

Appendix

Policy Studies

ECN, NRG and JRC-IE carry out continuous research in the area of (the attainability and effects of) energy policy. ECN advises on renewable energy policy, energy saving, security of supply and electricity production, as well as climate policy. On this account, ECN calculated the effects of the Dutch energy and climate program *Clean & Efficient (Schoon & Zuinig)* in 2007. Also in 2007, ECN/NRG published the *Energy vision 2050*, which constitutes an ambitious but realistic picture of a sustainable European energy supply in 2050, which currently is considered a “navigational route” for the policy of the Dutch government. The IE played a key role in the coordination of the first EnergyTechnology Map (a description of the potential of fourteen different energy technologies). This was one of most important building stones of the current European strategic energy policy. According to expectations, the intensified cooperation will lead to an even better founded analysis of the role energy technologies can play in the transition to a sustainable European energy supply, and of ways to perform this role as smoothly as possible.

Biomass and biofuels

The global interest for bioenergy and biofuels is growing. Increased use will have an expanding impact on our society. ECN performs intensive research on the production and “sustainable” exertion of bioenergy and biofuels, based on sustainable biomass. A prominent feature of ECN is its torrefaction technology (converting biomass into a fuel with profitable qualities), which enables the co-firing of biomass. The same applies to the MILENA biomass gasifier, which derives Green Gas from durable biomass. The IE works in a European context on drafting sustainability criteria for the production of electricity, heat and transport fuels from biomass.

It is expected that closer cooperation in this area will lead to an improved answer to the question on how to intensify the application of bioenergy technologies in a European context. This should occur with the highest possible energy and CO₂ efficiency, without it having a negative effect on food supply and biodiversity.

CO₂ capture and storage

In the near future, Europe will remain dependent on fossil energy sources and carriers. These are not only increasingly imported from outside the European Union, but their combustion also causes the release of the greenhouse gas CO₂. ECN and IE both work hard on technologies that enable the clean application of fossil fuels, among which CO₂ capture and storage (Carbon Capture and Storage). ECN's showpiece is the SEWGS test installation, which converts carbon monoxide and steam into hydrogen and CO₂. The CO₂ is captured and can subsequently be stored underground. In the near future the SEWGS installation can also be used to produce hydrogen from coal. The hydrogen in turn can be used as transport fuel or for electricity generation. These technologies are also interesting for industrial processes where hydrogen is used on a large scale, such as the refining of unrefined oil and the manufacturing of chemicals.

The IE focuses on the characterization of fossil fuels and co-firing with biomass. Moreover, the IE offers scientific support for initiatives of the European Commission to demonstrate a number of capture techniques and measures required for safe underground storage. Also in this area, increased synergy between ECN and IE will

lead to a better understanding of how energy technology – in this case for the clean application of fossil fuels – can best contribute to the transition to a more sustainable energy system on a regional, national and European level.

Nuclear

Nuclear electricity production is the only comprehensive technique for the generation of energy without CO₂ emissions. NRG is at the forefront of European research on extending the life span of current reactors, and works on building the third generation of reactors. Moreover, NRG researches the fourth generation of reactors. This entails High Temperature Reactors, rapid reactors and reactors cooled by water. This future generation is expected to become available after 2020, and will contribute to an improved sustainability of nuclear energy production. To determine what role this generation of nuclear facilities will play in the future, NRG performs scenario studies. These studies focus on an optimal realization of the nuclear production park with the different reactor types.

In addition, NRG is involved in the PAMINA-research. This project improves and harmonises methodologies for evaluating the safety of the final storage of radioactive waste in soil layers within Europe. The PAMINA project is implemented by 26 institutes and companies from 13 different countries. NRG also carries out material research for a type of reactor that can burn radioactive waste. This would not only generate valuable energy, but would also reduce the lifetime of nuclear waste by a factor 10. This technology may prove to be an important contribution to the sustainability of nuclear energy.

Nuclear fusion is an important option in the sustainable generation of energy in the second half of this century. At this moment, the first fusion reactor in the world, ITER, is being built in France. NRG, with her knowledge of materials, is an important partner in this project.

The IE focuses on the safety of existing as well as future types of reactors. Special attention is devoted to the safety of reactors built after the Russian model in the new Central and Eastern European member states of the European Union, and in the former Soviet republics. Another focus of attention are the intrinsically safe reactor types. The IE also accommodates the Clearinghouse for nuclear safety, which is devoted to spreading knowledge and experience in the area of nuclear technology safety more efficiently.

Hydrogen and fuel cells

Hydrogen and electricity are generally regarded interchangeable energy carriers for the residential and transport sector in the future. ECN has a strong position in the field of research on efficient and reliable fuel cells and fuel cell systems suitable for the transport sector. The IE aims at development and harmonization of test methods to measure the reliability and benefit of hydrogen storage and fuel cells objectively in applications that are relevant for companies. By applying unique test facilities, it is possible to test fuel cells under every possible working condition. The IE also operates as expert for the European Commission in establishing license conditions for hydrogen cars on a European and global level.

ECN and IE play a prominent role in the Joint Technology Initiative on Fuel Cells and Hydrogen, the first European Industrial Initiative within the SET-Plan. The intensified cooperation will make Petten stand out as the European centre for hydrogen and fuel cell technologies.

Solar energy

An important goal of ECN Solar Energy is to develop technology that contributes to a further decrease in generation costs, to the level of the consumer price for electricity. ECN investigates the various solar cell technologies, each with a different time frame for application. In the field of crystalline silicon solar panels, presently attending to 90% of the present market, ECN aims at cost reduction of materials and the production process, as well as the improvement of panel efficiency. Furthermore, a substantial part of the activities are directed towards technologies for the more distant future. This research consists of the development of thin-film silicon on foil as well as research on the improvement of the efficiency and stability of organic solar cells.

In short, the technologies developed by ECN pave the way towards cheaper, more efficient solar panels. This closes the gap with consumer prices for electricity considerably.

JRC-IE possesses a test facility for certification of solar panels in conformity with international standards. The European Solar Testing Institute, among other things, takes care of the accurate calibration of the test cells and modules of ECN.