to the prolonged trends.

The scenario stands as a comprehensive implementation of the three steps of action recommended by négaWatt, which puts sufficiency first and then efficiency before addressing the supply side with renewables. Therefore the contribution that the principle of sufficiency can make is included in all sectors and all uses – heating and cooling, mobility, specific uses of electricity. Yet the way it is represented varies according to sectors and is not complete yet. Energy sufficiency is to some extent explicitly introduced through the evolution of some indicators, such as the level of electrical equipment, the increase of shared travels in cars, the curbing of the trend in the average building surface per person, or the reduction of the volume of hot water used per day per person. But it is also represented, in less detailed sectors such as industry, through the inflexion of demand.

Overall, the main goal of this scenario is to emphasize the importance of sufficiency as a factor that goes hand in hand with efficiency, and to generally show the relative share of technical and behavioural changes in reducing energy consumption to make the transition to a sustainable energy supply possible. The main lesson drawn from it is that sufficiency could account for at least 25% to 30% of the overall reduction on the demand side, and that this contribution is absolutely necessary. Still, the scenario tries to show that this doesn't mean that comfort is reduced. The services which are described, like the surfaces of building heated or the number of p.km/a are down compared to a projected trend but still increase, although final energy consumption is respectively cut by 40% for heat and more than 50% for transports in 2050 compared to 2005. And while the consumption of electricity stabilizes, the services that it provides almost double. Sufficiency is not about cutting basic needs, but cutting waste to better fulfill needs.

These lessons reveal how important it is to include energy sufficiency into the energy equation, and therefore include behaviour change in the depiction of energy futures. This is essential to grasp the full dimension of the energy transition, which doesn't necessarily mean a reduction of living standards, but implies some change in lifestyle.

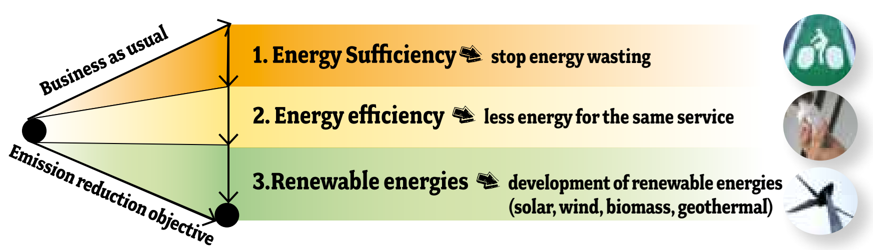
The reason why the négaWatt scenario has become such an influential reference as a future energy scenario is because it approaches these issues systemically, meaning that it inverts the traditional supply-to-use analysis to develop a strategy based on the identification and evolution of energy services – through all uses and all sectors. This also allows for deeper reflection, at an individual and community level, on the hierarchy of their energy uses and the potential to reduce their consumption. Applying a prioritisation of energy needs at the community level, from vital, to useful, to leisure, luxury or even frivolous uses of energy is proving a very effective tool to identify the potential for energy sufficiency, how to prirotise action and the way to reduce consumption.

This needs to be further developed in local scenarios and will be much more developed at the national level in the new négaWatt scenario. The forthcoming scenario will be one step closer to achieving a new methodology for modelling the energy transition that is increasingly needed to guide political action.

139. négaWatt (2006) *Scénario négaWatt 2006 pour un avenir énergétique sobre, efficace et renouvelable*, document de synthèse.

Figure 17 - négawatt - energy-triptych

Source: négaWatt.



10.
From the concept of Energy autonomy to 100% renewable energy territories

The concept of Energy autonomy was introduced by the bookwork of Hermann Scheer[140], who was also one of the strongest defenders of the German EEG[141] law. But what is concretely behind the objective of energy autonomy or 100% renewable energy production at a local or regional level? In an attempt to clarify this concept, several questions emerge:

What general forms of energy services are considered in the calculation - heat, electricity, mobility, processed energy? Are all sectors taken into account - transport, housing, industry, agriculture? Is the target achieved when the overall annual renewable energy production exceeds the consumption during this period, or is the aim to achieve a real-time supply-demand equilibrium at all times during the period in question?

For the moment the answers to these questions vary as much as the existing concepts.

But a general reflection on energy autonomy is, in any case, worthwhile, and it cannot be limited to energy concerns only. **The exploitation of existing renewable energy potential rewards the local territory and its people, creates local jobs and a positive, future oriented image, raising the resilience towards external shocks, such as the impact of rising energy prices.**

More and more local or regional authorities have decided to break this new ground; some of them[142] have already proved that 100% renewable energy territories are not only a concept, but a reality.[143]

The exploitation of existing renewable energy potential rewards the local territory and its people, creates local jobs and a positive, future oriented image, raising the resilience towards external shocks, such as the impact of rising energy prices.

1. Energy autonomy in Germany's regions – Visionary targets put to the test

Cord Hoppenbrock, DeENet eV. – 100% renewable energy regions[144]

Many German regions commit themselves to the target of 100% energy from regional and renewable resources. Energy autonomy has become a new discipline in local politics, in planning, and for the economy, far beyond its previous symbolic level. The catastrophic events in Fukushima have put the national spotlight on these regional strategies. Energy scenarios designed to show long-term development and structural change have been put to the test, as 100%-targets become part of national or regional policies and individual decision-making. To lay out new policies, not only technical data is needed. The effects on the economy, ecology or landscape will determine our lifestyle for many years to come. "100%-Renewable-Regions" are therefore labs, showing solutions, conflicts, standards and methods, all revolved around a policy in the making.

"100%-RENEWABLE-REGIONS" IN GERMANY

Renewable Energies have already conquered German landscapes, politics and homes. An array of programs and incentives – first of all the Renewable Energy Sources Act (EEG) – have led to an unparalleled boom of wind turbines (more than 23,000), photovoltaic systems (more than 800,000) and bio-energy plants (more than 5000).[145] Approximately 17% of national demand is currently provided from renewable resources.

Some areas can already state they have reached 100% renewable electricity within their territory, however, the target of 100% renewable energy for heating, electricity and transportation is further from our grasp, and will likely have to wait until 2030, 2040 or 2050. Right now, more than one hundred so-called "100%-Renewable-Regions" are spreading across the country; their number is constantly increasing.[146] In 2008, the German federal ministry of environment launched the "National Climate Initiative"[147], which offered many regions financial aid to evaluate their potential energy production and savings, according to their individual resources. "100%" is no longer the slogan of a

140. Scheer, Hermann (2006) Energy Autonomy. The Economic, Social and Technological Case for Renewable Energy.

141. EEG Erneuerbare Energien Gesetz – Renewable Energy Sources Act http://www.erneuerbare-energien.de/inhalt/42934/

142. Several cities in Europe have already achieved the 100% renewable energy target. The city of Güssingen - http://www.eee-info.net/cms/EN/
The city of Wildpolsried - http://www.cipra.org/en/cc.alps/competition/wildpoldsried
The village of Mauenheim - http://www.bioenergiedorf-mauenheim.de
The city of Munich with its 3,1 million inhabitants aims at producing 100% of the necessary electricity used by its households with local renewable energy sources by 2015. http://www.kommunal-erneuerbar.de/

143. Extract of an article: Régnier Yannick (2011) *Définir le territoire à énergie postive*. CLER Infos no°82.

144. http://www.100-ee.de/

145. www.energymap.de

146. http://www.100-ee.de

147. http://bmu-klimaschutzinitiative.de/en/projects_and_programmes

Energy scenarios designed to show long-term development and structural change have been put to the test, as 100%-targets become part of national or regional policies and individual decision-making. To lay out new policies, not only technical data is needed. The effects on the economy, ecology or landscape will determine our lifestyle for many years to come.

long-term (utopian) mission statement, but a target which is impacting current action, in planning (new wind farms) or investments (smart grids etc.), for example. Representatives at local level often state their hopes for a general impact on the economy. A transformation of the energy system creates new jobs, especially in rural areas; these targets therefore have to be evaluated as well.[148]

ANALYZING, SCENARIO-WRITING AND PARTICIPATION

These regions differ not only in their potential, economic background or innovative sector, but also in their applied methods or assumptions. Until now, there have been no accepted standards by which energy autonomy is measured. 100%-targets usually contain footnotes such as "excluding industrial emissions" or "focusing only on the electricity sector". There are at least five steps the planning process has to undergo:

Baseline: Survey of the level of transition already achieved in the area.

Potential: Estimation of the potential for renewable energy production within the concerned territory by using current technologies (often based on spatial analysis and standard GIS (Geographic information systemsApplication). This step is already based on numerous estimates and normative statements.[149]

Forecasting or scenario writing: The forming of assumptions at exploitation level is an autonomous step. Different methods can be used (forecasts, scenario technique).

Targets: Defining targets and milestones along the way is an important part of regional strategies.[150]

Evaluating the effects and side effects: This step is often underestimated; the analysis of the process of structural change is not yet an ordinary part of "energy planning concepts".

Mixing up these steps can lead to difficulties in understanding the targets or means to be developed. As the evaluation of local potential is first of all technical, the socio-economic aspects have to be considered too. **It might turn out that not using the full technical potential leads to greater economic benefit than "squeezing out" the landscape without considering the needs of agriculture etc.** As a result, practical energy planning is a difficult, transdisciplinary approach, building on spatial sciences and technical and economic expertise. The complexity of future, decentralized energy systems and the unpredictability of global markets make the task even more difficult.

German energy planning is therefore also grounded on participatory design to enable present action and small steps. To outline principles for policies to develop decentralized energy production, it is necessary to contact many different stakeholders, as decentralized energy equals decentralized decision-makers, stakeholders and expertise. **Analysis, results, vision and next steps should be developed consensually and based on a common idea. The idea of a "100%-Renewable-Region" and its "adding value" is a positive vision; an incentive for cooperation.**

REGION OSNABRUECK – HOLISTIC APPROACH TO ENERGY-STRATEGIES

Early in 2011, the "energy- and climate-concept" for the city Osnabrueck was published.[151] This region in the northwest of Germany bears many prototypical features of 100%-Renewable-Regions, such as a rural economy and high potential, combined with a strong and diverted economy. The concept takes a holistic approach towards the definition of potential, emission reductions, economy, and stakeholder participation. Figure 15 shows the potential and the targets in the electricity sector that were enacted by the municipal-parliament as a result of the analysis.[152] Climate and energy policies have gained not only acceptance, but even enthusiastic support; it was adopted without a single dissenting vote in the local parliament.

By 2030, all electricity should be produced by renewable and local energy, and heating should follow by 2040. To achieve these goals, investments have to be doubled to more than 100 million Euros per year. Among the crucial aspects are wind repowering, a sustainable restricted biomass-strategy, and individual investments for residential buildings. The

148. Hoppenbrock Cord (o.J.) (2009) Regionale Wertschöpfung durch 100% erneuerbare Energie? Gestaltung und Bewertung dezentraler Energiesysteme im Kontext regionaler Energiepolitik, Phd-Thesis at University of Kassel, Germany.

149. Ibidem.

150. Ambitious targeting (100%) has recently become a pre-condition for financial support. Subsequently, targets have lost their value as an indicator for cutting-edge regional strategies, cf. www.100-ee.de

151. Landkreis Osnabrück (2011) Integriertes Klimaschutzkonzept Landkreis Osnabrück. http://www.landkreis-osnabrueck.de/

152. ibid.

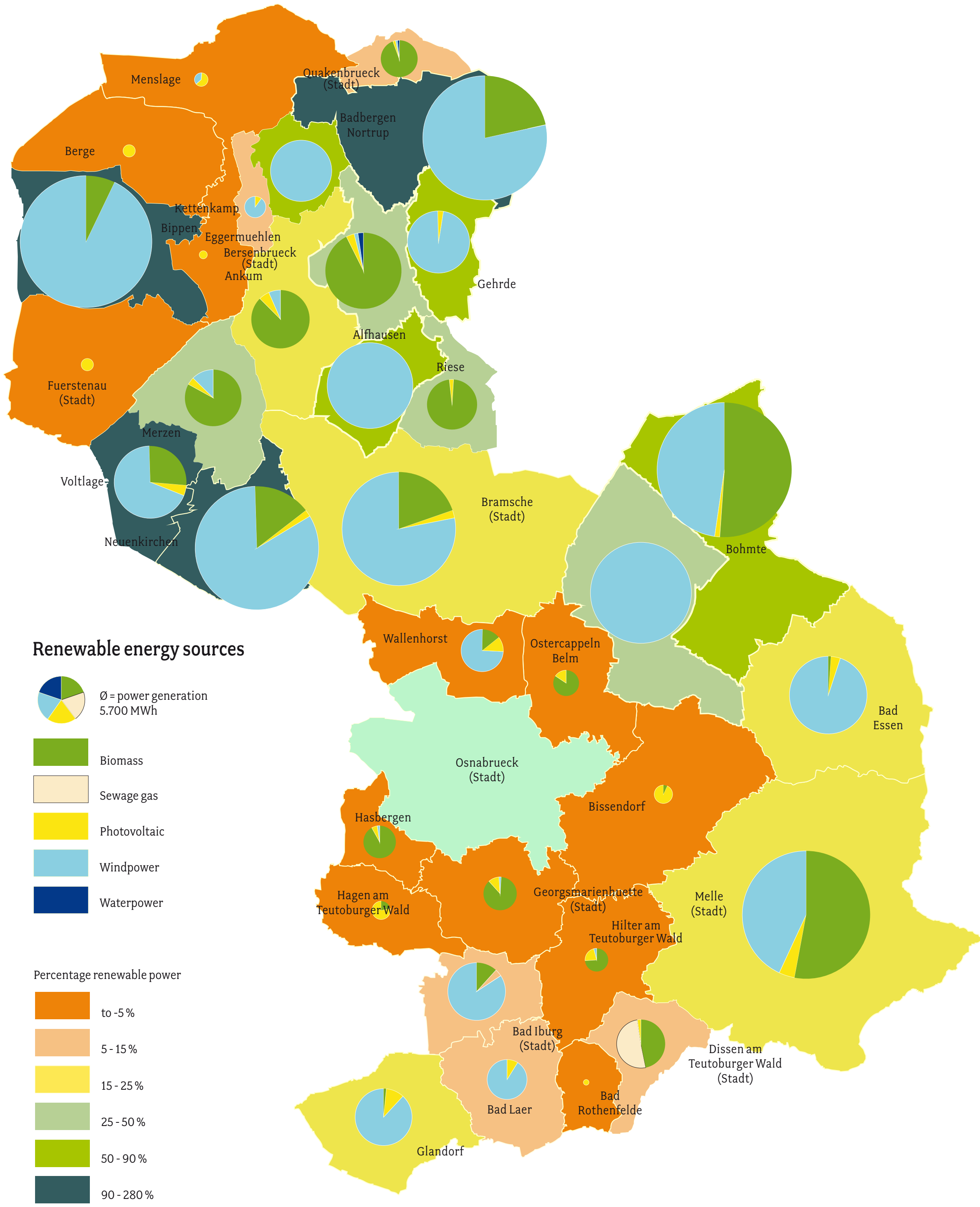


Figure 18 - Renewable energy production map of the region of Osnabrück

Source: © PB-Graw

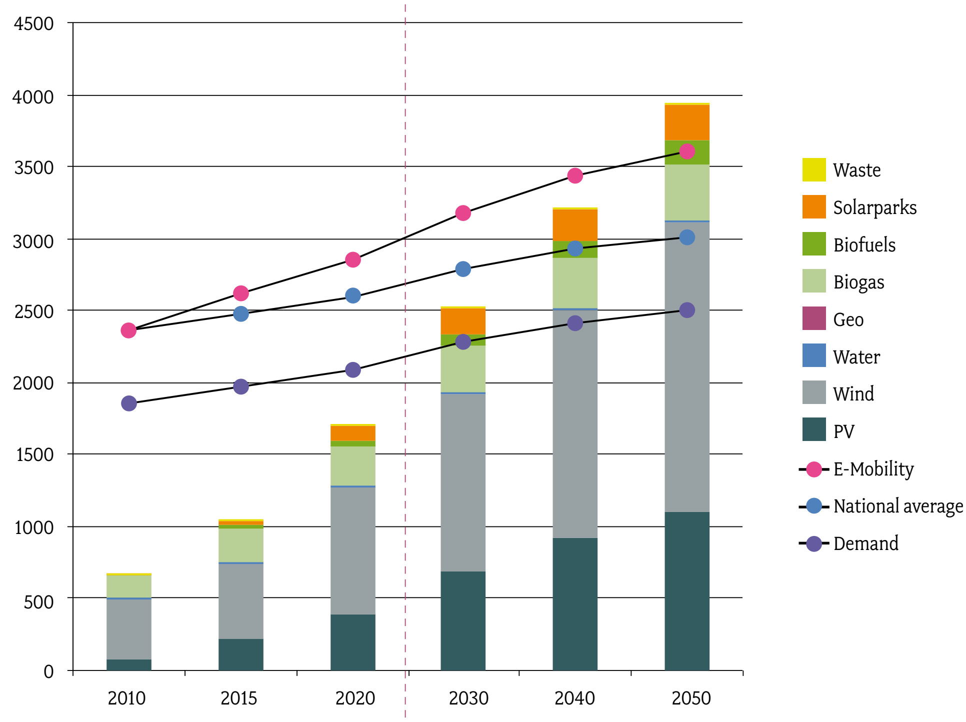


Figure 19 - Renewable electricity production and demand in Osnabrück

results are based on a spatial analysis (**Figure 16**). It shows the renewable energy production potential of the whole territory against the demand, and gives an impression of the enormous and long-term effects on land use, building etc.[153]

As a result, the Landkreis Osnabrück developed 15 short-term steps, which are already underway. For example, the region is characterized by many transportation corridors (highway, railway, and canal), which can – according to the present EEG[154] – be used for the development of photovoltaic parks. An advice program for the refurbishment of residential homes has been designed, as all scenarios are more or less based on one the following assumption: everybody must participate in the transition. It is particularly important to reduce the need for heating and transportation. Regional energy planning is vital in designing long-term strategies for regional and rural development. An important challenge for regional strategies is to influence individual decision-making and to gain acceptance and confidence for the construction of even more wind farms or bio-energy plants. Energy scenarios have to be feasible, accepted, visionary, and well founded – not an easy combination to achieve.

2. Energy autonomy: Temporary fashion or recipe for success?

Sarah Becker, Anita Wyss, CIPRA International[155]

The vision of being free from energy imports is fascinating many regions. Self-sufficiency is "in". The core of the concept is to meet demand with local, renewable energy sources, save energy and use it more efficiently.

Whichever region chooses to take the path towards self-sufficiency will transform itself and its structures, to the benefit of its own economy, society and the environment.

It is worth noting that terms such as energy-transition, self-sufficiency or autonomy applied here should not be read scientifically. They are different terms designing an alternative trajectory to a renewable energy future.

ENERGY SCENARIOS

Energy scenarios are central to the formation of energy self-sufficient regions. The definition of goals, the development of models and the creation of action plans are based on the results of energy scenarios. The basic elements are an analysis of the current solution, the definition of the target, and a comprehensive environmental analysis. Concrete recommendations to be implemented are then developed. Such scenarios can be very specific. In practice, however, compromises often have to be negotiated.

THE JOURNEY IS THE REWARD

The reorientation of a whole region towards energy self-sufficiency requires a strong vision as well as clearly defined, long-term objectives and innovative concepts. In many regions, the departure in the direction of energy independence more or less follows the motto "the journey is the reward".

153. ibid.

154. EEG Erneuerbare Energien Gesetz – Renewable Energy Sources Act http://www.erneuerbare-energien.de/inhalt/42934/

155. CIPRA International, Im Bretscha 22, FL-9494 Schaan. Tel. +423 237 53 53 - international@cipra.org, www.cipra.org The international alpine commission CIPRA is an autonomous non-governmental, non-profit umbrella organization. With representatives in seven Alpine states and around one hundred member organizations and institutions CIPRA today represents an important alpine-wide network working on sustainable development searching cross-border solution for nature protection and the preservation for regional diversity and cultural heritage. www.cipra.org

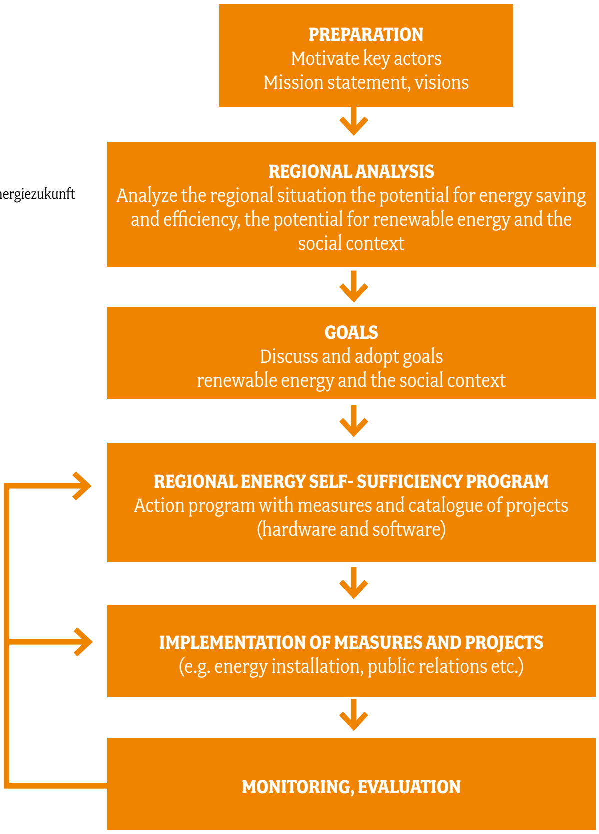


Figure 20 – The regional energy self-sufficiency process

Source: after Tischer et al. 2009: 44

Wind-mill in a mountainous region (proposal)

That may be enough for the outset; nevertheless, during the course of the energy transition process, the definition of specific objectives, measures and milestones, becomes crucial for success.

An example of an energy scenario is the vision to become a "100% renewable energy region". In this ideal case, the region covers all of its own needs entirely with renewable energy sources, is very energy efficient and uses its regional potential in a sustainable way. Thus, energy production becomes environmentally friendly and socially responsible; it is independent from external influences such as fluctuating oil prices and contributes to the creation of added regional value. The regional stakeholders are well integrated, and the population supports this type of energy production.

SUCCESS CRITERIA

There are now a number of alpine regions, which are on the path to energy independence. The general orientation is similar for the different initiatives. **The implementation of the vision of energy independence is, however, different from country to country, and from region to region.** This is due to several factors. Firstly, the natural conditions, such as the renewable energy potential of the region, are not the same. Secondly, the political framework has an important impact. In German-speaking countries, the concept of regional energy self-sufficiency is already well known. The most advanced projects are situated in these regions. For example, the Austrian province of Vorarlberg[156] adopted the aim of becoming energy independent by 2050. In other alpine regions growing interest for these concepts can also be observed, but there are only few examples that go beyond the initial stage. In the Italian part of the Alps, the idea of energy independence is poorly established.

Another success factor for the advancement of energy independence processes is the existing know-how off local energy agencies, research institutes, interest groups and associations. Different administrative levels have to be considered: there is a marked difference between a small community wanting to move towards energy independency and an urban-rural cooperation, or large regional association, wishing to do so.

156. www.vorarlberg.at/energiezukunft

Figure 18 – Meeting of local peoples working on their vision of an energy-independent region

Source: © Zeitenspiegel Frank Schulze

GOOD GOVERNANCE IS CRUCIAL

The successful implementation of the vision of self-sufficiency and autonomy is a result of a political decision-making process. Social changes, which are induced by such a process, are of great importance. In the end, the people decide on success or failure. For this reason, the involvement of appropriate stakeholders and a good information and communication strategy are key elements for success. This has been confirmed by the Murnau (Austria)[157] Energy Vision and the Achental (Germany)[158]ecological-energy region. The commitment to a shared vision and a common procedure links all actors together and strengthens networks. A positive internal view, and the cultivation of an image as an innovative territory, fosters the regions' identity.

A PROCESS WITH SWIFT, VISIBLE OUTCOMES

Recently, other factors have emerged which favor the development of energy self-sufficient regions. For example, from the outset a compelling vision is needed which appeals to the entire population, is able to trigger a feeling of unity, structured in manageable steps, allowing fast, visible and measurable results. The involvement of local politics has been generally positive. Committed people who carry the process serve as catalysts. Efficient teams create trust, which has to be built on repeatedly through actions. Also, secured long-term financing, or governmental start-up financing, has a positive effect on project implementation. In the medium term it is important to build up the maximum amount of financial support at a local level, within the region. It is equally important that the region regularly re-evaluates its energy self-sufficiency process, in order to adapt it continuously to new circumstances.

3. Solar Catalonia – Yes we can! - A Pathway to a 100% Renewable Energy System for Catalonia[159]

S. Peter (iSuSI), **A. Doleschek** (iSuSI), **H. Lehmann** (WCRE), **J. Mirales** (fundacio terra), **J. Puig** (Eurosolar), **J. Corominas** (Ecoserveis), **M. Garcia** (Ecoserveis) – 2007

The objective of launching this study was to show that the Catalonia region is capable of supplying its own electricity needs through renewable sources. It was important for the authors of the study to provide a fact-based vision of a future energy supply, in order to influence discussions on the transition from fossil/nuclear energy sources towards a sustainable energy system.

The study does not consider any major changes in lifestyle, and the reduction in energy demand neither causes changes in living standards, nor does it affect the demographics of the region. The study is focused on Catalonia's current electricity energy demand - and how it can be reduced - and the design of an energy supply system, which would cover electricity demand through renewable energy technologies. The study delivers basic information on energy demand, a simplified simulation of the Catalonia electricity supply system (developed with simulation software), and policy measures to best support a sustainable energy supply.

Two scenarios were developed: The *Climate protection scenario* (CPS) and the *Fast exit scenario (FES)*.

By 2050 Catalonian electricity consumption will have halved in comparison to 2007. The energy intensity will also have been halved, and the remaining effort in terms of energy efficiency improvements - increasing by 1.5% per year[160], in line with the EU efficiency target – does appear achievable.

Both scenarios achieve a fully renewable supply by 2050. This aim is not limited by the renewable energy potential - it is a matter of setting and pursuing ambitious goals, encouraging policy and people, and, of course, the financial investments that Catalonia and its inhabitants are willing to make. The scenarios show that the financial aspect is not as big an obstacle as one might expect. With an annual investment into renewable capacities peaking at 109 €2006[161] per inhabitant in the "Fast Exit Scenario" and 55€2006 / cap in the "Climate Protection Scenario", the financial burden for achieving a clean a climate friendly electricity supply in Catalonia is moderate in our view (**Figure 20**).

The average annual payments for the two different scenarios amount to 45 €2006 per habitant per annum in the "Climate Protection Scenario", and 65 €2006 in the "Fast Exit Scenario".

Compared to the Catalonian Gross Domestic Product (186,324 million € in 2008, on the 2006 price base) the

157. www.energievision.at

158. www.achental.com

159. Isusi et al. (2007) *Solar Catalunya - A Pathway to a 100% Renewable Energy System for Catalonia*. http://www.isusi.de/downloads/Solar_Catalonia_2007_en.pdf

160. Source: European Commission (2006) Action Plan for Energy Efficiency: Realising the Potential [COM(2006) 545]; 2006

161. These costs are pure investment costs for renewable generating capacities. There are no other costs included (e.g. operation costs), are there are no cost savings in other parts of the energy supply system considered, such as fuel savings and the related cost reduction or savings in the external costs of energy supply.

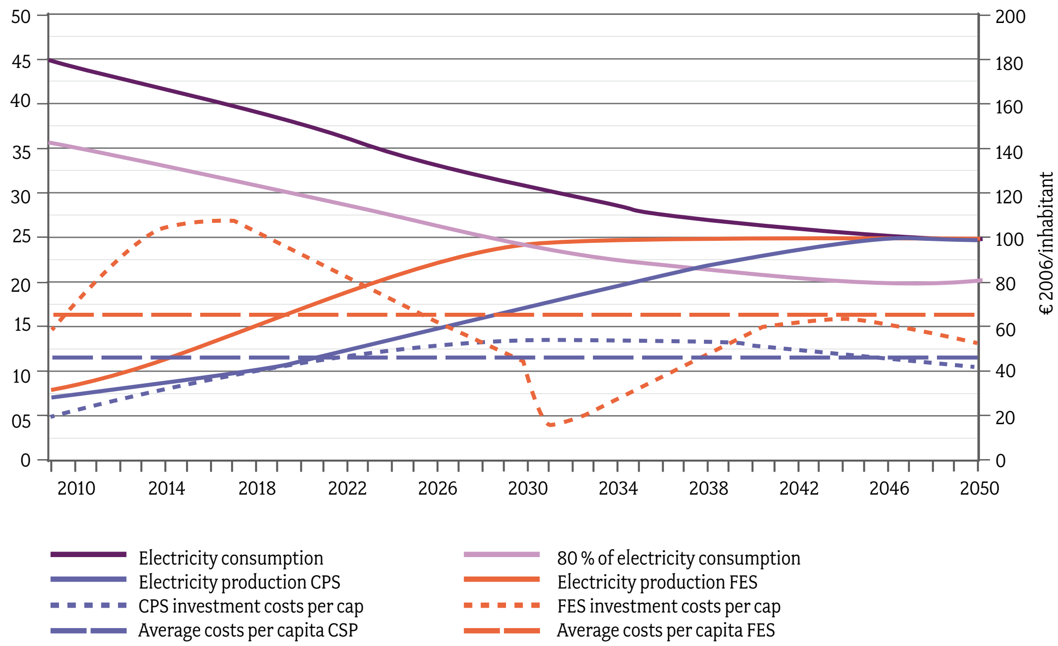


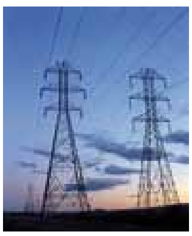
Figure 21 - Development of electricity demand and supply in the scenarios

Source: Solar Catalunya II; 2009.

annual costs of the scenarios are on average 0.19 % of the GDP for the "Climate Protection Scenario" and 0.27 % for the "Fast Exit Scenario". Set against the resulting costs, the development - as described in the scenarios - will create jobs and push down outgoings, by reducing the costs currently attributed to importing fossil fuels.

The challenge in designing a highly renewable electricity supply system is to find a combination whereby the advantages of each renewable source combine in a functioning and reliable system, balancing out the disadvantages, such as production fluctuations.

Any energy supply system must guarantee sufficient production and distribution of electricity, and heat and fuel to meet the demand for energy at any time of year. Energy is supplied in the form of electricity, heat or fuels, the advantage of the latter categories being that they can both be stored for later use and easily transported. The situation is different for electricity, due to the lack of an efficient storage system. The need to produce enough electricity, on demand and on time, makes this type of energy the most critical component in an energy supply system. While electricity transport via the public grid is relatively trouble-free, directly storing electricity on a large scale is material- and cost- intensive. Storage in batteries and accumulators can also involve the use of toxic substances; this option is therefore not considered here. Alternative indirect storage can be used instead, such as pumped hydro storage systems[162].



An energy supply system derived almost entirely from renewable energy sources increases the need for management on the demand side, for meteorological forecasts and storage capacity.

The challenge in designing a highly renewable electricity supply system is to find a combination whereby the advantages of each renewable source combine in a functioning and reliable system, balancing out the disadvantages, such as production fluctuations. The focus of the study lies in the dynamic nature of the electrical system in the "Fast exit" scenario. This was achieved not by optimizing the electrical energy system in general but by choosing, in the case of wind energy, for example, the best location among those suitable

162. Electric mobility was also not considered although electric batteries can be used as storage in electricity supply..

Electricity infrastructures are key issues

for installation. This simulation was done continuously for one year, with 2006's[163] typical weather taken as a model. Demand management is also included in the energy supply model. As there was no detailed simulation of individual consumers, the basic assumption is that the demand management will be able to cut peaks in electricity demand by 10% without changing the total amount of energy consumed in a year (load shifting).

Taking the results of the simulation of the "Fast Exit" scenario, the system is capable of supplying all electricity demand in Catalonia. While solar power is most effective from late spring to autumn, wind energy performs best in the late winter and early spring. During the spring and summer months, electricity production is likely to exceed local demand. During the autumn and winter, hydropower, geothermal electricity and biomass become more important, but it might be necessary, however, to import electricity.[164]

An electricity supply system with a high share of fluctuating energy sources needs strong grid interconnections with neighbouring regions and countries. Grids are a key issue for compensation fluctuations as they enable the export of surpluses, and imports during low production periods. Nevertheless, every single region should optimize the use of its own renewable energy potential.

FROM THEORY TO ACTION – GÜSSIGEN

The canton of Güssingen (27000 inhabitants) in Austria today already covers 100% and more of its energy demand (electricity, heat and mobility) – by using local energy resources. In 1990 the local authority of Güssing decided on a 100% reduction in fossil fuel use! This decision led to the creation of the European Centre for Renewable Energy[165] based in Güssingen, the development of 1000 jobs, and the flourishing of a veritable energy tourism industry. The so-called "Güssing Model" is a strategy of decentralised, local energy production using all available renewable resources in a region.

Grids are a key issue for compensation fluctuations as they enable the export of surpluses, and imports during low production periods. Nevertheless, every single region should optimize the use of its own renewable energy potential.

163. SMeteoCat (2006) Servei Meteorològic de Catalunya - Dades EMA integrades a XEMEC, Department de Medi Ambient i Habitatge.

164. The simulation considers the possibility of importing electricity from neighbouring regions and/or countries. To reduce imports it would also be possible to further increase the generating capacities in Catalonia itself.

165. http://www.eee-info.net/cms/EN/

III. STAKEHOLDER CONSULTATION AND CITIZEN PARTICIPATION

in the definition of long term strategies

Decisions on climate and energy strategies that potentially concern all of society's actors in all spheres of daily life (transport, consumption, building, agriculture...) should be taken on the base of a broad public consultation.

This is essential because of the transverse nature of such a strategy, and the time component, which will outlive any legislative program. As classic political accountability cannot be assured, a transition process toward a more sustainable society has to be anchored in civil society and to be supported by its main stakeholders.

"The institutions are starting to appreciate that a lack of accountability breeds a lack of legitimacy and trust. Society has become so complex that no decision will stick unless it has involved everybody with a stake in it."[166]
Whereas stakeholders can be identified and invited individually in order to participate in consultation processes, it is much more challenging to mobilize the non-organized members of civil society: the individuals.

The city of **Oldenburg**[167] in Germany developed in 2010 a local integrated climate and energy concept. Federal financing for the development of this strategy was conditional on the organization of a parallel public consultation process. Only 50 citizens participated in the thematic workshops, a small figure in comparison to the overall number of inhabitants: 160000.

The city of **Montreuil** (France) also develops a local climate and energy strategy. Several thematic public consultations in the form of workshops have been organized by external consultancies, again with relatively little attendance. [168]

London's draft Climate Change Mitigation and Energy strategy has been made available for public consultation via a web page open to the public. The London government also ran a survey of over 1,000 Londoners on this strategy. A web-based questionnaire has been created; aimed at associations and citizens, it acts as an interface of public contribution to the strategy.[169]
London's proactive consultation strategy – through the organization of a survey and online-questionnaire – inevitably led to a greater number of voices being heard, but people were less involved then those who decided to participate actively in a workshop.

In a 24-month project **EUCO2**[170], scenario workshops were organized in 15 European metropolitan areas, gathering different local political and economic stakeholders around a scenario tool - GRIP[171] - in order to settle on a consensual long term CO_2 reduction strategy.
These examples show three different drivers for the organization of public consultation processes: within the development of climate and energy strategy it can be didactically recommended (Montreuil), imposed by financing (Oldenburg) or simply be part of a communication strategy (London) or a project (EUCO2). But even if a consultation procedure is well designed in a transparent and democratic manner, it remains a top-down organization, and the voices of the citizens and stakeholders heard are not necessarily representative of a wider consensus.

In order to decide and implement a long-term climate and energy strategy, top-down consultation has to meet existing bottom-up interest.

There are at least four basic principles to be respected:
People want to discuss issues that concern them individually;
It has to be ensured that these discussions help people form their opinions, by creating a dialogue and not a debate;
The outcome of the discussions should have direct influence on the definition of the strategy;
The consultation should officially legitimize decisions. [172]
But a bottom-up initiative or social movement cannot be planned as a top down process; this is why local authorities have to be especially sensitive towards emerging activities in their area, not necessarily in order to associate these initiatives with the official strategy – most grassroots activists would not accept that anyway - but in order to create bridges for mutual exchange, allowing the strategy to be enriched. These initiatives are often niches of social innovation that should not be neglected.
For example, the initiative of the "Transition towns"[173], a network of nearly 800 local initiatives linked together by a common idea and guidelines, enabling individuals to take the climate and energy "destiny" of their town into their own hands.
These initiatives are emerging from the bottom-up, created by interested individuals with local knowledge. The network supports the local initiatives with guidelines, publications and training sessions, but perhaps its greatest virtue is the possibility for an individual to create a profile on their webpage, linked to a map, which helps them get in contact with people in their area who share their convictions.
Using maps in order to increase the visibility of local initiatives is also used by the UK initiative "Mapping for change" (➲ Chapter III.2).
In France three local associations called "Virage énergie" (➲ Chapter III.1) decided to create alternative energy scenarios for their regions. As opposed to the regional councils, the associations can deliberately go beyond the regional powers and analyze the pathway to a 100% renewable energy future, including - as one of the main issues - a nuclear phase out.

The integration of the visions that emerge from local citizens' initiatives in the definition of an official long term climate and energy strategy, and the management of the consultation processes in a way that allows individual citizens to get emotionally and politically involved, is an important democratic challenge for all local authorities.

166. New economics foundation – Perry Walker (1998) Participation works.

167. http://www.oldenburg.de/stadtol/index.php?id=6083

168. The outcome of the public consultations: http://www.montreuil.fr/grands-projets/lagenda-21/les-instances/ The climate and energy strategy: http://www.montreuil.fr/grands-projets/lagenda-21/

169. http://www.london.gov.uk/priorities/environment/climate-change/climate-change-mitigation-strategy

170. http://www.euco2.eu/

171. http://www.grip.org.uk/Home.html

172. New economics foundation – Perry Walker (2003) We, The People - Developing a new democracy.

173. http://www.transitionnetwork.org/about

1.

Virages énergie- creation of regional citizens' energy scenarios

Charles Esmenjaud, Gildas Le Saux, Khaled Gaiji – Virage énergie

Three regional associations called *Virage énergie* (energy turn) exist in France, for now. *Virage énergie* are citizens' movements that aim to find an alternative energy future through the development of energy scenarios.

The creation of such bottom-up, non-institutional but technically serious scenarios is important, to kick start concrete discussions at a local level with stakeholders and local politicians, concerning the orientation of a low carbon future.

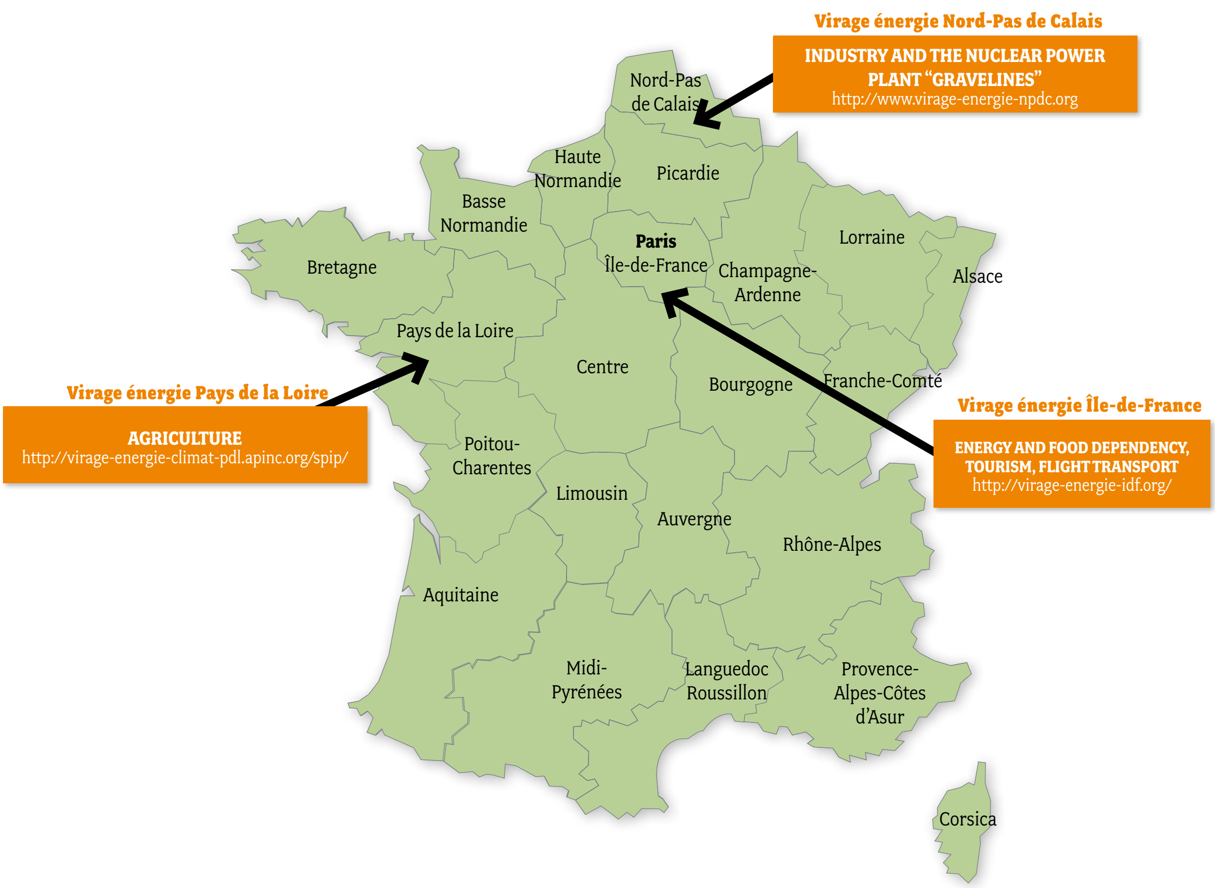
In 2010[174] a law was adopted that obliges all French regions to create low carbon energy scenarios (à article on page I.2). In light of this, these citizens' initiatives are extremely valuable, as they represent a counter-proposal, an alternative strategy, including the option of a nuclear phase-out, which is ex-ante excluded from the institutional exercise.

These three associations see themselves as citizens' initiatives whose challenge is to find a balance between the necessary technical knowledge (expertise) and the free expression of civil society on what an alternative energy future should be.

The integration of social aspects in the definition of a low carbon future vision is also considered to be crucial. The linking of technical, economic and social issues leads to a highly complex exercise – especially considering that the work of the associations is achieved solely by volunteers.

174. Grenelle Act II - Article 68: http://www.legifrance.gouv.fr/affichTexte.do?cidTexte=JORFTEXT000022470434

Figure 22 - Map of Virage énergie initiatives



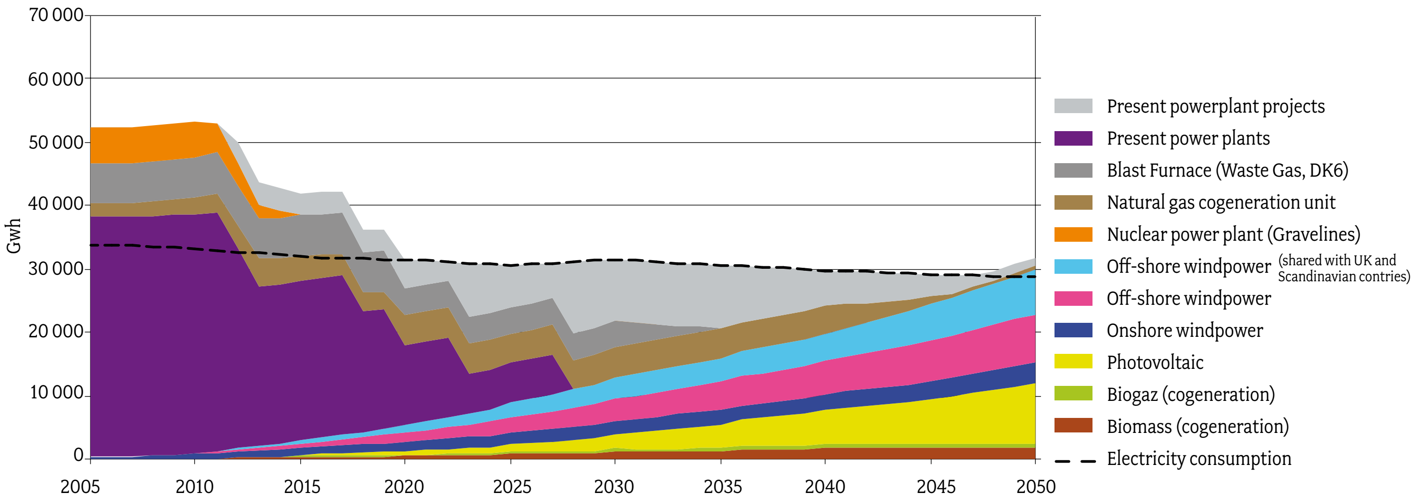


Figure 23 - Virage énergie Nord-Pas-de-Calais electricity demand and supply

Amongst the common objectives of the three initiatives are a nuclear phase out and the development of renewable energies, but beyond these principles the three *Virage énergie* are focusing on different regional key-areas because it is essential to find local solutions to local specificities:

VIRAGE ÉNERGIE NORD-PAS DE CALAIS

The initiative *Virage-énergie Nord-Pas de Calais*[175] (VE-NPdC) published in 2008 a comprehensive and technically detailed energy scenario. It shows that it is possible to reduce the regional CO_2 emissions by 75% in 2050, without renewing the nuclear power reactors that were built in the 1980's in the western part of the region (*Gravelines*), and without losing the economically important and highly-emitting steel industry based in the region.

Reduction in demand, increased energy efficiency and the use of renewable energies are the solutions proposed in this study. The proposals are based on the efficiency and renewable energy potential of the region, including off shore wind importation from the nearby English Channel. The decision was taken to replicate and adopt the basic hypothesis (in terms of economic development, evolution of mobility...)[176] of an official national energy scenario, in order to raise the credibility and audibility of the study.

From early 2008 to mid-2011, NGO activity has mainly consisted of communication and lobbying work, disseminating the results via public conferences and meetings with local and national politicians. More than 150 presentations - with discussions and debates - have been organized, aimed at different audiences: local authorities, universities, politicians, NGO's, trade unions... More than 3,000 people were subject to these productions, which in parallel led to several articles and interviews in the regional and national media. No more than a dozen volunteers conducted these activities!

The Regional Council of *Nord-Pas de Calais* and the local authority of the *Lille Metropolitan Area* carried out some of their own prospective studies on the basis of the *Virage-énergie* scenario.
Some regional policies have been influenced by the recommendations of the *Virage-énergie* scenario, namely the development of regional heating based on a solar energy development plan, and the efficiency improvement plan for electric engines belonging to regional industries.

The study also had an impact on the motion adopted by the Regional Council of *Nord-Pas de Calais* in April 2011, which urges the central government to implement an energy transition plan, including the decommissioning of the *Gravelines* nuclear power plant and the reduction of greenhouse gas emissions.

VIRAGE ÉNERGIE-CLIMAT PAYS DE LOIRE

The project *Virage Energie Climat Pays de la Loire*[177] (VEC) started in spring 2009 with three meetings of several associations involved in energy, climate and environmental issues: Alisee[178], the local Attac group[179] and the Network Sortir du nucléaire[180] (Nuclear phase out). Following these meetings an autonomous association was created in September 2009, when over 60 people attended the official launch of the *Virage énergie* study.

175. http://www.virage-energie-npdc.org
176. http://www.virage-energie-npdc.org/telech/chapitre1.pdf
177. http://virage-energie-climat-pdl.apinc.org/spip/
178. http://www.alisee.org/
179. http://www.france.attac.org/org/
180. http://www.sortirdunucleaire.org/

Figure 23 - Meeting Virage énergie

With the creation of working groups corresponding to the topics of the main chapters of the future scenario (agriculture, building, transport, renewable energy production, lifestyle...) the adventure started. Agriculture, an important economic sector in the *Pays de la Loire* region, is responsible for 40% of the greenhouse gas emissions of the region. So it was important for the study to focus specifically on this sector even beyond energy concerns. The putting together of the scenario is based on the official regional energy balance and GHG emissions inventory.[181]

The success of the overall initiative will depend on the implication and effectiveness of the different working groups. It is indeed difficult to mobilize volunteers for technical and theoretical work, which does not yield immediate and tangible results. However, a progress report was published in October 2010 summing up the work achieved.

Relationships have been established with regional state agencies and local authorities[182] and VEC will participate in the technical committees of the official regional scenarios process (→ Chapter I.2) and the future regional climate and energy action plan.

The association is composed of volunteers only, has approximately thirty members and publishes an electronic newsletter[183] sent to its wider network of over 120 people. One important step is to obtain financial support in order to pay a consultancy firm, which will validate the technical and political work of the association in order to ensure the viability of the scenario.

Two press conferences and two public conferences on alternative energy futures were held in Nantes and Angers concerning the nuclear disaster in Fukushima. Other requests soon followed (public meetings and NGO gatherings), showing the importance of a citizens' movement aimed at an alternative future without nuclear energy.

VIRAGE ÉNERGIE ILE-DE-FRANCE

The association *Virage énergie Ile-de-France*[184] was created in the spring of 2010. The objective of the association is the creation of an energy scenario for the region Ile-de-France responding to following criteria:

- at least a GHG emission reduction of 75% by 2050[185]
- a nuclear phase out
- a reduction in the energy and food dependency of the region
- a decrease in social inequality and fuel poverty. In order to envisage the necessary transition, different working groups on sector-based (agriculture, transport...) and transversal issues (lifestyles) have been created. Regular plenary meetings and daily seminars are also organized. Volunteers carry out all the work.

The study is based on the concept developed by the association négaWatt[186], the so called "energy triptych": in order to be able to cover your energy demand with renewable energies is it important to reduce energy consumption by energy sufficiency and efficiency:

The study will take into account the specific situation of the *Île-de-France* region.

- the region only covers 11% of its energy needs with its own resources
- the region has a largely single-crop agricultural policy: it produces 159% of its wheat needs but only 0,5% of its meat consumption
- 37% of the emissions are due to aviation, given the presence of 2 international airports
- Paris is one of the main tourist destinations in the world: tourists add 3,9t CO_2ec to the per capita emissions of each inhabitant of the region (7,2tCO_2ec)[187]
- social inequalities and urban segregation due to high land prices.

181. http://ores.paysdelaloire.fr/973--les-puits-a-carbone-et-a-methane-.htm

182. ADEME (French Environment and Energy Management Agency), Regional Council of Pays de Loire, the city of Nantes etc.

183. http://virage-energie-climat-pdl.apinc.org/spip/

184. http://virage-energie-idf.org/

185. This is also the official national objective fixed in 2005: http://www.legifrance.gouv.fr/affichTexte.do?cidTexte=JORFTEXT000000813253

186. www.negawatt.org

187. Région Île-de-France (2010) *Livre Blanc - Pistes d'action pour le Plan regional pour le climat*. - http://www.iledefrance.fr/missions-et-competences/environnement/limiter-leffet-de-serre/le-plan-climat-regional/

2.

Mapping for change and climate change mapping

Chris Church - Low Carbon Communities Network[188]

Community action has a critical role to play in tackling Climate Change but little research has been done to assess the real current level of grass roots activity. There are good examples everywhere, from behavior change and energy saving through to community-managed renewable energy systems. If these are to flourish then it is important to understand what is really happening.

The idea of mapping local action on climate in the UK in all its forms has come from collaboration between Mapping for Change[189] - a social enterprise that focuses on environmental and social justice – and the Green Alliance, a national think-tank. Research started in 2010. Mapping for Change played a key role in this, developing two on-line 'climate action' Community Maps. MfC have developed a web based mapping platform based on Google Maps that enables civil society to make the most effective use of Geographical Information Systems (GIS) and on-line mapping. Alongside this we have developed a process of engagement, which enables communities and organizations to visually represent their information, helping them to gather and exchange knowledge, draw new links and develop new ideas.

Mapping for Change worked with local partners in two areas. In north Dorset, a rural area in south-west England we worked with Dorset Climate Alliance. In inner-city Newcastle upon Tyne we worked with a major civil society network. It was agreed that the maps would in the long term become the property of the local people who could then use and develop their map in the years ahead.

In north Dorset (an area of 40,000 people) seventy organizations and projects are currently mapped for[190]. These include 16 'climate and environment' groups, and 17 'food projects'. There are 13 community energy projects. Only ten general community groups listed themselves. This suggests a high level of local climate-related action – if this was at the same level across the UK it would suggest some 18,000 climate / environmental groups, a figure some 50 per cent higher than previous estimates. Similar conclusions would infer 16,000 local energy projects, which seems likely to be a high figure.

In Newcastle seventy-two organizations and projects are mapped (for an area home to about 60,000 people[191]: Here there are just 11 'climate and environmental' groups, 4 'energy projects', 5 food projects and 28 'community and voluntary' organizations. Of the four energy projects only one is really a 'community' project; others include a university building with a photovoltaic roof and the national offices of National Energy Action. This shows that there is plenty of activity in both areas, although the richer rural area is more focused on 'green' issues than the deprived inner-city. One challenge is to share the lessons that are being learnt in these different areas.

Theses local maps have recently been incorporated into the UK Climate Action Map using the same Community Map platform with the UK Low Carbon Communities Network. The map[192] can be seen and contributed to at (see picture) Around 280 organizations/projects are currently mapped (excluding data from the two local maps), and more are adding themselves every week. It is a simple and effective of disseminating information, can encourage communities to feel part of a bigger picture and enables a range of stakeholders to see what is really happening.

Figure 24 – UK Climate and community Action Map

188. http://lowcarboncommunities.net/contact-us/
Chris Church: chrischurch@cooptel.net

189. www.mappingforchange.org.uk

190. www.communitymaps.org.uk/NorthDorsetClimateAction

191. www.communitymaps.org.uk/NewcastleClimateAction

192. www.communitymaps.org.uk/ukclimateaction

Conclusion

Putting together credible, methodologically sound, local low emission scenarios is, at first glance, a highly technical task. Access has to be gained to local data, an emissions inventory and an energy balance have to be established, local energy efficiency and renewable energy potential have to be calculated...

But all these ostensibly technical aspects imply choices that have political impacts:

- Does the renewable energy potential cover the whole range of what is technically feasible or do features of social and economic acceptability limit the potential? The evaluation of economic and social acceptability of renewable energies is easily influenceable by the desirability of renewable energies, as considered by the decision makers. If these aspects are integrated in the definition of a local potential, they are nevertheless imposing a limit on what is possible and what is not.

- The choice of the emission scopes for inventories is, on the one hand, a practical decision concerning data availability and accuracy and the prevention of potential double accounting, but on the other this choice is highly political, as it changes the pattern of responsibility. If up-stream indirect emissions are considered in the inventory, the responsibility is assigned according to the principle of consumption and not production. And even if the local capacity to act on foreign emission sources or the international trade system is limited, it is very important to take these emissions into account, because our unscrupulous lifestyles and unlimited consumption are the major reasons for resource depletion and climate change. Climate responsibility must not end at the border!

- The "simple" act of getting committed to an emission reduction objective is already largely based on political considerations and not necessarily on feasibility: this can potentially create an "emission gap" between the objective and the existing potentials and political measures put in place to achieve the target.

This diagnosis of the underlying political dimension leads straight to an important message of the publication: even the most detailed, highly elaborate energy and climate scenario is only a tool – it can foster decision making but it can never replace political will and commitment.
It shows possible developments coherent with the applied assumptions on efficiency, energy potential and impacts on political measures, but it remains nevertheless a theoretical, lifeless exercise if it is not used for lobbying activities by NGO's, or in order to support decisions taken by the government.

Different actors aim at different objectives and that influences targets and methodological choices. While local authorities have to respect the limits of their governance capacities, civil organizations develop scenarios that contravene these thresholds by developing local scenarios that will include, for example, a nuclear phase out.

Local policy cannot replace national commitment, but local climate and energy policy is, in many regards, interesting and important: local strategies have to take into account the particularities of the territory in question, which often differ considerably from the national averages, and must reconcile concretely economic activities with social and environmental considerations.

It is emerging that local authorities and regions are increasingly and voluntarily adopting ambitious climate and energy targets at their level, which go beyond state commitments. The concept of 100% renewable energy territories, for example, is no longer considered as an unrealistic green reverie.

The citizen and stakeholder involvement in the definition of local energy and climate strategies remains a democratic challenge for all local authorities, but it is vital that a socially acceptable transition process occurs - that has to go beyond even the transformation of the energy system - to respond to the urgency of climate change mitigation and adaptation.

No single scenario will predict the future and what we must do in a clear, step-by-step instruction manual, but robust strategies emerge in all scenarios and give general guidance on necessary climate policy.

Thomas Watson Jr., the managing director IBM, said in 1945: "I think there is a world market for maybe five computers". We know now how wrong he was. But humanity should certainly not do the opposite, by trusting in a miracle technical solution that will redeem us from today's responsibility for tackling climate change. We are part of this planet, and we won't survive if we tear it apart; it would certainly not be fair to wash our hands of it by passing this responsibility on to future generations.

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