Structural changes in the energy market

Thinktank on Energy Market Reform
Appendix 1

Appendix 1
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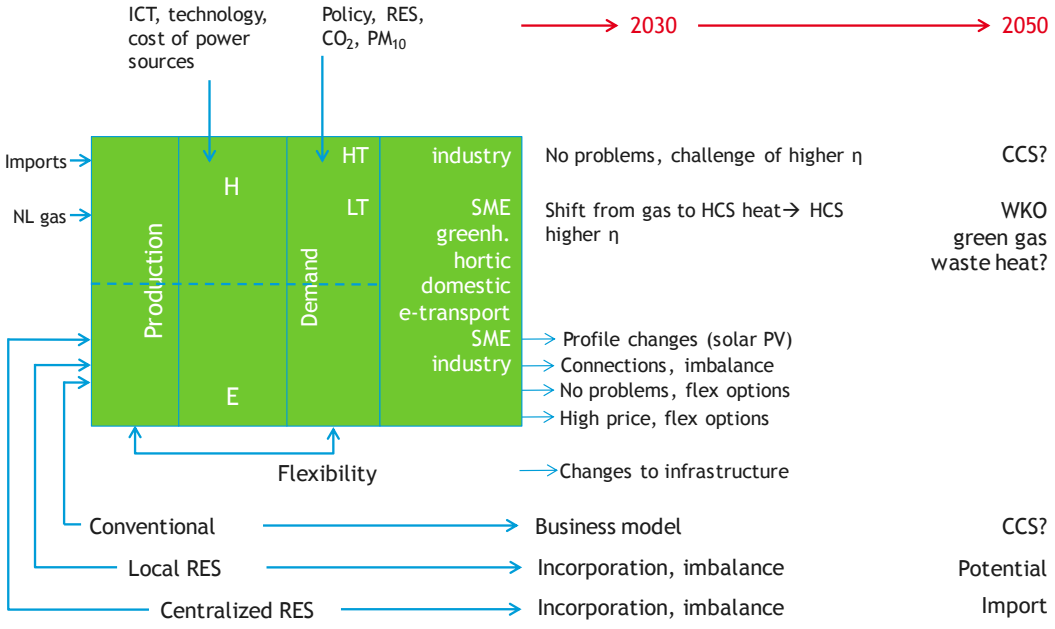
1 Aim of this appendix

This appendix aims to provide insight into issues perceived by thinktank members as problems or opportunities. It makes no pretence at giving a systematic account of all the problems and opportunities involved, just the main ones.

2 Principal trends - Netherlands

Most members are agreed that the energy system is set to undergo substantial change over the next few decades. While some are already experiencing the changes themselves, for most they still lie ahead. The energy system is in for a period of rapid evolution, from centralised to more distributed, with more renewables, more electricity, greater potential for load control, more efficient technologies. In Figure 1 we have endeavoured to summarize the main thrust of the key trends in the electricity and heat market.

Figure 1 **Schematic synopsis of main trends in the energy system (H = heat, E = electricity, HT/LT = high/low temperature, RES = renewable energy sources, CCS = carbon capture & storage, HCS = heat/cold storage)**



For the period through to 2030, these trends can lead to problems in the following areas:

- managing imbalance;
- business modes for both renewable and conventional energy sources;
- shifts in government tax revenues;
- higher efficiencies in both electricity and heat production;
- securing renewable energy targets.

They can also generate the following opportunities:

- development of distributed renewable sources, for both power and heat;
- exploitation of dispatchable ('connect/disconnect') capacity (flexibility).

2.1 Technical and financial trends

Electricity

Over the past few decades fossil-fueled power generation has become more efficient – in theory, at least, because for much of last year the most efficient plant was not on stream, since merit order is ultimately determined by marginal costs. There are problems on the demand side, too. Despite the wealth of high-efficiency technologies and appliances available on the market, around 25% of savings potential is still not being exploited, whether by households or industrial consumers. One key technology that will continue to suffer in the years ahead is cogeneration, which is simply unprofitable as prices stand at the moment.

Current developments regarding Dutch overcapacity and the low coal price are not in themselves structural problems – they can occur in any market. More fundamental is the fact that the business model on which conventional power stations have always operated is no longer working. Major inputs from intermittent capacity (at present mainly from abroad) mean hours on-stream have fallen substantially. At the same time we see enormous price fluctuations in countries with a larger share of wind and solar photovoltaic (PV) in their mix. In this context it is worth recalling that today's volumes of solar PV and wind are still far short of what is required to meet the EU targets set in the Renewable Energy Directive (RED), which means the share of these sources is set to increase yet more dramatically.

What has also been realized the past few years is that the Netherlands is not an island within Europe, but that prices are formed in complex interplay among numerous European nations, with today's vastly expanded electricity market mainly the result of far greater interconnection. Owing to substitution in both the heat market (heat pumps) and mobility market (electric vehicles), electricity is becoming ever more important as an energy carrier.

Gas

In the gas market, the first cautious steps are being taken to feed in green gas, as yet generally from only very small-scale facilities. In contrast to the electricity market, renewables do not yet represent a robust overall strategy, but there is potential for hydrogen feed-in (Power to Gas) and for gasification of imported biomass, which means the gas market may be able to play a role in maintaining balance in the electricity market and boosting the share of renewables in the mix.

Demand for natural gas in the heat market is declining, the result of improved insulation and use of alternative energy sources like heat/cold storage (HCS) and waste heat. The key question is: what does this mean for the gas infrastructure in the coming decades and for coverage of its operating costs? On the other hand, there will be new potential for local use of (natural) gas in cogeneration plant with a high overall efficiency (fuel cells).

At the same time, the European gas market is expanding, from the Balkans (to Russia) and Southern Europe (to Africa), while gas production in the Netherlands is coming up against constraints (earth tremours in Groningen). What impacts will all this have on our country's position as a gas producer and for its national gas strategy?

Heat

Most of the energy we use is for heating, whether high temperature (industry) or low temperature (buildings, greenhouse horticulture). Transporting this heat is expensive compared with transport of electricity and gas. But because heat is relatively cheap (waste heat) or renewably sourced (geothermal, biomass, heat pumps), and because renewable energy targets are a political reality, new opportunities for innovative solutions emerge. On the other hand, fossil-sourced heat (in the urban environment, natural gas) is in for tougher times once those political targets are translated into legislation and prices.

Distributed heat and power

Future growth in electricity production no longer lies in large-scale power stations, but above all in distributed renewable energy sources (RES), in terms of both capacity and output. Certainly given the SER[1] Energy Agreement for Sustainable Growth, this segment of the market is set to be given a new boost, with new players emerging in the coming years, adopting new business models. But while the tax measures and feed-in premium arrangements in place today are a good incentive in the near term, when operational on a larger scale may lead to problems in terms of costs not being paid by those causing them. At the same time, distributed renewable heat projects (HCS, geothermal heat, biogas cogeneration, etc.) also affect the range of realistic options for meeting demand for both heat and power.

At present, local initiatives are driven mainly by enthusiasm and volunteers, but in the coming years there is bound to be professionalization, with new business models being developed. Besides renewable sources and more efficient technologies, demand response and comfort are also set to play a greater role.

2.2 National policy

Dutch energy policy is driven increasingly by EU regulations, with environmental performance (CO_2 emissions, renewables) and competition in the internal market now the predominant issues. Within certain bounds, Member States are free to elaborate their own mechanisms for implementation: whether renewable energy is rolled out via subsidies or through mandatory obligations, for example, whether the focus is on electricity or heat, whether all energy consumers are to pay the costs, or mainly households. In practice we see a wide range of systems across Europe, but in most cases the bulk of the costs are currently being borne by small and medium-sized entreprises and households.

For various reasons, the carbon emissions trading scheme (ETS) has not become the driving force it was conceived as: the price of carbon is not (yet) providing sufficient incentive for investing in low-carbon systems.

Increasingly, energy suppliers are becoming European players, and this holds for Dutch operators too. A growing number of head offices are now located in Germany, Sweden or France. Energy system investments are now being made in the country offering the highest returns (determined by subsidy levels, among other factors).

[1] The Social and Economic Council of the Netherlands (SER) is an advisory and consultative body of employers' representatives, union representatives and independent experts which aims to help create social consensus on national and international socio-economic issues.

The most relevant pledges in the SER Energy Agreement relate to:
- improved energy efficiency;
- 16% renewables in 2023, including the SDE+ renewable energy incentive scheme;
- tax incentives for local energy projects;
- accelerated decommissioning of old coal-fired power stations.

Against the background sketched, though, no decisions have yet been taken on structural reform of the energy market.

3 Principal trends - EU

3.1 EU policy

In the Netherlands, as in neighbouring countries, energy policies are determined largely by European energy and climate policy. The issues with greatest relevance for future changes in the energy sector are carbon emission reduction targets, the ETS and renewable energy, as laid down in the Renewable Energy Directive (RED) and supporting legislation and regulations.

In addition, the EU has legislation on government support, some of it aimed specifically at interventions in the electricity market. In this context, the EU has recently published national policy directives[2] aimed at:
- renewable energy incentives;
- maintenance of sufficient production capacity;
- consumers, to harmonize electricity demand with fluctuating output.

The Electricity Directive (2009/72/EC) sets a number of market conditions, while the trans-European Energy Infrastructure Guidelines (347/2013) concern infrastructure development. The Energy Efficiency Directive (EED) and other energy efficiency policies such as the ERPD (Energy Performance of Buildings Directive, 2010/31/EU) also affect the energy sector.

European policy, including targets, has already been laid down for the period through to 2020. Policy targets for 2030 are currently being elaborated, with the debate now focused mainly on target levels and the issue of what specific targets are then required[3]. The results of this debate will undoubtedly have major consequences for further development of Europe's energy system. For 2050 a concrete climate target *has* already been set: 80-95% carbon emissions reduction relative to 1990.

The Energy Roadmap 2050 describes the challenges and strategy envisaged for securing this target[4]. One element of the roadmap is an overview of CO_2 reduction milestones for the various sectors, reproduced in the table below. The greatest reductions are scheduled for the electricity sector and the built environment.

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2 http://ec.europa.eu/energy/gas_electricity/internal_market_en.htm

3 http://ec.europa.eu/clima/policies/2030/index_en.htm
The Commission's proposal is anticipated on 22 January, 2015.

4 http://ec.europa.eu/clima/policies/roadmap/index_en.htm

GHG reductions compared to 1990	2005	2030	2050
Total	**-7%**	**-40 to -44%**	**-79 to -82%**
Sectors			
Power (CO_2)	-7%	-54 to -68%	-93 to -99%
Industry (CO_2)	-20%	-34 to -40%	-83 to -87%
Transport (incl. CO_2 aviation, excl. maritime)	+30%	+20 to -9%	-54 to -67%
Residential and services (CO_2)	-12%	-37 to -53%	-88 to -91%
Agriculture (non-CO_2)	-20%	-36 to -37%	-42 to -49%
Other non-CO_2 emissions	-30%	-72 to -73%	-70 to -78%

Source: http://ec.europa.eu/clima/policies/roadmap/perspective/index_en.htm.

In addition, the EU has R&D programmes in the energy field, currently under the umbrella of Horizon 2020, that seek to encourage innovation and technological development on various fronts.

3.2 Relevant developments in neighbouring countries / north-west EU

Some of our neighbours are already market leaders in renewable energy, with the following implications:

1. The Netherlands will feel the consequences, including cheap imported power when sun and wind are amply available, as well as impacts on competitiveness due to electricity price differentials for industrial users.
2. The Netherlands can learn from developments in these countries: what policies have been adopted, what problems have been encountered, and what solutions are being implemented?
3. In pursuit of a coherent, efficient energy market, the Netherlands can seek guidance from policies in place in other countries or, alternatively, follow a course of its own.

3.3 Germany[5]

German energy policy, known as the *Energiewende*, is basically a two-track strategy: phase-out of nuclear power, accompanied by substantially accelerated growth of renewable energy sources (RES). The *Energiewende* covers electricity, heat and transport, but is concerned primarily with the first.

Main policy elements:

- Nuclear power plants are to be retired, the last in 2022.
- A system of feed-in tariffs for RES, regularly adjusted to keep apace with current trends. These tariffs are funded via the so-called *EEG-Umlage*, a surcharge under the Renewable Energy Sources Act. The share of renewables is to increase to 40-45% in 2025 and 55-60% in 2035.
- With nuclear power being phased out, security of delivery is being given particular priority. To this end the *Bundesnetzagentur*, the government agency charged with maintaining sufficient capacity, sometimes enters into capacity contracts with foreign suppliers.

[5] Based on the following sources: http://www.iea.org/Textbase/npsum/germany2013SUM.pdf; http://de.wikipedia.org/wiki/Energiewende#Deutschland; http://www.agora-energiewende.de/fileadmin/downloads/publikationen/Faktencheck/2013er_Zahlen/Agora_Energiewende_im_Stromsektor_2013_07012014.pdf; http://www.erneuerbare-energien.de/die-themen/datenservice/zeitreihen-entwicklung-ab-1990/

- In addition, the (gas and power) infrastructure is being further developed, based on 10-year plans filed in 2012. There is heavy investment in grids at various scale levels.
- Heat policy is focused on thermal PV and building insulation and an EPC standard for new buildings.
- A number of R&D projects on energy storage are in progress.

Results:

- Very substantial growth of installed wind and solar PV capacity, from a little over 29 GW in 2005 to 77 GW in 2012. Over this period there has been particularly strong growth in onshore wind and PV: in 2012 approx. 31 GW onshore wind and 33 GW solar PV was installed.
- In 2013 RES delivered over 24% of German power, compared with approx. 16% in 2010 and 10% in 2005, with wind and solar responsible for 7.9 and 4.5% of the total, respectively (approx. 50 and 28 TWh in 2013). The contributions of biomass (approx. 48 TWh) and hydro (21 TWh) are likewise substantial. Over the period 2010-2013 aggregate RES output increased by 42.3 TWh.
- Despite the acclerated phase-out of nuclear, Germany has remained a net exporter of electricity.
- Over the same period, however,the carbon emissions associated with power generation have risen (by 4.5% since 2010), owing mainly to the marked increase of coal in the fuel mix. These developments are due to the phase-out of nuclear, combined with the low prices of carbon emission credits and coal.
- 60% of the country's renewable energy capacity is owned by private citizens, farmers, business and industry. Energy producers own 12%, financial agencies 13% (data for 2012).

Main current debating issues / bottlenecks:

- The new government has announced that it will be publishing its plans for a major reform of German energy policy in the spring of 2015. This will cover numerous issues, including the following:
  - The costs of the feed-in tariff system and thus the *EEG-Umlage* have risen substantially. In the coalition agreement, plans are presented to improve the cost-efficiency of the policy, among other means by gradually reducing the feed-in tariffs for new installations, making greater use of market-based incentives, and improving policies on distributed power production.
  - To guarantee grid stability, new rules will be introduced for new renewable production capacity, by making temporary disconnection obligatory, for example.
  - The scope for obliging large-scale renewable energy producers to provide back-up capacity is being examined.
  - There will be greater focus on flexibility of supply and demand, intelligent grids, graded tariffs and storage; tenders will be put out for further development of grids, and capacity policy will be elaborated.
- In addition, in the public debate there is also criticism of:
  - the distribution of costs: households and SME now pay substantially more than industrial consumers (who are largely exempted from the *EEG-Umlage*);
  - the limited focus on energy conservation/efficiency;
  - the investment climate – there are definite long-term targets, but the policies for getting there are not yet sufficiently stable.
- Because of overcapacity, many power stations are now unprofitable. Among other things, this has led to a strong lobby for a capacity charge.

3.4 Denmark[6]

Denmark got off to a relatively strong and early start in the renewable energy business, particularly with respect to wind power. Incentives were rolled out from the early 1970s onwards, and in the 1980s the country chose to focus mainly on wind, as an alternative for nuclear. More recently, in 2012, ambitious long-term targets and policy have been laid down in a national Energy Agreement.

Main policy elements:

- The target for the share of RES is 35% in 2020. In that year wind power is to provide around 50% of the country's electricity (roughly a doubling relative to 2012).
- Since the beginning of 2013 oil and gas boilers are no longer permitted in new-build homes, while from 2016 onwards the ban on oil-fuelled heating will also apply to existing buildings with a district heating or natural gas connection.
- To incentivize various forms of renewable energy, a series of subsidy schemes are in place.
- A strategy has been elaborated for the development of smart grids.
- There is a heavy focus on energy efficiency. In 2020 aggregate energy consumption is to be reduced by 12% compared with 2006.
- The cost of expanding the share of RES is passed on to final consumers by means of a Public Service Obligation (PSO). This is a charge on heat (for space heating) that provides the revenue for subsidies on biogas, industrial cogeneration, renewables in industry, etc. This charge is also used to compensate for reduced income from fossil fuel levies. To safeguard competitiveness, electricity and fuel taxes for industry have been lowered.
- To ensure continued smooth operation of the energy market with high feed-in of intermittent capacity, the Nordic Power Exchange (NordPool) has been established jointly with the other Scandinavian and Baltic states. The Transmission System Operators (TSOs) in these countries have set up a spot market trading in 1-hour contracts for the upcoming 24-hour period. Additionally, on the Elbas market electricity can be traded up to one hour prior to physical delivery. There is also a regulated power market and a market for back-up capacity.
- The long-term target is 100% renewable energy in 2050, in all sectors.

Results:

- These policies have resulted in RES providing over 40% of Denmark's electricity in 2011, 70% of it from wind, the rest mainly from biomass and biogas.
- Approx. 50% of the country's dwellings are now connected to some form of heat grid: district heating (via cogeneration), waste heat or geothermal.

Main current debating issues / bottlenecks:

[6] Based on the following sources: http://www.energie-experten.org/uploads/media/DK_Energy_Agreement_March_22_2012.pdf; http://de.wikipedia.org/wiki/Energiewende#Deutschland; http://www.iea.org/publications/freepublications/publication/Denmark2011_unsecured.pdf

- Danish energy policy, including the ambitious targets for 2020 and 2050, enjoys very broad political and public support.
- In Denmark, too, the required investments are an issue of concern, but the stable policy setting ensures a relatively attractive investment climate.
- A 2011 IEA review also concludes that Danish policy is extremely well-designed. Issues requiring attention are progress monitoring and review, grid expansion, particularly in the context of import and export capacity, smart grids and market regulations.

3.5 United Kingdom[7]

The UK has set itself ambitious climate targets: 50% reduction in carbon emissions by 2027 and 80% by 2050, relative to 1990. The main thrust of national energy policy is to achieve major investments in low-carbon capacity, from offshore wind through to nuclear. The main drivers for this strategy are the fact that a sizeable portion of the country's electricity infrastructure has come to the end of its service life (around 20% needs to be decommissioned or replaced in the coming decade) and concerns about growing dependence on oil and gas imports (and price fluctuations) due to declining domestic North Sea oil and gas production. In addition, a considerable amount of antiquated coal, oil and nuclear capacity is scheduled for shutdown in the coming years: all in all, about 20% of national generating capacity (approx. 19 GW, of which 7 GW nuclear).

The principal policy goals are:
- to help households and businesses reduce their energy costs;
- to enable investment in energy infrastructure, thus to facilitate economic growth;
- to play a leading role in the international climate debate.

Main policy elements:
- Renewable energy policy is focused primarily on wind, supplemented by biomass. Between 2010 and 2020, installed wind capacity is scheduled to increase by 65 TWh. In 2020, the share of RES in electrical output is projected to have reached 30-36%, translating to 98-118 TWh (of which approx. 9 TWh small-scale).
- In addition, a major focus on nuclear (16% of capacity in 2012) and CCS.
- RES are incentivized via the Renewables Obligation.
- To achieve the large-scale investments required in the sector (estimated capital expenditure: £ 110 billion) an Electricity Market Reform (EMR) programme has been approved, comprising the following main elements:
  - Contracts for Difference (CfDs), providing longer-term guarantees on returns on investment in renewables, nuclear and CCS. To this end, 'strike prices' are set (in £/MWh), with the government making up the difference between market price and strike price when the former is lower and the producer paying the government if it is higher. The strike prices are to be gradually lowered, while for most kinds of RES

7 Based on the following sources:
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/268221/181213_2013_EMR_Delivery_Plan_FINAL.pdf;
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/254250/FINAL_PDF_of_AES_2013_-_accessible_version.pdf;
http://www.iea.org/Textbase/npsum/uk2012SUM.pdf;
https://www.gov.uk/government/policies/maintaining-uk-energy-security--2/supporting-pages/electricity-market-reform http://www.nao.org.uk/report/levy-control-framework/

15-year contracts are provided. The Renewables Obligation remains in force, but will decline in importance.
    - Capacity Market (CM), financial returns (via tenders) for reliable back-up capacity and demand flexibility, and perhaps also energy efficiency.

  In addition, there is also funding for renewable energy technologies that are still in their infancy and for which CfDs are as yet inadequate.
- The costs of this energy policy (including CfDs, but also other renewables policies for power and transport, plus heat policy) are being funded through a levy paid by energy suppliers, who then pass it on to consumers. A Levy Control Framework sets a ceiling on the sum total of these levies, rising from £ 2 billion in 2011/12 to £ 7.6 billion in 2020/2021. This does not include the costs of the CM; a decision on this issue is still to be taken.

Results:
- Between 2010 and mid-2013 an estimated £ 35 billion was invested in electricity infrastructure, with a further £ 20 billion investment in large-scale production projects already consented.
- At the end of 2013 the government's EMR Delivery Plan was published, detailing its policies on CfDs and the CM. Among other things, it quantifies the strike prices for the various types of RES and lays down a 'reliability standard' for the capacity required for reliable delivery that serves as the basis for the CM, the kick-off auction for which was scheduled for the end of 2014.

Main current debating issues / bottlenecks:
- Of concern are the rapidly rising energy costs for households, particularly for lower-income brackets. These costs are part-compensated through tax measures, but they are also potentially undermining the country's ambitious renewable energy targets and the energy efficiency obligations for energy companies[8].
- The EMR was only recently launched, and it is too early to say whether the envisaged policies are sufficient for the investments required to achieve policy targets: large-scale modernization of infrastructure, maintaining adequate generating capacity *and* ensuring consumer affortability.

3.6 What lessons can be drawn from developments in neighbouring countries?

- Very substantial investments are required to secure the policy targets that have been set for 2020 and the longer term, and countries are exploring cost-effective ways of making them a reality. In this context there are two key issues:
    - a clear vision of the future and a policy landscape that remains stable in the longer term, to create an attractive investment climate;
    - continued security of delivery, particularly in terms of required infrastructure maintenance/modernization/expansion and availability of sufficient capacity.

8 http://www.bbc.co.uk/news/business-25181676

- Countries are pursuing different policy tracks. Denmark is focusing on wide-ranging collaboration and market integration with its neighbours, the UK is putting out tenders for back-up capacity, while Germany is about to present a major plan to review its overall energy policy, for example. There is certainly much to learn from.
- Things are developing so rapidly that it is of crucial importance to monitor and review policies at regular intervals, adapting them if necessary.
- To maintain public support for energy policy, it is also crucially important to limit additional costs for final consumers, pay serious attention to the consequences of energy bill hikes for low-income groups, and optimize policy cost-effectiveness.

4 What are the potential problems and opportunities?

A number of problems loom:
- growing volume of intermittent sources → reliability issues;
- incorporation of distributed energy sources → not always smooth;
- renewables, but no CO_2 reduction;
- changing role of customers (also acting as producers, shift in demand);
- problems with parties' existing business models;
- massive investments required in infrastructure and generating capacity;
- affordability and tax revenues;
- political and public support;
- inconsistent government policies, in the Netherlands, between countries.

In addition, there are opportunities for new technologies and new economic activity, through greater use of ICT in the energy system, among other things.

4.1 Problems

Against the background of these developments in the Netherlands and neighbouring countries, it can be concluded that problems are likely to occur in the following areas:

Growing volume of intermittent sources

Problems maintaining quality as share of renewables rises (solar and wind)

It is above all the major volumes of solar and wind power that have infused the energy system with an entirely new dynamic. Already today, Germany has built up more solar PV and wind capacity than required to meet minimum demand. At times of low demand when the sun shines or wind blows, no conventional capacity is therefore required for volume demand, and excess power is consequently exported to neighbouring countries – at a price that is very low, sometimes even negative.

Generating capacity no longer profitable.

This creates problems not only in terms of maintaining short-term balance (voltage quality), but is also having an impact on the profitability of both solar/wind and conventional capacity. In the Netherlands as of 2013, however, this problem is due above all to the 'pork cycle', with far too much capacity having being built during the economic recession.

Incorporation of distributed capacity

Energy market still unprepared for major input from distributed capacity

Today's electricity system was developed to take electrical power from (large-scale) power stations to final consumers. Feed-in of locally produced electricity leads to technical and organizational problems which, while largely well-handled at present, will inevitably result in new problems as distributed capacity increases yet further (for example, expansion of MV-grid capacity for

solar PV in rural areas). Similar considerations hold for 'green gas'. At the same time, operating times are likely to be extremely low, while costs will be socialized.

Mismatch of supply and demand

As yet, the market is still providing insufficient incentives for a proper match between periods of supply and periods of demand, implying a high risk of investments having to be made in excessive capacity (both production and infrastructure).

Willingness to invest

With current business models, investors are unwilling to (re)invest in conventional and renewable capacity

Given the above developments, in the longer term willingness to invest will become a major issue – for both conventional and renewable plant. Increasingly, conventional capacity will be confronted with low operating times not foreseen in today's business model. Renewable capacity, for its part, while now supported by the SDE+ incentive scheme, faces a problem when replacement investments are called for, as these seem to hold little appeal as market returns decline ever further. To keep renewables afloat once SDE+ has come to an end, a new system will have be thought up.

Cost of renewables

Growing difference in costs between households able/unable to invest in solar PV

Besides the 'willingness-to-invest' issue, there is also the problem of unequal burden-sharing when it comes to the cost of renewables. Renewable capacity is currently being paid for through SDE+ on top of the market price of conventional electricity. Because that price is falling, on average, SDE+ payments are rising. This creates a problem primarily for government, which passes it on to final consumers, in the form of a higher SDE+ payment. A certain percentage of those consumers are buying increasingly less electricity on the market, however, having installed their own solar panels, and because of the feed-in provisions are paying virtually nothing for the growing input of renewables to the mix.

Excessively high energy costs

Citizens and businesses no longer accepting ever higher energy costs

The present system of energy-cost allocation (including SDE+) is not leading to energy being delivered to consumers at lowest cost, nor does it minimize the social costs of energy, moreover. To compound matters still further, the costs of a greener energy system are:

- set to rise still further than at present, or than is necessary, because of impending higher infrastructure costs, among other factors;
- higher than in other countries, with negative consequences for the Dutch economy;
- leading to growing disparity in the tax burden of various user categories; or
- leading to declining revenues for the Treasury.

In other countries there is growing resistance to spiralling energy costs, which may have the drastic consequence of the energy transition no longer being accepted and the license to operate evaporating (Spain, UK).

Sustainability targets

Because the energy market was not designed to accommodate any major change in the mix of energy sources or a shift from centralized production to a mix of central and distributed, securing sustainability targets may come up against constraints and even resistance. This is already manifestly apparent when it comes to the shouldering of costs, but it is also affecting installation of renewable energy systems in the landscape (onshore wind). The bottom line is that targets may become steadily harder, if not impossible, to secure.

Efficient technologies cleaner, but not profitable enough

Because of the current divergence of gas and coal prices, problems are also arising with efficient technologies (like cogeneration), which can no longer operate at a profit.

4.2 Opportunities

In addressing these problems, there is enormous potential for solutions that can lead to new products and services and thus to novel economic opportunities. Although numerous 'smart' technologies and services are already feasible (including Demand Response services), today's tariffs and market rules mean they are not yet being sufficiently exploited.

ICT throughout the energy system can promote service flexibility

Given its small size and high energy intensity, however, the Netherlands can develop a creative market in which new products and services help secure environmental targets, reduce costs and maintain a high-quality energy supply. One key possibility lies in maximum application of ICT throughout the energy system, on both the consumer and producer side, which seems essential for enabling greater flexibility in matching the supply and demand of both heat and electricity. In addition, though, there is also scope for use of more efficient heat and gas technologies.

New business models required for local projects

The challenge lies in the scaling-up of local initiatives, which today are basically volunteer projects, to new professional business models that can also generate local employment.

4.3 Synopsis

Table 1, below, endeavours to match the problems and opportunities discussed in this appendix to particular groups in society, to clarify how big the problems are, and for whom. In all of this, due care needs to be taken that a problem for any one particular party is not designated universal.

We have also endeavoured to indicate whether the problems impinge on the affordability, reliability or sustainability of the energy system. Finally, it is important to establish whether the problems loom in the shorter or longer term: in the next few years, or post-2020. This is shown in the last column.

Table 1 Synopsis of problems and opportunities in the energy market

	Reliability	Affordability	Clean	Current producers	Power suppliers	Grid operators	New RE producers	En.-effic. companies	Government	Households	Industry	Environmental NGOs	Short vs. long term
Power stations no longer profitable	P			P			O				O	O	ST
Willingness-to-invest in conventional capacity	P			P			O	O					LT
Willingness-to-invest in RES without SDE+			P										LT
Far more infrastructure required		P					P				O		ST
Renewable energy targets - rising energy prices - targets not secured		P	 P			P				P	P	 P	 ST LT
Tax revenues									P	P	P		LT
License to operate	P			P	P								ST
Supply-demand mismatch	P					P		O					ST
CO_2 targets - rising energy prices - targets not secured		P	 P					O		P	P	 P	 LT LT
…..													
Efficient technologies		O						O		O	O		LT
Flex services	O	O	O					O		O	O		ST
Local projects			O		O	P		O					ST
….													

P = Problem
O = Opportunity
ST = short term
LT = long term

5 Exploring concrete trends

To get to grips with the cited problems and opportunities in greater detail, it seems sensible to examine a number of concrete, real-world cases and assess likely impacts for all parties in terms of problems, challenges and opportunities. The parties in question could be all those mentioned in Table 1, while the following might serve as case studies:

- a large solar PV project in an outer urban residential estate (2 MWe):
  - grid operator
  - imbalance
  - investment
  - customers
- climate-neutral heating of a 1930s housing estate (5,000 dwellings);
- electric transport for 10% of households in Amsterdam-East;
- offshore wind farms (6,000 MWe);
- demand-side management for SME;
- ….

6 Government and market roles in a period of dynamic change

Ongoing changes in the energy market require reform of the regulatory setting, so much is clear, but the question also arises whether the very roles of government and market need redefining. There will always be interaction and cooperation between the two, but with the major changes now occurring in the energy mix the market is proving less proficient in its traditional role. While market forces work well for all kinds of (price) optimization, they are not kick-starting the innovation cycle required today, particularly at the systemic level. How can this be remedied? Will changes to the regulatory playing field be sufficient, or does the government need to take the lead, by creating new institutions tasked with specific activities, for example? The risk at present is that the true power of the market is remaining unexploited and unsuspected solutions are being left untapped.

Market players are at the same time, understandably, unable or unwilling to take any great risks in a situation in which returns on investment are by no means guaranteed. There is a major risk that the regulatory changes we are concerned with at present will not be the last of their kind, and that the stranded assets of some of today's players will later be followed by those of newer ones. On the other hand, risk-taking is part and parcel of entrepreneurship and it would be irresponsible to automatically expect government to shoulder the risks.

In the past, new government regulations have proved to have a massive effect and unleash a wealth of creativity. Two examples may suffice:

- introduction of the National Basic Tariff (LBT) under the 1989 Electricity Act, paving the way for a successful cogeneration market;
- implementation of the Surface Waters Act in the early 1980s, triggering a new industry supplying small-scale, green, innovative water treatment technologies in response to discharge bans and (high) pollution charges.

In the energy context, the trick is to design regulations and tariffs in such a way that market players are likewise triggered to supply cleverly designed services that together contribute to managing balance, securing renewable energy targets, keeping costs manageable, and so on. At the present juncture in time, however, perhaps new institutions are indeed also required.