Low Carbon Societies Network

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SEVENTH FRAMEWORK PROGRAMME

New Scenarios
Expert Meetings
and Delay of the Project

News from the ENCI Lowcarbon Project and the Low Carbon Societies Network

The German and French partners of the project have been busy in the last few months with *expert meetings.* They have gathered national experts in the two countries in a number of sectors that are key for the transition to lowcarbon socities. The first *4 expert meetings* are reported in this newsletter. Longer reports from the meetings are available on the website.

Futher, the *scenarios for Germany and France are being developed and improved*, by the academic project partners, respectively PIK in Germany and CIRED in France.

The German and French partners are also preparing the next step of the project with the German and French stakeholder dialogues that form key parts of the project.

In the meantime, INFORSE-Europe has been increasing the *database of experts and NGOs* and have been *collecting scenarios* with at least 80% CO_2 reductions by 2050. It has collected national scenarios as well as EU-wide ones. More than 25 such scenarios are now described on the project website and the task continues.

The project period has been extended until March 2012.

If you would like to join the network as NGO or expert, please sign up on the website: www.lowcarbon-societies.eu .

Support: 100% Sustainable Energy on Facebook

Join Our Event at EUSEW'11 April 14, 2011

EU Sustainable Energy Week

Visit Us at the EU Green Week'11 May 24-27, 2011

Exhibition stall: INFORSE-Europe

GREEN WEEK

Roadmap2050 Leads the Way, but we need more options on the table

The EU Commission's new climate Roadmap2050* gives an unprecedented direction towards a low carbon future with a scenario for 80 % reductions of greenhouse gases until 2050, responding to the call of the EU leaders for 80-95% reductions.

While it is really welcome that official bodies are working with ambitious scenarios, we still miss the scenario for the 95% reduction, as called for by the EU leaders.

A 95% reduction scenario would most likely include a 100% renewable energy supply, and strong measures to reduce emissions from agriculture, industrial gases and waste. There are already several scenarios for 100% renewable energy by 2050 or earlier, as documented on our Low Carbon Societies Network website. Now the EU should include such scenarios in the debate about Roadmap2050.

** Roadmap2050, Communication from the Commission, COMXXX/2011 of March 8, 2011.*

This newsletter is published by the *"Low-Carbon Societies Network"* project, financed by the European Commission's 7th Framework Program for Research (FP7). The project's official name is *ENCI-LowCarb* or *"European Network Engaging Civil Society in Low-Carbon Scenarios"*. The project period is 2009-12.

The project's aims include the creation of a European network on energy scenarios to facilitate information flows between Civil Society Organizations (CSOs) and research institutes in Europe about low-carbon energy scenarios and technologies.

We want to establish a lively exchange concerning existing scenarios and examples of best practices already in place today that will be indispensable in meeting the requirements of a low-carbon society.

If you want to join our network, please contact the Project Team. Alternatively, you can register on the web site, as well as subscribe to this newsletter.

Our Project Team builds ambitious energy scenarios for 2050 for Germany and France. In the process we meet with stakeholders to build support for the scenarios and to identify measures that might counter negative social and economical impacts.

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French Experts: Transport & Power Sector

Highlights from expert workshops on February 14 2011, and December 13, 2010. *By Sandrine Mathy, CIRED, France*

Transport Issues

Political and Planning Solutions

Different political measures have to be applied in order to influence the various drivers of the increasing individual mobility. For instance, to reduce emissions due to commuting, car-sharing or special shuttle systems connecting working places with the nearest public transport station can be organized. Long-term urban planning could reduce urban fragmentation and the separation of working and living spaces.

For road freight, there is a consensus that the balance should be changed to more rail and inland waterways transport, but this will need political measures.

One possibility is the taxation of road transport to finance rail infrastructures.

Technical solutions / behavioral changes

The contribution of technology (improvement of efficiency or new technologies) and behavioral changes differs among low carbon scenarios. The NégaWatt scenario from 2006 includes no electric vehicles and no biofuels. The scenario from the German Environmental Ministry (2008) includes only a marginal share of electric vehicles and hydrogen, and it is quite hesitant with the deployment of biofuel. For both scenarios an improvement of efficiency is the key strategy.

In the scenario "Zero Carbon Britain" (from 2010) the majority of the transport carbon savings comes from efficiency savings and new "fuels" (electricity).

Electric vehicle and biofuels

The French government has announced in 2009 that France will develop the electric vehicle. It is obvious that the deployment of plug-in vehicles means a change of the mobility structures. An electric vehicle will only be valuable (at least for the next decades) in a short distance context, so it is important to avoid that electric vehicles replace zero-emission transport modes (bicycle and walking).

Hybrid vehicles are showing wider deployment opportunities and should be observed closely.

There is a general agreement that a strong deployment of 1st generation biofuels is economic, social, and ecological non-sense.

Impact of the electric vehicle on the grid stability and peak capacity

If a significant portion of the vehicle fleet is composed of hybrid and electric plug-in cars, the impacts on the power systems can be considerable. Recharge in the evening (during peak consumption time) may increase the level of the peak demand.

The following figures shows the impact on peak level and price for a linearly growing stock of electric vehicles to 10 million by 2050.

In conclusion: The large-scale use of electric cars requires an intelligent management of battery charging.

Power Sector Issues

The drivers of the investment decision

One of the challenges for modeling the evolution of the electricity sector in a liberalized market is the representation of the investors' behavior, especially through the economic criteria justifying their decisions for investing or not.

Observations shows that investment decisions in the power sector tend to favor short payback periods because of uncertainties.

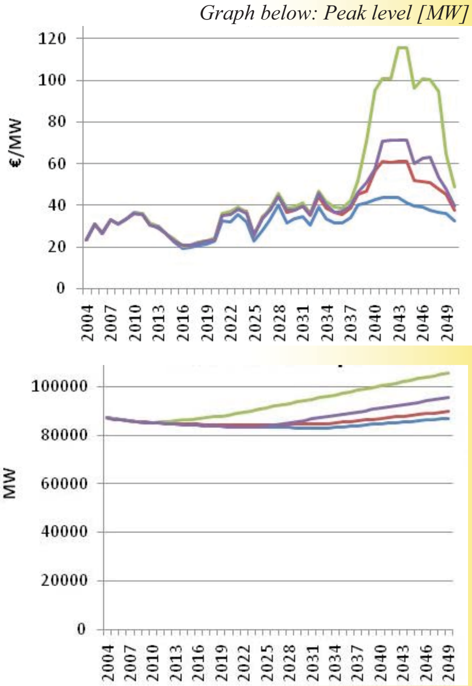
Usually private investors have a lower risk aversion than public investors, but it appears that the discount rate used by investors is strongly linked to the nature of the technology.

To reach 2020 objectives related to renewable energy and to greenhouse gas (GHG) emission reduction as well as to orient investments in specific technologies, the society will have to provide coverage on the investment risk inherent to some technologies, to reduce the risk premium for investors.

The lack of investment in peak-load capacity

One of the specific issues in France is that the high proportion of electric heating in France creates a peak demand that requires the use of power plants operating a few hours per year only. These facilities are hardly profitable. As a consequence, France experiences a deficit of investment in these specific capacities. The recent law NOME (Electricity Market New Organization) assigns to the French electricity suppliers an obligation for investing in peak power capacity.

Graph above: Electricity mean price [EUR/MW]
Graph below: Peak level [MW]



Graph colours on Electric Vehicle (EV)
Blue: Without EV; Black: EV Base load;
Green: EV Evening; Lilla: EV Night.

Another issue related to the evolution of the French power production is the reliance on imports to solve the problem of peak capacity. Imports are indeed a major criteria in investor decisions in France. Most of the time, the marginal power plant in the French electricity generation mix is a German (coal) power plant.

The large imports questions the legitimacy of modeling the electricity sector at the national level and pushes for a broadened analysis focusing on the Western European mainland.

Transmission grids

High-voltage grids will integrate large production units in remote areas, including offshore wind-farms. This should go hand in hand with improved interconnection. These developments call for a stronger planning, especially since the installation of power lines creates local opposition. The issue of cost allocation between actors (producers, suppliers and consumers) for the financing of this grid development is also a critical but still unresolved issue.

Distribution grids

The development of medium and low voltage grids are required to effectively manage the system that will become more complex with the integration of intermittent energy sources at a decentralized level and the development of demand side management and smart meters. There is so far little exercise on the deployment of intelligent networks.

Climate Policies in the French Residential Sector

Two studies were compared by French researchers from CIRED and NGO-representatives from RAC-France on a seminar on climate policies and the state of the art of modeling for the residential sector on January 26, 2010.

By Sandrine Mathy from CIRED, and Meike Fink from RAC-France

The first study relies on a bottom-up approach: *"Housing Factor 4: CO_2 emission mitigation related to thermal comfort in housing by 2050"* from IDDRI, 2010. This study includes 4 scenarios with different priorities for the 3 main energy forms for space heating: wood, gas, and electricity. The demand reduction follows the same trajectory for all scenarios where all existing buildings are supposed to be retrofitted during the next 40 years.

In all scenarios, the final energy demand for heating is halved by 2050 and the governmental objective of 38% reduction of primary energy for heating and hot water production by 2020 is reached. These results are reached due to optimistic assumptions related to the availability of wood resources, as 100 TWh of this energy resource is needed for energy scenarios favoring wood.

Besides, the emission reduction of the residential sector can be considered highly optimistic. The high wood scenario achieves a reduction of -94% of the CO_2 other scenarios have less reductions.

The second study was realized with the Imaclim-France model, which is a hybrid techno-economic model.

The approach is based on an economic efficiency approach. It assesses the techno-economic impacts of policies and measures, both existing measures and additional measures.

Results are much less optimistic than those of the bottom-up study:

Existing measures are not ambitious enough to reach governmental objectives (-38% between 2008 and 2020 of primary energy and -75% of CO_2 emissions by 2050).

Additional measures are necessary: a high carbon-energy tax, the extension of fiscal measures, of tax discounting and the implementation of a retrofit obligation. The study also shows that fiscal incentives are less efficient than regulation, that policies dedicated to energy efficiency improvements have to take into account the rebound effect, and that the carbon energy tax is important.

The comparison of these two studies shows that:

- The question of wood resource availability and of the structure of timber industry is decisive to reach mitigation objectives.
- The rebound effect can deter the efficiency of energy efficiency measures.
- The question of the evolution of the CO_2 content of the electric kWh for heating is also decisive.

System compatibility? Conventional vs Renewable Energy

Highlights from a German Expert workshop, 28 October 2010, Potsdam, Germany.

For achieving ambitious climate protection targets, Germany faces the big challenge of transforming the structure of the energy system to renewable energy within a few decades.

Due to the peaks in wind power, there are increasing variations in supply. In some cases renewable supply have to be regulated, e.g. by switching off wind power plants. The reason for this is mainly due to the limited capacities of the grid transmission lines. Awareness about the problem regarding the extension of grid capacities already exists - at least among experts.

There are, however, less public attention regarding the increased regulation needed with increasing windpower to balance demand and supply. In principle, several technical and institutional solutions are at hand to handle the problem of balancing. These are (a) application of storage technologies, (b) demand side management (DSM) by so-called smart grids, (c) balancing of supply by a European power supply network or the domestic market, (d) virtual power plants for concerted supply, (e) increased regulation of thermal power plants (both fossil and biomass fired plants). The question remains if and how these solutions can be implemented by a concrete political design during the transition phase.

In order to provide reliable renewable energy supply, substantial investments into storage technologies would be required. But the potential of some of these technologies (e.g. pumped-storage plants) is limited. Other storage technologies are not yet mature enough to be operated in a business environment. Alternatively stronger networks need to be built that can balance the variability by regionally different conditions. A network expansion however often encounters problems due to its public acceptance.

It is crucial that coal and gas power plants can provide the required flexibility. Moreover, it remains an open question whether fossil power plants may still be used when aiming for ambitious emission reduction targets. Therefore, this problem is sometimes called "system conflict" which means that the additional deployment of new fossil power plants must be ruled out in face of a transition strategy towards a completely renewable power supply.

But even if a further deployment of flexible fossil capacity was desirable, the future market situation could probably not offer sufficient incentives. The reason for this is the electricity market's marginal pricing design: a higher fraction of renewable energy sources reduces the demand for more expensive medium and peak-load capacities and therefore also the average price level. Furthermore, the price margin reached in the course of a day is reduced, which is the crucial economic criterion for the employment of storage capacities. Thus, a development and deployment of modern storage technologies could be substantially delayed.

Full summary by Brigitte Knopf, Michael Pahle, Falko Ueckerdt (PIK), at: www.lowcarbon-societies.eu .

Modeling the French Power Sector for Low Carbon Scenario Development

By Sandrine Mathy and Ruben Bibas, CIRED, France

Modeling the evolution of power sectors in Europe presents many challenges. While liberalization aims at implementing the most profitable projects, reaching European renewable objectives requires governmental regulation and support policies. In the end, the power sector is a hybrid market. Within the ENCI-LowCarb project, CIRED has developed a power sector model that focuses on these features specifically for France.

Specificities of the French power sector

The French power sector has been historically structured after the Second World War with the deployment of nuclear technology. Today 63 GW of nuclear capacity (for a peak demand equal to 94 GW) are operated by Electricité de France (EDF) and produces 78% of the electricity consumed in France. The oldest nuclear power plants are arriving at the end of their life time and the last nuclear plant should be closed around 2035. Therefore the question of power capacity renewal is urgent.

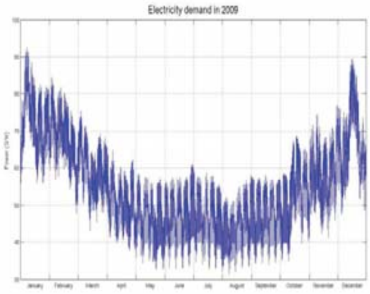
In order to ensure commercial outlets for nuclear energy, electric heating has been extensively developed. This has lead to a French specific feature: the daily peak load level in the evening in winter keeps on increasing (last record occurred in December 2010) and the temperature sensitivity of the French power sector is particularly high (each degree below 0°C requires 2.3GW of additional capacity i.e. 2% of total capacity). As a consequence the daily load in France presents very high seasonal variations.

This problem, to ensure the security of the system as increasing peak load, requires the investment in power plants that would be used only a few hours each year. These investments are not profitable for private investors and there is a constant risk of shortage. This shows that the shape of the load curve in France is decisive for the development of the power system.

Description of the model

In CIRED, we have built a power sector model to represent the evolution of the French power sector. It includes the evolution of demand load shape, the hourly price evolution and the dynamics of investments. It is part of the larger IMACLIM-R model developed by CIRED.

For the demand side, the hourly demand is rearranged in a load duration curve (LDC). The load duration curve allows segmenting the demand into three kinds of demands: the base demand corresponding to the level of capacity required more than 5000 hours a year, the semi base demand between 500 and 5000 hours and the peak demand, less than 500 hours of use. See Figure 1a and 1b.



For the supply side, we represent the investment dynamic in the power sector with investors on the liberalized market looking for profitable investment. To do this, we represent how technologies compete on the spot market. See figure 2.

- Different technologies have different total (investment + production) production cost curves (Figure 2a):
- Some technologies like Techno1 have high investment cost (INV) and low fuel cost (equal to the slope of the curve) to produce one MWh (for example nuclear, hydro, and windpower).
- Other technologies like Techno 2 and Techno 3 have lower investment costs but higher fuel costs (oil and gas power plants).
- In figure 2a, we can see that below a certain amount of hours (H1) during the year, it is less expensive to rely on Techno3 (low INV and high fuel costs) and that above H2 hours during the year, it is less expensive to rely on Techno 1.
- Given these production costs, some technologies will be used for base load, for semi base load or for peak load (figure 2b) to fulfill the LDC and to minimize production costs.
- The spot price (figure 2c) is then equal to the production (fuel) cost of the marginal plant: Techno3 is marginal for H<H1, Techno2 is marginal for H1<H<H2, and Techno1 is marginal for H>H2, so the spot price (the red line) is equal to the production cost (the fuel cost) of Techno3 for H<H1, of Techno2 for H1<H<H2 and of Techno1 for H>H2.
- The profitability for each technology is determined by the difference between income from electricity sales on the spot market and investment + operating costs. The rent for a technology on the spot market is determined by the difference between the spot price and the cost to produce one MWh. This is shown in Figure 2c by the yellow box for Techno 2.

These principles have been implemented in the model in order to represent the investment dynamic for the construction of power plant. The model limits the expansion to projects with a return on investment superior to 11%.

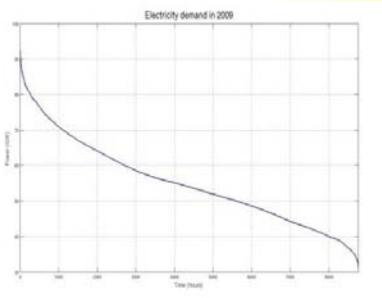
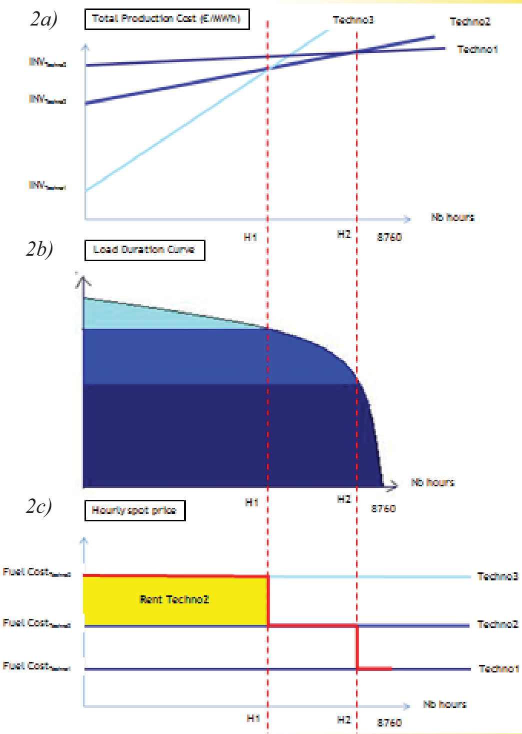


Figure 1: Hourly electricity demand in France (1a. left side) and the corresponding LDC (1b. right above).

Figure 2: How technologies compete on the spot market: Figures from up to down.
2a) Total production cost, EUR/MWh
2b) Load duration curve (LDC)
2c) Hourly spot price, determination of the price on the spot market and the rent for investors.



Scenarios and further work

The model is now calibrated to make scenarios for the French power supply for the period 2009-2050. It is able to carry out an economic optimization with nuclear and fossil fuel power plants, including fossil fuel plants with Carbon Capture and Storage. It can optimize with and without a CO_2 tax on fossil fuels. This has been tested with scenarios with low and high demands and fuel prices.

Further development of the model is ongoing, including work on the possibilities to optimize also the use of demand-side management and renewable energy plant construction, in addition to the current optimization of nuclear and fossil fuel power plants construction.

See longer version of this article at www.lowcarbon-societies.eu .