Energy & Infrastructure

SPECIAL REPORT

Energy Transition

Strategies and Insights from the C-suite

By
Roland THEUWS

Amrop
Leaders For What's Next

Credits

We warmly thank the industry leaders who contributed to this report. We also thank Prof. Dr. Coby van der Linde of the CLINGENDAEL INTERNATIONAL ENERGY PROGRAM and the UNIVERSITY OF GRONINGEN for her invaluable guidance.

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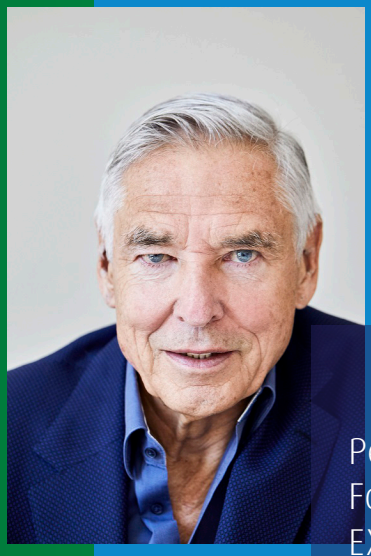

Peter Brabeck-Letmathe
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Foreword

The Paris Agreement brought the imperative for the energy transition to a head. Following the first tentative steps by governments and companies, we are now on the eve of a large-scale movement. The need for change is clear, making the switch to sustainable energy sources less and less of a choice, and we have passed the tipping point. Sustainability has moved from small-scale, experimental CSR measures into new ways of doing business - and new revenue models.

The energy transition is on a growing number of board agendas. The 'why' is no longer in doubt, the questions are now 'how' and 'how fast'. We are not only building the world of tomorrow, but working on the here and now. Nor can these be isolated efforts, but rather require collaboration between stakeholders.

The scale of the energy transition is unparalleled and will affect all sectors, some dramatically. Ever more companies are seeing the opportunities: innovation and efficiency have helped put the green energy business case on the map – and by association, whole countries.

The Netherlands – energy transition microcosm

With a dense population of 17 million, the Netherlands is a small but significant country. Its collaborative culture, enterprising spirit and technological prowess have been forged by a close relationship with natural forces. These it has systematically harnessed over two thousand years, shaping its internal geography and economy. It occupies a central position in North West Europe, a highly integrated region in energy terms.

For the Netherlands, famous for its dikes, polders, canals and windmills, the interplay between wind and sea has long been central to its survival and prosperity. However, recent decades have been marked by a strong reliance on fossil fuels, as is evident from the port of Rotterdam and companies such as Shell. Indeed, the Netherlands is home to some of the world's most important energy and infrastructure multinationals.

It is an incubator of innovation, and it's ready to regain its old position in relation to the wind and the sea. This report views the energy transition through the lens of this fast-evolving market.

Global energy transition – a growing movement

The global economy is under relentless competitive pressure, with sustainable innovations often requiring significant investments, or being difficult to scale up. Transforming the energy economy is no trivial task, and to succeed it is crucial to take a holistic approach – one in which the energy transition is not seen as a series of separate measures, but as an interconnected whole. Industries, companies and households must become more sustainable individually, and at the same time, transform entire energy systems. Countries must take this into consideration, distributing the burdens and benefits so that each stakeholder's contribution creates optimal value in a clean and competitive energy economy.

As the energy transition gains momentum, it's becoming clear that whilst the challenges are many, so too are the opportunities. Companies can and must look forward to jointly growing new markets, backing their pioneering role with solid investments. And as the Paris goals already risk missing the mark, urgency is concentrating minds and money as never before.

Roland Theuws
Partner, Amrop, the Netherlands

About this Special Report

Against a backdrop of super-fast innovation, disruption and digitization, selected directors of major Dutch companies, including global market leaders, respond to the transforming energy space. Beyond the hype, this report contains:

- Honest reflections from the industry front lines
- Insights into energy transition innovations
- A window on the progress of sustainability post Paris

If you are an executive in the energy and infrastructure sector, if the energy transition is affecting your supply chain, growth or profitability, or you want to discover how leadership peers are tackling high-profile change in a fiendishly complex environment, we invite you to read on.

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New Leadership in the Energy Transition – 5 Drivers
Talent Strategy in the Energy Transition – 6 Keys

New Energy, Stakeholders – Topline Findings

This special report is divided into 2 parts. In 'New Energy', we set out a vision for the future and the key developments of different energy sources. In 'Stakeholders' we focus on the social ingredient of energy transition. We look at the 3 major groups: companies, consumers and the government.

1 | NEW ENERGY

01 | The Power Grid

Once a simple connection from power plant to customer, the cumbersome fossil-fueled plant is no longer future-proof. The energy transition is fostering a spectacular nationwide growth in wind turbines and solar panels, clean but small power sources.

Demand for electric power will surge in the coming decade

The further electrification of industry, and increased use for heating buildings, will make this one of the most important energy sources.

Disconnecting power generation and supply will break up old monopolies

Utilities were once managed by single parties that were regional grid operators, producers and suppliers. Encouraged by new legislation, companies increasingly focus on one of these niches.

One-way grids are moving to interconnected, dynamic systems

Whilst the green advance will remove the dominance of large power plants, the electric power grid must change fundamentally and fast. The change can be summarized as '3D': Digitization, Decentralization and Decarbonization. The one-way grid will be replaced by a system interconnecting small supply points, transporting electricity in all directions according to supply and demand.

The grid is vulnerable to extra load and an unpredictable solar and wind energy market. The new grid will be a dynamic platform. Operators, suppliers and consumers will all play a role. Smart, digitized grid management will address new challenges and limit costs.

Technology and digitization are putting customers in charge

Digitization, smart metering and other devices are giving customers insight into their power consumption, allowing them to spread and reduce it. By installing solar panels and recycling, private individuals add value to the economy to become prosumers: consumers who produce.

Weather risk is offset by alternative sources, integrated markets, and storage

As wind and solar power gains dominance, a reliable constant power supply must be assured. Several factors are stabilizing production and prices. Sustainable energy sources - biofuels, hydro-power and nuclear- can keep the supply on norm if things go wrong. The increasingly integrated European energy market and legislation are helping (and obliging) countries to handle local shortages. Improved storage techniques allow the gradual separation of electric power generation and consumption.

Energy supply means 3 A's

CEO of Royal Vopak since 2011, Eelco Hoekstra says it is impossible to confidently predict which energy sources and technologies will win, but the requirements are obvious: "Every country must act according to its strengths. Energy supply must comply with the three A's: Affordable, Available and Acceptable." Environmental acceptability is quickly gaining importance; coal is losing ground.

Wind energy is gaining dominance in a mix of energy sources. The ultimate outcome is still open

The winner/s will be decided by technical developments stimulating the business case. Top candidates include wind turbines, solar and wind combination, gas, deep energy and hydrogen. Nuclear was mentioned, but is not necessarily very likely. Biogas/biofuels may also gain in importance.

1 | NEW ENERGY (Ctd)

02 | New Heat Supply

For over half a century, the Netherlands has heated its homes and buildings with natural gas – a unique situation in the world. But change is afoot.

Neighborhood actions could free up the fossil fuel lock-in

Decades of investments in gas have created a lock-in, and liberating existing buildings from gas dependence is labor-consuming and expensive. Alternatives include local heat solutions, making groups of houses or neighborhoods heat-autonomous via collective actions, drawing on residual heat, central district heating and geothermal heat. Excellent insulation is a red thread.

Old infrastructure calls for creativity and cooperation

Stopping the flow of natural gas through the pipelines will generate creative ideas about the repurposing of infrastructure, but will take close cooperation between local authorities, pipeline operators and housing corporations.

Gas, still the cleanest fossil fuel, is under threat from cheaper dirty relatives

Natural gas burns cleaner than oil and coal, and ideally would be the last fossil fuel to go, but in the Netherlands at least, it seems to be the first.

03 | New Fuels, Disconnected World

Contrary to grids, fuel has the capacity to bring power to mobile power consumers, which we call the "disconnected world". Fossil fuels form the cornerstone of today's energy economy: for the transport sector, as a raw material, for industry. The transition to sustainable fuels will be a far greater challenge than to green electricity. Making industrial processes sustainable is technically demanding, innovation involves high costs affecting the entire chain.

Just as the clean energy agenda gathers pace, the global fossil fuels market is growing

Leaders are appealing for patience: different markets are evolving at different rates, and change cannot happen overnight.

To compete with fossil fuels, a clean fuel must meet high technical requirements

Large-scale clean production, storage and transport will be needed to enable trading on a liquid market. Hydrogen seems to fit the bill – its combustion only emits water vapor. But truly 'green' hydrogen, made from water using sustainable electric power, cannot (yet) be produced on a commercial scale.

Energy transition demands transition fuels

The intermediate phase in the energy transition may last decades, and so-called 'transition fuels' will bridge the gap. Liquid and compressed natural gas, scrubbers, (air pollution control devices), electrical/hybrid and hydrogen, are the most-cited candidates.

04 | Storage

One of the most crucial innovations is decoupling electricity production and consumption. When demand is high, electric power must be generated, but in future the power of wind turbines and solar panels can be stored for later, absorbing dips in the grid.

Batteries will need a technological breakthrough to leave the house

Until then, batteries will serve the niche of domestic applications such as electric cars and home batteries. The scarcity of rare metal components may prevent a battery revolution.

All storage methods will find their niche

Current forecasts suggest molecular storage is more suitable for industrial use, but innovation in the energy transition is moving too fast to state that with any certainty. So companies are spreading their investments.

2 | STAKEHOLDERS

01 | Companies

Business front-runners are using energy transition to their advantage. They are making sustainability a fully-fledged earning model and securing an enduring competitive advantage beyond 'business as usual'. This helps attract young talent and out-innovate rivals. But it cannot be a casual enterprise. It will take a balanced strategy, consistently followed-through, clear and public corporate declarations, and the involvement of employees.

Organizations who fail to plant the flag risk falling behind

Given the rapid developments in the energy economy, it is vital for companies to keep a close eye on what is happening in their sector, whatever their internal progress and pre-occupations.

Disadvantages can be turned into their opposite

Creativity is being sparked by worsening conditions, or spin-offs from other innovations.

A successful story means balancing the books

Companies that allow sustainability to migrate from CSR into their core business and daily routines have a long-term advantage. Cost-effective green energy further strengthens the intrinsic motivation in the corporate world.

Bridges are being built in surprising ways

The energy transition is uniting heterogeneous bedfellows. For example the co-launch of a wind farm by Google, Philips and AkzoNobel, or cooperations between competitors. It is even building new sectors. Other partnerships are stimulating durable business models: under the Dutch Sustainable Growth Coalition, sustainability-oriented companies are co-investigating internal carbon pricing.

A virtuous circle is growing

As ever more companies embark on the energy transition, the support base is growing – and the expectations of business are rising. Every company starts the transition for itself, but its activities impact other players, creating a new network of sustainable partnerships - and a positive feedback loop.

02 | Citizens

Consumers often lag behind companies in the energy transition. But public backing is crucial to building a critical mass of support. Business is trying to encourage consumers to think differently.

Business is taking the lead over consumers

Corporates have the power to make a difference, in part due to their sheer size, and unsurprisingly see energy transition as an opportunity

Green is still the domain of the well-off

Energy players understand that if richer consumers need no encouragement to shift, for others, sustainability means painful choices: pay a premium, and/or sacrifice convenience. This challenges companies to devise new strategies to democratize the energy transition across consumer segments.

Business must show consumers the way

The previously-mentioned digitization, smart metering and other devices are giving customers insight into their power consumption, allowing them to spread and reduce it. New financial instruments can seal the deal.

Households will need a major structural shift

New builds are increasingly (almost) energy-neutral, but existing structures remain a major obstacle. Making a building climate-neutral is a customized project, and people have difficulty estimating the costs, how to bear them, and how to predict the real outcome

2 | STAKEHOLDERS

03 | Governments

Government has the muscle to determine the playing field for the energy economy and set the conditions for a coherent transition, from setting business objectives, regulatory and energy provision frameworks, to providing technical education. However, government will have a lesser role than business in effecting the actual change.

Government policy must be decisive, predictable and forward-looking

Clean tech is advancing fast, so commercial scale-up is badly needed. This will take huge investments, recouped only years later. To provide businesses with the security they need to invest, government policy must be predictable. This starts with clarity about long-term national ambitions. Clear signals of intent, for example via legislation, will motivate companies and households alike. And policy has to answer social need.

Government must lead the big investments in clean energy, innovation and creating new sectors

It is time for governments to make social and fiscal choices. To accelerate progress means setting focus points and creating resonance around the importance of clean energy. It will take courageous measures: for example replacing corporate tax benefits with state investment in infrastructure and education.

Regulation means setting the goal, not the way

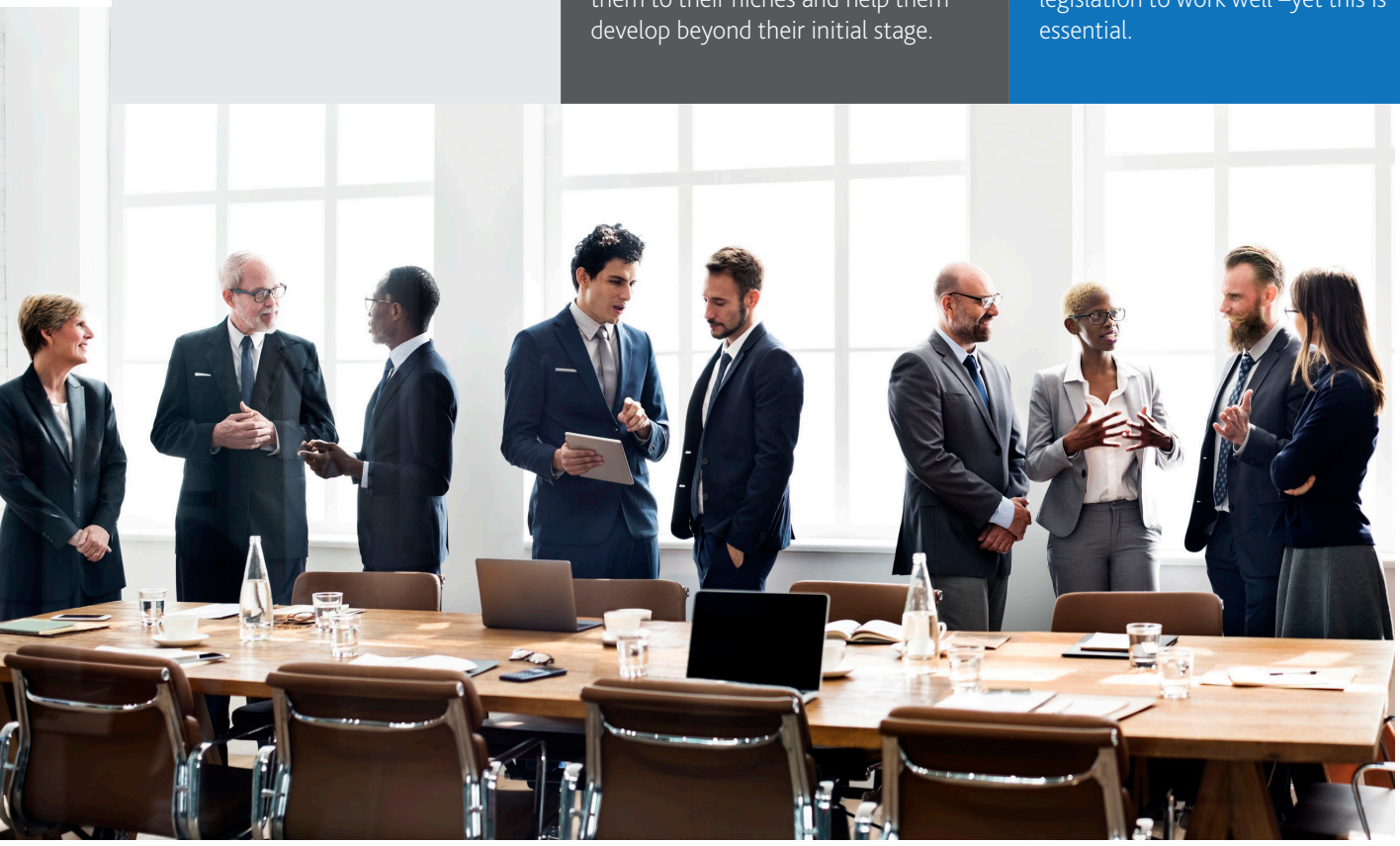
Regulation is a balancing act: the government should set specific directives, whilst giving business the room to find creative solutions to achieve them

The market is the ultimate arbiter

Giving space to experiment will result in more variations - and the market will decide which has the most traction. For example, once several energy storage innovations become available on the market, economic forces will favor the best ones, fit them to their niches and help them develop beyond their initial stage.

Too much restriction will backfire

Setting over-punitive conditions will cause companies that fail to keep up to trip up. So over-restrictive requirements may backfire and damage the very economy they are trying to serve. It is difficult to achieve the sophisticated balance needed for legislation to work well –yet this is essential.



New Leadership in the Energy Transition | 5 Drivers

Energy transition leaders report a multi-faceted set of challenges and responsibilities. Technology is advancing rapidly alongside ever more demanding standards and regulations.

1 Keep a dual focus - external and internal

The energy transition is having a tentacular effect on daily operations. Successful leaders balance an inquisitive attitude to the outside world with close attention to internal process improvement.

"What's incredibly important for a company in such a disruptive environment is that your people – and you of course – keep a really good eye on the outside world."

Ingrid Thijssen, CEO, Alliander

2 The energy transition is unexplored territory. Map, anchor, and reshape.

This challenge is the first of its kind, shaped in new ways by leaders every day. There is no blueprint, but incremental steps marked by improvisation. In this technical environment, dynamism and creativity are critical to guide companies through alternatives and adopt best practices. Leaders who explore unconventional solutions can put their organization in the lead once a strategy starts paying off. Luckily, the desired result of the energy transition is clear and can serve as an anchor point.

"Leadership is about setting a course. Choosing a dot on the horizon, but to reach it everybody must support the journey. That road can be pretty bumpy at times, but by always maintaining that dot, everybody will know what you're working towards. Then you can very gradually reshape an organization, step by step. That's what we have taken 4, 5 years to do."

Wim Pelsma, CEO, Aalberts Industries

3 Invest to prepare - and prepare to invest

Throughout the energy transition, companies may well need to invest quite ambitiously. Several CEOs interviewed are dedicating serious resources.

"We have an innovation focus group and an energy transition portfolio. That entails 36 or 38 capabilities that we work on and we know need to be installed to maintain a high standard of performance when energy grids run on sustainable energy in the future."

Ingrid Thijssen, CEO, Alliander

4 Blend vision and pragmatism - integrate quarterly reporting into the long term whole

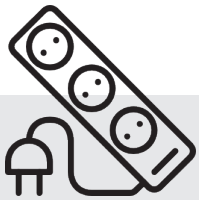
For a sustainable transition, organizations must balance ambition with a realistic pace, balancing shareholder and stakeholder perspectives

"Now and then also look past quarterly figures and even years to study what the future holds, and invest in it. As we all know, it takes a long time before these investments start to pay off, so the right balance is needed. You can't forget your quarterlies for two years."

Atzo Nicolaï, President, DSM Nederland

5 Finally, engage, empower, and listen

During piloting and experimentation phases, management must give talent space to adapt, listening to their issues, adjusting along the way. Senior executives also need courage to change or cancel their own plans in favor of the bigger picture — even their best will not be failsafe. Clear and honest communication can make the difference between a steady, successful transition and a counter-productive, strategic mess.



Talent strategy in the Energy Transition | 6 Keys

The energy transition is unearthing specific leadership challenges and structural changes. Attracting and retaining the right leadership talent will require an appropriate response.

1

The best leaders will be agile, connected and forward-looking

These three characteristics, in Amrop's view, define 'Leaders For What's Next'. For hiring organizations addressing the energy transition, they are particularly crucial. *Agility:* executing incremental change in a fast-evolving, innovative environment, adjusting according to fast-changing circumstances, re-thinking legacy approaches, alliances, infrastructure. *Connected* thinking: joining traditionally-separate sectors, fostering new links between companies, organizations and citizens. And a *forward-looking* perspective: seeing beyond the horizon and making sense of ambiguity.

2

Green is the new employee branding proposition

Leading energy and infrastructure organizations are clearly broadcasting their commitment to sustainability imperatives, and their progress. From strategy to culture and business/revenue models, consumer groups, investors, and tomorrow's talent are all playing close attention to these indicators.

3

Digital and customer journey leaders will be vital

Digital professionals, 'T-shaped' profiles, combining technical and strategic weight, will be a critical ingredient of boards driving the energy transition. But energy and infrastructure companies* are under-equipped. Only 6% of profiles of listed boards fit the bill according to a recent Amrop report ('Digitization on Boards 2nd Edition'). The energy transition is putting the customer in the driving seat, as digital devices enable decisions not only regarding how s/he consumes power, but who provides it. Virtuoso engineers of win-win *customer journeys* will put their organizations in the lead, building sustainable relationships across a consumer base spanning affluence, energy-literacy, and need.

4

As sectors blend and connect, lateral thinking will facilitate hiring

A special breed of leaders will be needed to steer organizations through the turbulence of the energy transition. The talent pool within energy and infrastructure industry verticals is limited and hotly-contested. Savvy talent strategists take a creative, cross sector approach to hiring: from profile design, to search, selection, and closing negotiations.

5

A war for technical talent is brewing

Technical talent is thin on the ground. To be positioned as the employer of choice will take a compelling employer value proposition, the installation of cutting-edge training to bring talent up to speed in new technologies and applications, and working hand-in-hand with government institutions to inform and support state provision of the next generation of skilled technicians.

6

Wise decision-making must underpin the energy transition

A recent Amrop global study has made the case for a new kind of leader: one who addresses the dilemmas of modern business in a holistic way. Creating and capturing vital economic value, whilst building a more sustainable, legitimate organization. Examining 3 pillars of wise decision-making, our study found positive intentions submerged in the vortex of daily business, cognitive overload and short-term imperatives. See this groundbreaking report: 'Wise Decision-Making: Stepping Up to Sustainable Business Performance" (www.amrop.com).

*The team analyzed the profiles of members of boards (supervisory or equivalent) of the top 20 listed companies in terms of revenue in 15 countries (14 in Europe, plus the US).

Full Report

The Dutch Energy Sector - Fast Facts
Part 1 | New Energy
Part 2 | Stakeholders

The Dutch Energy sector - Fast Facts

The energy flow through the Netherlands is enormous, with fossil fuels traded to neighboring countries from Dutch ports and refineries. High-voltage lines to Great Britain, Norway, Denmark, Germany and Belgium supply electric power overflow for import and export. In 2016, more than 11,300 Pj of energy was imported, more than 9,200 PJ exported, and less than 3,200 PJ consumed in the Netherlands[1].

The energy sector is critical for the Netherlands

The Dutch economy has a strong focus on fossil energy, with a highly-developed petrochemical industry, evidenced by the port of Rotterdam, multinationals such as Shell, and the nation's gas network and gas production epicenter in Groningen. Large-scale industrial consumers, such as blast furnace operators and chemical companies, power their plants with fossil fuel.

Companies in the Netherlands are now leading in sustainable strategy and innovation

The business case for offshore wind turbines in the Netherlands has developed at lightning speed, practically removing the need for subsidy grants. The era of 'PR-stunt sustainability' is over, replaced by a genuine and colossal impulse to work intensively on a sustainable business model. And this includes the energy sector. Companies are setting concrete targets to purchase renewable Dutch electric power. Players large and small are innovating in collaboration with R&D institutions and governments.

In March 2018, the energy provider Nuon Vattenfall won the Netherlands' first grant-free wind turbine tender. Within ten years, photovoltaics will also be cheaper than coal-fired plants[2]. Over 2016 to 2020, the employment rate in the country's renewable energy sector will have increased each year by 3 000 labor hours, just as the conventional energy equivalent drops.

Renewable electricity is often in the news, but for years, electricity has accounted for just 18% of energy consumption in the Netherlands[3]. Most energy still relies on direct fossil fuel combustion, used in transport, the maritime sector and industry. It is these sectors that will see the most fundamental transformation in the coming decades.

In reality, the Netherlands is fast catching up

In past decades the Netherlands had lagged behind other Northern European countries: in 2017, only 6.6% of its energy was renewable[4]. However this is set to double in the next two years, thanks to the growth in (mainly sea-based) wind farms. The country's energy needs are extensive, space is limited and large hydro-power plants unfeasible. Yet the Netherlands has advantages. Installing and maintaining energy networks is relatively inexpensive due to the small surface areas involved. Developed industry lies near major cities, allowing the use of residual heat. A well-maintained gas network conveys the cleanest fossil fuel throughout the country. The North Sea is also highly suitable for the large-scale generation of wind energy. Robust regulation and cooperation between the business community and the government will be a good starting point for the Netherlands to catch up.

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1 *EBN*, 20 June 2017. Focus on Energy 2017
2 J. Farmer & F. Lafond, 2016. How predictable is technological progress? *Research Policy, 45*(3), p.647-665
3 Based on *EBN*, National Energy Outlook 2017, 2016, 2015 and 2016 figures of *CLO*, 26 February 2018. Supply and demand of energy carriers in the Netherlands, 2016
4 Centraal Bureau Voor de Statistiek, 2018

Part 1 | New Energy

Energy is consumed everywhere in society, but different users run on different energy carriers. Along these lines, the energy world can be divided roughly into two. Everything connected to a network, for example a power grid or gas network, falls into the *connected world*. All energy carriers consumed by mobile units, such as hydrogen, fossil fuels and batteries, belong to the *disconnected world*.

We'll look at developments in four energy systems within these two worlds: the power grid and the heat supply within the connected world, and environmentally clean fuels and energy storage within the disconnected world.

01 | The Power Grid

The traditional power grid has undergone a drastic shake-up. Once a simple connection from power plant to customer, the cumbersome fossil-fueled plant is no longer future-proof. The energy transition is fostering a spectacular nationwide growth in wind turbines and solar panels, clean, but small, power sources.

Demand for electric power will surge in the coming decade

The further electrification of industry and heating buildings will make electricity one of the most important energy sources.

Van Oord is a leading international specialist in dredging, marine engineering and offshore projects (oil, gas and wind). Its CEO, Pieter van Oord, explains: "We are entering a society which we are going to electrify. In the Netherlands, only 18% of our mixed energy sources is currently electricity, something I always emphasize. If we are going to meet the Paris targets, our society needs to be electrified at least at 50%."

One-way grids will become interconnected, dynamic systems

Many of the CEOs predict a more dominant position for wind and solar energy. Whilst the green advance will remove the dominance of large power plants, the electric power grid must also change fundamentally and rapidly to keep up.

Smart, digitized management will be deployed to address new challenges and to keep costs down. These trends can be summarized as '3D': *Digitization, decentralization and decarbonization.*

The old one-way traffic grid will be replaced by an interconnected node system from small supply points. These, depending on dynamic supply and demand, must be able to transport electricity in all directions. The power grid is subject to change due to the extra load on the grid and an unpredictable solar and wind energy market. The new grid will be a dynamic platform, where operators, suppliers and consumers all play a role. Smart, digitized management will be deployed to address new challenges and to keep costs down. These trends can be summarized as '3D': *Digitization, Decentralization and Decarbonization*.

Disconnecting power generation and supply will break up old monopolies

Utilities were once managed by regional monopolies, acting as grid operators, producers and suppliers. Now, parties are specializing to occupy just one of these roles. Fitting this trend, grid operator and electricity supplier must be legally different parties in the Netherlands. This disconnection between power generation and supply has broken up – and freed up – the old relationships between consumer, grid operator and producer.

“

Often, initiators jointly set up a cooperative and put three wind turbines into operation themselves. I think this is fantastic progress. Both from a sustainability and from a democratic perspective.”

Ingrid Thijssen, CEO, Alliander

The traditional giants must now share their playground with younger parties who trade, but do not generate, energy. As intermediaries, newcomers link the small producer to a specific customer who knows exactly where her power comes from, starting with the wind turbine. The fast-pace energy market is emerging: electricity can be purchased in advance at a variable rate for the next hour. Even households increasingly make use of variable power consumption rates.

Technology and digitization are putting customers in charge

Digitization, smart meters and other devices are giving customers insight into their power consumption, allowing them to spread and reduce it. No longer mere consumers, private individuals are now prosumers: consumers who produce.

Take as an example solar panels on residential roofs, as well as larger projects where private individuals can be involved. Ingrid Thijssen is CEO of Alliander, an energy network operator. She explains: “Often, initiators jointly set up a cooperative and put three wind turbines into operation themselves. I think this is fantastic progress. Both from a sustainability and from a democratic perspective.” The once-clear role of households as customers and end users is now fading in favor of the household as autonomous station and value-creator in the circular economy. Households and businesses have insight into their energy consumption; they can evaluate it and contribute to the grid.

Weather-driven risk is offset by alternative sources, integrated markets, and storage

As power plants lose dominance, a reliable constant power supply must be assured. Thanks to large wind farms in the North Sea, it is partly the weather, rather than demand alone, that will drive electric power generation. However, a number of factors are stabilizing production and electricity prices:

1 Sustainable energy sources - biofuels, hydro-power and nuclear - can keep the supply on norm if things go wrong

2 The increasingly integrated European energy market helps countries deal with local shortages and is even obliged to do so according to European legislation

3 By improving storage techniques, the generation and consumption of electric power can gradually separate, partly stabilizing the price of electricity

Energy supply = 3 A's: Affordable, Available, Acceptable

The CEO of Royal Vopak since 2011, Eelco Hoekstra says it is impossible to confidently predict which energy source will win. However: "Every country must act according to its strengths. Energy supply must comply with the three A's: Affordable, Available and Acceptable."

He explains: "You must ensure your economy is protected and energy is *available* uninterruptedly. It must be *affordable*, because you naturally want to compete economically, but also that people get affordable bills. Finally, the energy source must be *accepted* by people. If the cheapest solution is coal but society doesn't want it, you'll have to switch to something else, both as a government and collectively as an industry. You have to make use of the power you have. In the Netherlands, that force is in the wind, I think, especially offshore."

"I may be a voice in the wilderness, but I'm not completely giving up on nuclear power. Because with the new nuclear energy technology the waste is becoming very compact. There's still waste, which remains a problem, but totally CO_2 neutral."

Dave Vander Heyde, CEO, Royal IHC

Wind energy is becoming part of a mix of energy sources. The outcome is still open.

The winner – or winners- will be decided by technical developments stimulating the business case.

Wind turbines: The North Sea is the future energy garden of North West Europe. Pieter van Oord: "A wind turbine at sea north of the Wadden Islands runs more than 4,000 hours per year. A solar cell in the Netherlands generates about 800 hours of energy per year. So, if you look from the time perspective alone, offshore wind beats solar energy."

Solar: The power of the sun is not to be underestimated. Manon van Beek, CEO of TenneT, the company that manages the high-voltage grids in the Netherlands and large parts of Germany, explains:

"Based on anticipated cost reductions of solar panel systems and a commercial breakthrough of battery storage, there is a chance that solar PV [Photovoltaic cells] is growing stronger than anticipated in the predictions of 2016[5]. The maximum is an increase to 30 GW of installed solar PV power for 2035."

Gas: Dave Vander Heyde, CEO of Royal IHC, a supplier of equipment, vessels and services for offshore, dredging and wet mining, does not anticipate this any time soon. "Particularly sun and wind are not continuous. I think we are still dependent on a proportion of fossil fuel, with a shift to gas. Either you use batteries, which are too expensive and not widely available, or rely on gas-fired power stations."

Deep energy: Companies such as EBN are researching deep geothermal energy[6], while the coalition agreement aims at large-scale underground storage of fossil fuel emissions until a good alternative emerges.

[5] *ECN*, 14 October 2016. National Energy Outlook 2016. ECN-O--16-035.
[6] *EBN*, 20 June 2017. Focus on Energy 2017.

> There is so much cheap emotion in this energy discussion, it is wrongly focused, data is not analyzed objectively. Looking at 2050, I don't think our energy mix is going to change substantially. There is no doubt that solar and wind will increase, but they will not be the most important energy sources in 2050. I think it will be mostly oil, gas, and nuclear energy, followed by what we call renewable today."
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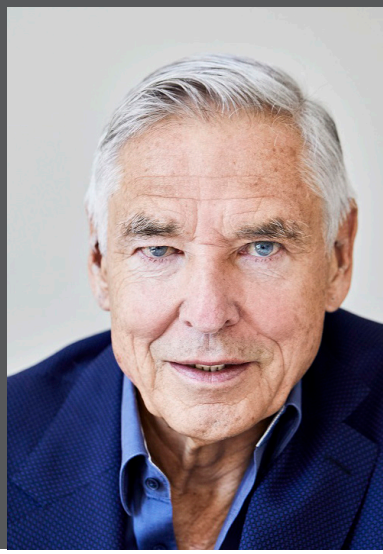
> Peter Brabeck-Letmathe,
> Former Member of the Board,
> EXXONMOBIL



Nuclear: For Vander Heyde: "I might be a voice in the wilderness, but I'm not completely giving up on nuclear power. Due to new nuclear energy technology, waste is becoming very compact. There's still waste, which remains a problem, but it is completely CO_2 neutral. With all other fuels, apart from renewables, you will still have a CO_2 problem. However, there's no support for nuclear energy today."

Pieter Van Oord: "If there is power supply disruption, and we can think of foil that you can stick on windows, generating power even when it's cloudy, then you're talking about something new. But looking at the current technology, offshore wind will play a prominent role, according to reports from Boston Consulting Group, and McKinsey."

Conventional energy: Peter Brabeck-Letmathe, former Member of the Board of ExxonMobil, personally fears progress might be more limited than some might hope and that globally, conventional energy will continue to dominate for some time. "There is so much cheap emotion in this energy discussion, it is wrongly focused, data is not analyzed objectively. Looking at 2050, I don´t think our energy mix is going to change substantially. There is no doubt that solar and wind will increase, but they will not be the most important energy sources in 2050. I think it will be mostly oil, gas, and nuclear energy, followed by what we call renewable today."

How smart is the power grid?

Electricity demand is set to significantly increase, as a result of the electrification of industry and an increasing number of electrically-heated homes. Wind turbines and solar panels also contribute during peak loads. One of the inevitable consequences of the energy transition is an increased load on the power grid. Local power grids must also meet higher requirements. To keep costs as low as possible, integral transition is essential.

Grid overload calls for precautions

Dutch households are busily installing solar panels, resulting in a growing role for residential areas as energy producers.

Alliander's Ingrid Thijssen sees "a tsunami of electricity flooding the power grid, something it was never designed for. If the load is too heavy, the lights will blackout. Then the fuses blow in the transformer houses." To prevent that scenario and minimize social costs Alliander must act strategically as a grid operator, "to ensure we know what will happen in this fragmenting world so that we can adjust our infrastructure on time. Or, even better, managing without any adjustments, by having already implemented innovation."

Companies such as Alliander are investing liberally in grid digitization: their own fiber optic network, digital sensors and switches.

More data allows better monitoring of the balance between production and consumption. Remote-controlled switches ensure the automation of management tasks. In some places, it is possible to even prevent an increased load on the grid. Wind farms in the North Sea, for example, can already dispense much of their power on coastal ports, markedly increasing electrification in industry. This will protect the inland grids.

The internet of things is a boon

Local grid operators will also be helped by the *Internet of Things*, smart devices triggered when the electricity price is low.

A freezer can start extra freezing at night using cheaper electricity and consume low or no power for longer during the day. Electric cars and home batteries can be linked to the owner's e-calendar with battery recharging at desired times – for example, when electricity is cheapest. This allows devices to benefit from cheap electricity and reduce dependency on a constant power supply. On the other hand, weather-dependent energy sources fit better in the electricity market.

Major technical talent shortages loom

Still, one obstacle is blocking the transition of the grid: a shortage of technical staff.

Thijssen: "We will not achieve the Paris objectives. Not because of technology, not because of finances… if we're not careful it will be because of a shortage of hands. Literally. Physically." The 130 000 workforce faces a shortfall of 21 000 employees - people who install heat pumps or assemble offshore wind turbines. Companies, educators and governments must continue to co-invest in technically-trained personnel at all levels in order to meet the rapid rise in demand.

02 | New Heat Supply

For over half a century, the Netherlands has been a gas country - all buildings traditionally have central heating. Ingrid Thijssen: "95% of our households and buildings are connected to natural gas mains, because we heat our buildings with natural gas. That is a unique situation in the world."

The sense of urgency is growing

An important evolution is taking place in the gas sector.

Kees-Jan Rameau, the Chief Strategic Growth Officer and Board Member of Eneco, an energy provider, sees the pressure on gas stepping up: "Groningen, with all those dramatic developments there, has suddenly led to a sense of urgency. We used to think: we can still do it tomorrow. And now, it is evident that something actually has to be done now."

To neighboring countries, however, getting rid of natural gas first may seem strange - many use even more polluting fuels for heat production, such as oil or coal. Paul van Gelder is CEO of Mammoet, an international heavy lifting company serving the energy sector. He relates: "When I was CEO of Gasunie, in 2011 in Belgium, a celebration party was organized because a whole village was connected to natural gas and people no longer needed to use fuel oil."

> "When I was CEO of Gasunie, in 2011 in Belgium, a celebration party was organized because a whole village was connected to natural gas and people no longer needed to use fuel oil."
>
> Paul van Gelder, CEO, Mammoet

Neighborhood actions could free up the fossil fuel lock-in

So the energy transition in the heat supply sector is signaling the end of at least one centralized heat network. But decades of investments in gas have created a lock-in, and liberating existing buildings from gas dependence is labor-consuming, expensive and lengthy.

All alternatives would be local, making groups of houses or neighborhoods heat-autonomous. For Ingrid Thijssen, it's vital to ask questions and act as a neighborhood collective, asking: "if we want to make this neighborhood sustainable, how and when do we do that, to make the social costs the lowest?" However, residual heat, central district heating and geothermal heat are only possible at certain locations. Electric heat pumps are often the most expensive option and impose an enormous burden on local power grids. In all cases, excellent insulation is essential. "Energy efficiency is where you can make substantial use," emphasizes Eelco Hoekstra. "There is a lot to be gained there."

“

We need to rethink how we can re-use our gas network for alternative sources of energy, like hydrogen.”

Eelco Hoekstra, Chairman & CEO,
Royal Vopak

The shift to local heating doesn’t mean completely dismantling the existing gas network, however. Eelco Hoekstra explains: “Our gas network is also our strong side. We need to think how we can reuse it for alternative sources of energy, like hydrogen. This is key to accelerate the energy transition in a cost efficient way.”

Old infrastructure calls for creativity and collaboration

Stopping the flow of natural gas through the pipelines will reveal possibilities for creative ideas and repurposing.

For Peter Smink, CEO of Nuon, an energy supplier to two million people: “You could maybe use the existing infrastructure to eventually transport hydrogen through it, although domestic heaters would need to be made compatible before they could use hydrogen. The original natural gas pipeline in a lot of cities was hydrogen with carbon monoxide: the city gas of the past.” So if the gas grid is going to be used for hydrogen, then houses will need to be updated.

Joining forces can power the big investments.

According to Peter Smink, getting offshore wind lots up and running can involve investments in the order of 1 bn EUR: “Offshore wind is high-stakes. As a standalone Nuon couldn’t have placed a bid on wind farm sites Hollandse Kust I and III. Now, as an integral part of Vattenfall, we are able to make bids at that level.”

But it takes close cooperation between local authorities, pipelines operators and housing corporations to keep up.

Ingrid Thijssen: “It depends very much on the local situation. How is the power grid laid out, when is the housing company going to renovate its homes? When should the town open the street for the sewer? How is our gas pipeline laid out, is geothermal energy or residual heat possible in the area? You have to find that out in time, otherwise you will not make it by 2050, but it must also be programmatic, because otherwise it will become unmanageable for construction and installation companies, as well as for us.”

Gas, still the cleanest fuel, is under threat from cheaper dirty relatives

Finally a note of caution. Natural gas burns cleaner than oil and coal, and ideally would be the last fossil fuel to go, but in the Netherlands at least, it seems to be the first.

The gas pipeline is under question, and gas-fired power plants are also being turned off, because coal-fired power stations are now more profitable. “We are going too quickly to get rid of gas,” cautions Paul van Gelder. “We should not dispose of the cleanest fossil yet.” He continues “In many countries — and not everyone is aware of it, even on a political level — fuel oil is still just the fuel to heat homes, both in France and in England, for instance.”

03 | New Fuels, Disconnected World

Fossil fuels are the most important pillars of today's energy economy, not only for the transport sector, but as a raw material and for industry.

Fuel transition means changing the cornerstone of the economy. The challenges are considerable. Firstly, it is often very difficult technically to make industrial processes more sustainable, while innovation involves high costs affecting the entire chain.

Due to international competitive pressure in almost all sectors of industry, the extra cost required to reduce emissions can be disastrous for companies. As a result, a transition in this part of the economy that is too fast-paced will only relocate the industry to other countries, instead of saving emissions. Moreover, governments worldwide are reluctant to sacrifice wealth and economic growth on the altar of emissions reduction. Making the disconnected world sustainable is therefore the major challenge of energy transition. "Nobody should think that it is a free ride" says Manon van Beek. "The transition from a fossil energy system to a largely sustainable system will cost a lot of money. To maintain the current support within our society, affordability is a very important prerequisite for success. Governments must be transparent about this, market parties must – on the basis of the framework set by the governments and in cooperation with those authorities – ensure smart solutions that result in a new, sustainable system. With trial and error, I think this is absolutely feasible."

"Everyone knows the current state of affairs is some sort of elephant in the room. Despite this, a fair few people dare to voice it: You can only do so much for the world, can't you? Transforming such an energy system, in my experience, is a delta plan*. You need to look after a project for 25, 35 years if you really want to change the system. You could argue that we are ambitious enough at the moment, and, if we add a little more ambition every year, we will eventually get there. But there is one thing that will have a great effect on the outcome of the Paris climate agreement. Really a very big variable — global economic growth. If the global economic growth rate drops to 1%, the world will look completely different in 25 years than if it varies between 3% and 4%."

Pieter van Oord, CEO, Van Oord

*This refers to the large scale delta plan installed after the flood of 1953: a series of dams and protections from the sea were installed across the Netherlands over dozens of years.

People think: *you don't want to develop sustainable energy*. Of course we do! That is why we are so busy with our sustainable agenda, provided we can find business models. We would really like to develop those as quickly as possible. However, it cannot happen by snapping your fingers."

Marjan van Loon,
President-Directeur,
Shell Nederland

As the clean energy agenda gathers pace, the global fossil fuels market is still showing moderate growth

Leaders ask for patience: different markets evolve at different rates, and change cannot happen overnight.

Pieter van Oord: "Fossil fuels are still growing, despite the fact that nowadays, when you look at the power sector, we are investing more in renewables than in oil, gas and coal." For Van Oord, the most important driver is Asia, specifically China and India: "The growth will no longer come from Europe and America. Those developed countries do a lot of energy saving and know how to reduce energy costs a bit." Marjan van Loon, President-Directeur of Shell Nederland cautions: "It takes decades to become more sustainable on a global level… to arrive at that tipping point. And people think: *you don't want to develop sustainable energy*. Of course we do! That is why we are so busy with our sustainable agenda, provided we can find business models. We would really like to develop those as quickly as possible. However, it cannot happen by snapping your fingers."

The energy transition within this framework is a shift towards cleaner fossil fuels and improved processes with fewer emissions and higher efficiency. Hoekstra: "You see coal getting replaced by gas, fuel oil getting replaced by gas. In other words, next to the shift to renewables, you see that the whole energy system is starting to shift towards lighter hydrocarbons in order to do two things: lower air pollution like soot particles and sulfur, and reduce CO_2."

A clean fuel must meet high technical requirements to compete with fossil fuels.

Ultimately, a replacement for fossil fuels will be needed. But large-scale clean production, storage and transport are prerequisites to enable trading on a liquid market.

In order to allow competition with fossil fuels and gain dominance, a clean fuel must allow industry to reach high temperatures and pressures, having sufficient energy density. This latter property is limited to a few fuels capable of producing enough energy to power a large ship or aircraft — a bottleneck for batteries.

One fuel does fit the bill: hydrogen – whose combustion emits only water vapor.

"I am personally very much in favor of hydrogen," says Peter Brabeck-Letmathe. "It is sustainable, its by-products are only oxygen and water, both of which are clean. I see hydrogen in the medium-long term as a much better solution than electricity."

Furthermore, hydrogen is capable of supporting the industrial processes that many manufacturers rely on. Manon van Beek sums up its potential: "The produced sustainable hydrogen will be used for a large part in the energy-intensive industry. This involves large quantities of hydrogen that are used for the production of for instance fertilizer, plastics and basic chemicals. Also for the production of the required high temperature heat for the process industry, hydrogen is still the option to replace natural gas."

Short term, however, 'green' hydrogen, made from water with sustainable electric power, cannot yet be produced on a commercial scale.

So the largest part of the market is represented by 'gray' and 'blue' hydrogen, and its raw material remains natural gas – which entails emissions, even if 'blue' hydrogen greenhouse gases are stored underground. These factors, and the need for high-tech storage and transport, make hydrogen a challenging fuel. Time and ingenuity will be needed, after which future demand could be enormous.

Manon van Beek explains: "In a system almost entirely based on renewable energy sources it has been determined that between 60 and 75 Gigawatts of electrolysis capacity will be required to meet the demand for green hydrogen. Together with the other forms of electricity consumption (including electric transport and electric heating of buildings) and electricity storage, the demand for hydrogen can lead to a load on the electricity transmission grid that can be five times higher than the current peak load."

"Together with the other forms of electricity consumption and electricity storage, the demand for hydrogen can lead to a load on the electricity transmission grid that can be five times higher than the current peak load."

Manon van Beek,
CEO,
TenneT

To prepare for these volumes, Gasunie Transport Services and TenneT have started an exploratory study to show the consequences for the gas and electricity transport infrastructure in the Netherlands and Germany. "The construction of electrolysis installations in the vicinity of the production sites for sustainable electricity is obviously a way of keeping the consequences for the electricity infrastructure manageable," says Van Beek.

Questions surround electricity

Particularly regarding the feasibility of using electricity in the disconnected world, Peter Brabeck-Letmathe raises substantial doubts. "Electric vehicles are not a solution, as they are much too resource-intensive. First of all, electricity has to be produced. As of today still, the biggest source of electricity is coal, which is certainly not the best option. Secondly, if we move to a cleaner fuel, it will be natural gas, which is happening just now, but it is still not renewable energy. To have wind and solar as the sole energy supplier is a dream of the future, and it will never happen. From this point of view already, electricity is not suitable. I am personally very worried about the trend towards an electric solution, because of the limited resources we have. Both lithium and cobalt are limited. Additionally, a Tesla weighs about twice as much as a normal car, and in order to move it, you need more energy. On the other hand, a hybrid car makes a lot of sense, to use the kinetic energy we have by braking or going downhill. Hybrids are something I fully support, but not fully electric."

Energy transition demands 'transition fuels'

Realistically, we can expect an intermediate phase in the energy transition from a few years to decades, using so-called 'transition fuels'.

"So much energy is being consumed, and you still need so much, that you can never switch to purely sustainable in no time," says Wim Pelsma, CEO of Aalberts Industries, a globally active specialist in industrial products and processes. "There must be a transition for fuel." Made of natural gas, for example, transition fuels would burn cleaner than oil or coal, but still not be emission-free. "If you can make gas dominant on the supply side, as Shell is doing and we as well, then naturally that increases the speed at which you become cleaner."

Wim Pelsma believes transition fuels will emerge faster at petrol stations than hydrogen: "I don't think hydrogen is coming that soon. We have been researching hydrogen for years and we are already in it. The point with hydrogen is that there is no infrastructure, despite some development, but we think that's peanuts. This does not mean it will not come at all, but, as for today, only a few stations are being built. If you look at CNG [compressed natural gas], there are already hundreds of stations. For LNG [liquid natural gas] there were 60 stations in Europe in 2016, while in 2017 there were almost 100. Transition fuels will play the leading role in the energy transition in the coming years."

Prominent transition solutions

LNG (liquid natural gas)
CNG (compressed natural gas)
Scrubbers (air pollution control devices)
Electrical/hybrid
Hydrogen

The spotlight is on LNG vs CNG, as the infrastructure slowly grows

Peter Brabeck-Letmathe is "quite convinced LNG is going to replace coal in electricity production, as it has a substantially lower CO_2 output. LNG is certainly one of the fuels that is much cleaner and therefore is going to have a major positive impact."

Shell has already shifted its focus from oil to gas. Aalberts similarly.

Wim Pelsma: "Last February, we said that we were going to do less with oil because I think oil is losing its position." In the Netherlands, one of the most important drivers for transition fuels is the maritime sector. When it comes to his company's future fleet, Van Oord explains "We are thinking of building the most on LNG. When I talk to LNG experts, they say: *by 2030, about half of the world's new shipbuilding will be running on LNG*. Only half, so the other half would still run on conventional fuels." Time will be needed.

Link by link, the chain is being forged

Dave Vander Heyde: "We are leading in offshore LNG technology with dredgers. We already delivered three for DEME driven entirely by LNG. We're now working for Van Oord, also with LNG, but it's still more expensive because of the safety provisions, tank systems, pipelines and so on." Progress is not without its difficulties, however. "The infrastructure is not yet widely available and these are bombs at sea, where you have tanks of 800 m^3 on board."

In the port of Rotterdam, however, the pipeline is ready. And the supply and demand of vessels that can store and dispose of LNG is growing. In the coming decades, the liquidity of the LNG market will increase. Ever more ports around the globe will receive the licenses and terminals to bunker the fuel.

LNG must also be able to compete with traditional fuels.

Pieter van Oord: "The success of LNG is largely dependent on its price versus MGO [Marine Gasoil]. If oil companies can ensure a good LNG price for a substantial period, that market will grow. Oil companies are very open to investigating this, to encourage maritime companies to switch to LNG technology."

Onshore, an emerging network of filling stations is allowing vehicles to refuel with gas products.

Will Pelsma: "I don't think hydrogen is coming so fast. However, LNG can be used for both ships and for trucks. If you consider CNG (Compressed Natural Gas), there are already hundreds of stations. If you look at LNG today, there were 60 stations in Europe in 2016, while in 2017 there were almost 100. Because of innovations, the consumption of LNG will decline in a few decades to make room for a really clean fuel."

> "If you look at CNG, there are already hundreds of stations. For LNG there were 60 stations in Europe in 2016, while in 2017 there were almost 100. Transition fuels will play the leading role in the energy transition in the coming years."
>
> Wim Pelsma,
> CEO, Aalberts Industries

However, LNG will remain a temporary solution. Vander Heyde: "The long term future is not in LNG. LNG is an intermediate solution, a transition fuel. I do not believe it will be there forever, because it is too expensive, too complex, and technology will continue to develop towards 'non fossil' fuels, such as hydrogen solutions and electrification."

Which energy solution will win?

Peter Brabeck-Letmathe says: "If I look at the energy challenges of today, I think we have to work on all available technologies in parallel. I don´t think any one solution is valid. We have to continue to work on carbon capture and storage, no doubt at all. I think we have to substitute carbon with LNG as soon as possible. It is already happening, but it needs to go faster. Electricity will play a role, but I think a limited role."

04 | Energy Storage

This report divides energy into two worlds: *connected* and *disconnected*. These are largely separate: once energy has been converted into electricity, it is no longer possible to make oil out of it. Storing energy brings the two worlds closer, yielding countless innovations and solutions in the energy transition. One of the most crucial is decoupling electricity production and consumption. When demand is high, electric power must still be generated, but in the future, it will be possible to consume the power of wind turbines and solar panels later, from storage. This allows dips in the power grid to be absorbed.

Energy storage can kill two birds with one stone: shortage and surplus

If North Sea wind turbines and other sustainable sources produce surplus power, storage will be essential for balancing the energy market.

In exceptional cases, over-production can hit profits, as in an unusually windy Germany at the close of 2017[7]. German producers actually had to pay to dispose of their electricity, and electricity price also dropped in neighboring countries.

Apart from batteries, energy storage can also be implemented in molecular form; hydrogen, formic acid or another compound — good candidates for fuel in the disconnected world. However, due to an enormous difference in capacity, batteries and molecules will have completely different functions in the economy of the future. Van Oord: "the number of energy units you can store in the Bergermeer gas field will correspond to a few billion Tesla power banks. So we are far from thinking that we have solved our storage problem with those power banks… They can still ensure a lot of energy in the micro environment of the house is climate-neutral. But for the industry here in Rotterdam, this solves 0% of the problem."

Hydrogen can provide the capacity and will become one of the most important fuels in industry and transport. It could even be cost-effective to produce at sea.

Peter Smink: "If you have to transport electricity through a copper cable in the form of electrons, it costs significantly more than when you do it in the form of molecules. There are already ideas to produce hydrogen from water and to use existing infrastructure for transport."

Eelco Hoekstra, CEO of tank storage company Vopak: "We expect that new international product flows will develop to transport and store renewable energy. Once solar energy gets converted into hydrogen on a substantial scale, you will see hydrogen flow from sunny regions to, for instance, Rotterdam."

[7] *Energeia*, December 27, 2017. Windy Christmas causes negative power prices in Germany.

> The system contains many uncertainties, so I think you should develop everything."
>
> Pieter Van Oord,
> CEO,
> Van Oord

Batteries will need to grow up to get out of the house

Without a technological breakthrough, however, batteries cannot play a major role in industry versus its current use in small-scale applications, such as home batteries and electric cars.

Certain devices will be individually equipped, while buildings will have a central battery to make households independent of a constant power supply. Kees-Jan Rameau relates that a single battery charge of a Tesla can provide an average household with power for more than a week.

According to Peter Smink, the fact that household batteries are still only infrequently installed is mainly due to regulations: "Our system here in the Netherlands doesn't actually reward having a battery, because of the net metering policy. In Germany, they sell lots of solar systems with a battery because their system is organized differently."

On the contrary, Peter Brabeck-Letmathe warns of the ethical and resource issues associated with "the battery problem," which are so serious he questions whether this technology holds the future. "The amount of lithium in a Tesla is about 74 kg in one car, which is absolutely incredible. Take cobalt: if you look at the cobalt mines in Africa, you see poor children working in the most dangerous situations. Most of the cobalt mines anyway are in the hands of the Chinese, so we will not have the raw materials and resources to manage an electrification. That's why I'm not convinced of it."

Still, companies continue to focus on battery technology; the significant improvements made in recent years are set to continue. Peter Smink: "In the Flevopolder, we have wind turbines, and we're going to install PV panels there, because we already have that plot. We have a connection to mains, but a very large battery as well. We are committed to all those technologies."

All storage methods will eventually find their niche

Although current forecasts suggest molecular storage is more suitable for industrial use, innovation in the energy transition is going too fast to state that with any certainty. So companies are spreading their investments.

Pieter Van Oord proposes: "We live in an energy system with a very high VUCA aspect; Volatile, Uncertain, Complex and Ambiguous. This includes 'Uncertain'. The system contains many uncertainties, so I think you should develop everything. You have to develop a battery technology, but also hydrogen technology, and continue with hybrid boilers, for example. I think that can also play a very important role."

Investing — how wind surpassed biomass

It will take solid coordination to recover as much economic value as possible from investments in clean energy. The government must take steps together with the business community to roll out promising technologies on a large scale and allow growth sectors to flourish. In the case of the Netherlands, this concerns offshore wind turbines, insulation programs for homes and business premises, new networks such as for hydrogen or heat, a charging station infrastructure and hydrogen filling stations.

A logical strategy also implies skipping intermediate solutions wherever possible, and leap-frogging to more future-proof technologies.

The issue is not where society is heading, virtually all CEOs agree, but when. It may not be clear whether it is 2030, 2040 or 2050, but the final picture is increasingly clear. The question remains: *which sustainable sources will provide energy and how to invest in it?*

In 2016, 3.6 billion euros were spent in the Netherlands on co-firing biomass in coal-fired plants — 40% of the subsidy ceiling in 2016. However, the sustainability of this practice was widely critiqued.

The biomass used is mainly wood chips, shipped by container ship from Canada[8,9]. There were concerns in the Netherlands that forests were being cut down to burn in the coal-fired power plants. As a fuel, wood is as polluting as coal and it takes trees 20 to 100 years to regain their former CO_2 absorption level. Biomass releases the same CO_2 and hardly contributes to further innovation.

Nevertheless, the investment in biomass co-firing was a logical decision at the time, based on the costs per kilowatt hour of clean energy.

The subsidies started in 2015, when the costs of power generated by co-firing were estimated at around 0.11 euros per kilowatt hour[10]. In the same year, it was estimated that a kilowatt of offshore wind energy would cost 0.133 euros at the most favorable location[11]. But contrary to those expectations, costs have now dropped far below that.

[8] *Zembla*, 25 January 2017. Government continues controversial subsidy coal-fired power plants.
[9] *KNAW*, 2015. Position paper biofuel and wood as energy sources.
[10] *ECN*, 22 January 2015. Note — Structure of the grant for co-firing. ECN-N--15-006
[11] *ECN*, 14 May 2015. Costs of offshore wind 2015. ECN-N--15-014

The high costs of offshore wind energy meant it used to have many opponents – this is changing:

"Ten years ago, a lot of people used to say: we have to stop offshore production," Pieter van Oord remembers. "In the Netherlands, renowned media wrote about it very negatively." In 2015, investing in biomass co-firing resulted in more 'green' power generated for the same money. Then a spectacular drop in the cost of wind energy occurred. In December 2016, the tender for Borssele III and IV sea wind farms was won by a consortium with a bid of 0.0545 euro per kilowatt hour[12] - less than half of the estimated costs in 2015. Now, in 2018, wind energy is so profitable that the first tender without a grant has been successfully won by Vattenfall. Nevertheless, in spite of criticism, the granting system for coal-fired power plants will be preserved at least until 2024.[13]

The coming ten years will see intensive installation of wind turbines in the North Sea – requiring collaboration across countries and companies.

Manon van Beek, CEO of TenneT: "If we want to achieve the COP21 [Paris Agreement] objectives, we will have to do much more on wind energy on the North Sea on a European scale, perhaps in the direction of the 200 GW [capacity]." TenneT is the initiator of the consortium known as the North Sea Wind Power Hub. "Up to now, five parties are participating: TenneT Netherlands, TenneT Germany, Gasunie, Energinet and Port of Rotterdam."

This consortium is currently studying the creation of an artificial island to act as a marine wind hub in the North Sea. Van Beek: "Connecting large-scale offshore wind power to a central hub (PowerLink Island) far from shore, or even larger amounts to several interlinked hubs, provides a unique basis for harvesting benefits of scale. International coordination is crucial if we are to succeed in rolling out mass-scale offshore wind power in the North Sea at the lowest possible cost." The island would have a permanent base for personnel and could even host "possible synergy technologies such as Power2Gas. The consortium is currently conducting feasibility studies in which economic, ecological and regulatory aspects play a crucial role."

Despite the rapid decrease in the price of wind energy, Dave Vander Heyde warns that this development is partly based on the expectation that costs will drop even further. "What is happening today is predictive discounting. The tender resulted in smaller grants and ultimately makes parties think: *how much would that technology improve and what risk do we accept on that expectation?* And we already discount. Given we are not talking about some distant future here, but rather the next five years. Still, there are a number of assumptions that have yet to be proven." Offshore wind energy will certainly remain cheaper than co-firing in the near future, so this example shows that forecasting the most cost-effective way to avoid emissions can be a risky game.

[12] Ministry of Economic Affairs. Letter to Parliament — Results of the second offshore wind energy tender for lots III and IV of the Borssele wind farm. 12 December 2016.

[13] Coalition Agreement — Confidence in the future. 10 October 2017.

Part 2 | Stakeholders

In Part One we set out the future of some important technical components of the energy economy. Yet that is only one side of the story. Part Two presents a social perspective, focusing on three stakeholder groups: companies, governments and citizens.

Dave Vander Heyde: “Transition is a mindset. All technology is a result of a paradigm shift that grows in small groups of people, receives support and is set in motion.”

Introduction

Any new paradigm advances faster because of felt events, rather than abstract trends - one reason why climate change is such a difficult problem. For our interviewees, one Asian country is an obvious example. "For the Asian city, perhaps the most important driver in the shift to electric or hydrogen transport is local air quality, not sustainability," says Kees-Jan Rameau. "Consider China..." Of Beijing, Dave Vander Heyde says: "Often, you cannot see the sun there, just a shiny disc behind a thick layer of smog. When I experience that, I know why we're doing this, and then you get things moving."

Energy transition is a human transition

Tackling two environmental issues at once can be an effective strategy, as improving air quality in cities also reduces greenhouse gases.

Royal Vopak deals with meeting energy needs in communities around the world. Eelco Hoekstra explains: "People who now live in Lagos, Jakarta or Delhi are mainly interested in improving air quality. For them, the way in which industrial and transportation companies are currently using energy is first and foremost a health issue."

This example shows that finding solutions in the energy transition needs to be a creative process, one which often benefits from a link to other issues. Government, industry and private individuals must all collaborate to create value and impetus.

Solutions must be consistent and holistic to remain affordable and feasible, connecting to existing energy systems. This requires a willingness to innovate and invest together, with different parties playing different roles. One CEO says that due to the complexity of the problem, the government can help in particular by providing predictability for the future. Others feel the change will be driven more by the business world. Clearly the energy transition must be solidly backed by society at large, with the government formulating clear and innovation-proof frameworks. This will encourage companies to switch to sustainable energy as economically and quickly as possible.

> "People who live in Lagos, Jakarta or Delhi are mainly interested in improving air quality. For them, the way in which industrial and transportation companies are currently using energy is first and foremost a health issue."
>
> Eelco Hoekstra, Chairman & CEO, Royal Vopak

In this triangle, all parties have to undergo a complete transformation, hand in hand.

01 | Companies

Today, energy is not only a means of production, it is becoming a commodity to gain a strategic advantage. Business front-runners are using the energy transition movement to their advantage, making sustainability a fully-fledged earning model. Beyond 'business as usual', energy-efficient and sustainable operation gives an enduring competitive advantage. It is a lever to attract young talent and out-innovate rivals. For Peter Brabeck-Letmathe, a sustainable agenda is a must: "In today's world, any company I know has integrated sustainability in general into their strategic thinking. Energy is a very important part of it, and I think no industrial company today can really have a sustainability agenda without including sustainable energy." To benefit, the transition cannot be a casual enterprise. Only when a corporate headline clearly states that the energy transition is a priority can the organization make use of the opportunity. Subsequently, this renewal can — and should — involve employees.

Organizations who fail to plant the flag risk falling behind

Given the rapid developments in the energy economy, it is vital for companies to keep a close eye on what is happening in their sector, even if internal progress is also demanding attention.

"What is extremely important, if you have a company that works in such a disruptive environment, is that your people — and you too, of course — really have your eyes open to the outside world," says Ingrid Thijssen. "It takes your employees to focus their antennae on what is happening and which way it is going. All that should be combined with implementation and subsequent scaling up."

Disadvantages can be turned into their opposite

Creativity can be sparked by worsening conditions, or spin-offs from other innovations.

Nuon is developing a hydrogen power plant in Eemshaven, a major port. According to Nuon's CEO, Peter Smink: "The economy for stand-alone gas-fired power plants has deteriorated, but because people are forced to think when economic conditions worsen, creativity emerges. That's how the idea was born to convert the gas fired power plant into a hydrogen plant."

Dave Vander Heyde notes the new way in which IHC raises offshore wind turbines: "We had a tool to minimize underwater noise – it may reach up to 160 decibels. We developed a shield around the monopile to mitigate the underwater noise. We actually made a revenue item from a cost item, because the tool is now used to position the monopile." Aalberts, meanwhile, is opting to produce high-quality components, which also contribute to reducing emissions. CEO Wim Pelsma explains: "It's part of innovation. We extend the life of materials unbelievably. Thanks to the heat or surface treatment of metals and sometimes of plastic, a part can sometimes serve 30 or 50 years longer. We are now also trying to recycle it - so you get a resource cycle."

A successful story means balancing the books

Companies that already allow sustainability to migrate from CSR into their core business already have a long-term advantage. This is a far-reaching step: a real energy transition promotes the key position that energy occupies in a company's daily routine.

Sustainably successful players balance sustainability with other business imperatives. Wim Pelsma: "You can talk about energy transition for a long time, with all kinds of beautiful stories, but the real beauty is when it is becoming a revenue model. You can say, you have to be a philanthropic institution, but of course you cannot be. A company is a company."

The energy transition has big advantages and undoubtedly owns the future, but that does not deflect from the challenge. Atzo Nicolaï is a former member of Parliament, Minister for European Affairs and Minister for Government Reform and Kingdom Relations. Since 2011 he has been President of DSM Nederland — a global science-based company active in health, nutrition and sustainable living. He explains how DSM balances a sustainable policy with financial health: "Three years ago, we deliberately decided to fully hold on to our strategy for the next three years. It was no less ambitious, but the decision was to focus on operational and financial targets. When you have managed to be just above expectations quarter by quarter, your share price will also rise and you'll be entering a positive spiral."

If green energy is cheaper than gray energy, companies have an intrinsic motivation to transition

Momentum is needed to put the company in a position where it can make the move. Nicolaï: "Sustainability is a beautiful story, but actually your ticket for that big story is also composed a bit of the quarterly results. It is people, planet, profit, but you cannot really put them clearly in order here. They cannot do without each other."

> "It is really a revenue model. We distinguish so-called 'Brighter Living Solutions' products that distinguish themselves by being more sustainable than the standard ones. The return on these 'Brighter Living Solutions' products is on average larger than that on the regular products and therefore these products make up a substantial part of our portfolio... You cannot have simpler and more convincing evidence that it is really a win-win situation."
>
> Atzo Nicolaï,
> President,
> DSM Nederland

DSM has chosen to be at the forefront of the energy transition. Their investment is solid, but so is the return. "It is really a revenue model. We distinguish so-called 'Brighter Living Solutions', products that distinguish themselves by being more sustainable than the standard ones. The return on these 'Brighter Living Solutions' products is on average larger than that on the regular products and, therefore these products make up a substantial part of our portfolio… You cannot have simpler and more convincing evidence that it is really a win-win situation."

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If you want to create a new market, you first have to build it up together to lay down a network you can all continue to build on. So working together, spurring each other on, being curious, being able to live with uncertainty, yet stubbornly researching how we as a society and as a company can move toward that sustainable future, on a societal level as well as in business models.”

Marjan van Loon,
President-Directeur,
Shell Nederland

Bridges are being built in the most surprising ways

The energy transition is uniting the unlikeliest of industries.

Atzo Nicolaï: “We [DSM the Netherlands] took the initiative, together with Google, Philips and AkzoNobel, to get a wind farm off the ground.” Even competitors sometimes have to be approached, (although they are not usually the first port of call).

In the energy transition, this kind of critical synergy can build new sectors.

Marjan van Loon. “You need everyone, the government, NGOs, other companies. In the Botlek [a port and industrial area in Rotterdam], we should work with neighbors and other companies and organizations in building hydrogen and LNG stations, for example. If you want to create a new market, you first have to build it up together to lay down a network you can all continue to build on. So working together, spurring each other on, being curious, being able to live with uncertainty, yet stubbornly researching how we as a society and as a company can move toward that sustainable future, on a societal level as well as in business models.”

Partnerships stimulate sustainable business models.

One example is the Dutch Sustainable Growth Coalition. Atzo Nicolaï: “It consists of seven sustainability-oriented Dutch multinationals. What we discuss in that collective is for example an internal carbon pricing. Not everyone has introduced it yet, but at least in the boardroom, business cases are settled as if there were a price on carbon emissions. A way to ensure your investments are future-proof towards a low-carbon economy. “

A virtuous circle is growing

As ever more companies embark on the energy transition, the support base is growing – and the expectations of business are rising. Every company starts the transition for itself, but their activities impact other companies affected by the energy transition in other ways, creating a new network of sustainable partnerships, and a positive feedback loop.

Wim Pelsma: “We also need to demonstrate it. But I think the pressure, or the sentiment, (maybe that’s a better word), coming from society, investors and youth, who also find it increasingly important... This sentiment stimulates the business community to make certain choices. If there are business models that allow you to earn money, whether they include solar or gas energy, then the development is going in the right direction. That’s what’s happening now.”

02 | citizens

Consumers often lag behind companies in the energy transition. This matters, because public backing is crucial to building a critical mass of support to boost the energy transition. Part of the pressure on businesses to go green fades out when the public drags its feet. As a result, sustainability-oriented companies try to encourage consumers to think more about energy.

Business is taking the lead over consumers

Corporations have the power to make a difference because of sheer size, and consequently are quicker to see energy transition as an opportunity.

Kees-Jan Rameau: "Until recently, the consumer business cases were still a bit undeveloped, because household volumes are limited. So you can see that it initially happens in industry." Companies also want to set the example, he observes: "It actually goes faster on the business side. Because you see with the large corporations, especially corporations supplying to end consumers, that it is really a big thing to be able to say they are leaders in the sustainability index in their sector." Business customers of companies, such as NS and DSM, not only want green power but homegrown green power. Peter Smink, CEO of Nuon, observes "This is a conscious choice of many companies, and you can see it with more and more."

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Peter Smink, CEO, Nuon

Green is still the domain of the well-off

Energy players know that richer consumers — at least — need no encouragement.

"There has always been a segment that opts for sustainability," says Kees Jan Rameau. "That segment is growing, but it's still only a proportion of consumers - often slightly more educated, richer people with the money to invest a little more, because the transition to sustainability for consumers often involves an investment, for example in solar panels." Peter Smink confirms that green power, in reality, is not on every consumer's agenda. "Most people don't care about whether it is sustainable or not. They want electricity that's reliable, and at a good price. And if you want it green, we have it green for you."

At first glance sustainability means difficult personal choices — pay a premium, or sacrifice convenience.

Green power, organic foods and products with a quality mark have a price tag. Flying, driving, and eating industrially-farmed meat all harm the environment but are relatively cheap. Only a minority of consumers are willing or able to structurally reduce their consumption of these goods. Therefore, one challenge for energy companies such as Eneco is to devise new strategies to involve the consumer in the energy transition, including the less well-off. Not an easy task, since the investors in domestic sustainability (who are usually already relatively wealthy), also benefit most from private grants. Kees-Jan Rameau: "They can take advantage of all kinds of sustainability measures, thereby avoiding

part of the energy transition costs. Because many of these costs are now being surcharged to all consumers, as a tax on top of the energy price for the parties who simply get their power from the grid, instead of their own solar panels, for example."

Business must show consumers the benefits — and help them along

With new financial instruments and simple insights into energy, new technology can democratize

Kees-Jan Rameau: "You have to take people along with it. So you should avoid some technocratic, top-down-style rollout, because then you'll just lose the public support." That's why a better strategy can be to show people the benefits of transitioning.

Energy is a given in the Netherlands and consumers have neither the time nor the intent to constantly think about it. Apart from behavioral adjustments, sustainability for consumers often takes the form of short-term projects, given extra attention during the time needed to get organized. A successful project then lifts burdens. Households become increasingly efficient thanks to sophisticated energy systems capable of automatically displaying and coordinating their energy requirements through digitization. Bringing consumers closer to their energy consumption - and sources - requires solutions that fit seamlessly into their routine. Residents must be able to see at a glance their consumption, forecasted use, evolution in use, and the composition and origin of their energy.

Households will need a major structural shift to become energy-neutral

If new builds are increasingly (almost) energy-neutral, existing structures remain a major obstacle. Making a building climate-neutral is a customized project, and people have a hard time estimating the costs, how to bear them, and foresee the outcome.

Even understanding potential measures is a challenge — many consumers can no longer see the wood for the trees. Many also depend on a housing association, grid operator or other entity for larger interventions in energy supply - housing insulation, for example, or connectivity to district heating. This all makes sustainable housing vulnerable to fragmentation. Consumers quickly get discouraged from engaging in energy-neutrality. Whilst this is an inevitable teething problem, and households will become more sustainable over time, more parties are needed to bring all these elements together and offer a complete package to bewildered consumers. Speeding up the pace of the energy transition will require households to become energy-neutral, and customers experiencing the benefits.

Public debate around climate change is a key — and experience takes primacy over theory

The consequences of climate change are abstract and difficult to measure. Specific events can create momentum. Kees-Jan Rameau cites the city, "where perhaps the most important driver in the shift to electric or hydrogen transport is local air quality, not sustainability as a whole, for example in China." As we saw earlier, movement is catalyzed by felt consequences. Attitudes towards gas consumption are a further example. In less than half a decade, backlash from repeated earthquakes surrounding Dutch gas extraction sites caused the once-celebrated resource to be completely discontinued after only a few years.

Public involvement, Eneco and Nuon

Many companies are working to make the energy transition accessible to consumers. Kees-Jan Rameau of Eneco: "With Rabobank we have developed a prototype concept called a 'solar hub'. Rabobank makes roofs of its branches available where solar panels can be installed." If local residents within a branch's postcode lack roof space, they can install their panels on a Rabobank roof. "So, from a taxation and administration point of view, it's as if those panels were installed on your own roof. By doing so you make solar panels accessible, because everyone lives somewhere within your postcode, and there is always a place to install your solar panels. That makes it something that everyone can be involved in."

Eneco goes one step further. "We have a product called CrowdNett: you buy a battery to hang on your wall. You get a considerable discount, making it much easier to make a quantifiable business case out of it. In exchange, you have to let us deploy the top and bottom 10% of that battery. Next, we bundle batteries together and then we can trade this total energy on all sorts of flex markets through our trading desk." As such, consumers are incentivized to opt for sustainable energy, but these installations also add to a solution for weather-dependent renewables, such as solar panels. This helps reduce the peak load of the grid.

> "With Rabobank we have developed a prototype concept called a 'solar hub'. Rabobank makes roofs for its branches available where solar panels can be installed."
>
> Kees-Jan Rameau, Chief Strategic Growth Officer, and Board Member, Eneco

To give consumers insight into their consumption, Eneco has launched Toon, a smart thermostat that helps achieve potentially big savings. Looking ahead, Rameau explains: "As a consumer you will be able to select certain preferences on your smartphone, but also give us some space to help you save energy. And that's where blockchain can come into play, because you need to have protocols to automate those processes."

Swedish Vattenfall owns PowerPeers, connecting small green electricity generators to private customers, ensuring the supply of Dutch green power. Users can choose to link up to one of a number of sources, so that they know the origin of their power at any time.

03 | Government

Government plays a central role in the energy transition, determining the playing field for the energy economy. The Dutch government's responsibilities include setting objectives for companies, regulations and energy provision. A government is in a position to stimulate technical training to make the energy transition coherent and to bring companies together. To be successful will take wise policymaking.

Government policy needs to be careful, decisive, and consistent.

Policy must correspond to social need. At this stage of the energy transition, clean technology is advancing fast, so scaling up to a commercial scale is badly needed. This can only be achieved with huge investments, recouped only years later.

Still, the Dutch economy has great potential. Even absent a well-elaborated strategy at the outset, it is crucial to just start. Multiple CEOs see no harm in the occasional lack of coordination, as long as there is action. Many of the companies interviewed are reaping ever more of their turnover from sustainable products and services. In the knowledge-based society of the Netherlands, sustainable sectors will soon become a cornerstone.

To provide companies with sufficient security to invest heavily, government policy must be predictable.

Atzo Nicolaï argues: "Predictability is certainly crucial for big business, but at the moment predictability is low. I am a great supporter of climate law. It helps tremendously, because adopting a law is a long procedure — and then it is difficult to change it."

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The first step for predictability has to be clarity about long-term national ambitions. If a government takes energy transition seriously, exemplified for example via legislation, it will better motivate companies and households alike.

This attitude could be far more emphasized, according to Wim Pelsma: "People do not choose. I think the Netherlands is unique in the area of Internet, start-up culture, a very open, transparent community. People here are very open, informal, keen. We have the best installation rate for fiber optic cables alone, the infrastructure is fantastic. The Netherlands can really get ahead with digitization as a whole, if committed to the business of the future and sustainability. But you have to make certain choices."

“

You can significantly accelerate if you adopt another model. Then spend money! Don’t give those 11 billion back in tax benefits. Just invest them!”

Wim Pelsma,
CEO,
Aalberts Industries

Government must lead the big investments in clean energy, innovation and creating new sectors

The government is a prime position to drive change, but it has to make social and fiscal choices.

“A government can stimulate or accelerate the process,” says Pelsma. “How to accelerate? By setting focus points and creating an enormous resonance around its importance. You have to create an infrastructure to train lots of people going into the same direction, but then you will have to choose. To choose not for the old industry, but for the future, for the youth. We hold a few great things in our hands, digitization, our start-up culture, the chip industry. We are quite good at that, but you can significantly accelerate if you adopt another model.

Then spend money! Don’t give those 11 billion back in tax benefits. Just invest them! Aalberts is investing 120 million, I’m going to invest 140 million this year. Why don’t you invest? Don’t give all that money back. This year, in the top 40 companies in the Netherlands, such as AEX and AMX, 23 billion were returned to the shareholder, 9 billion used for acquisitions, and 8 billion used as loans to finance this. So, when you return 23 billion to the shareholders, what should they do with it?”

The energy transition is still in an initial phase and is relatively slow-moving, while ambitions are big. Only if the government continues to invest decisively can the innovative strength be achieved to keep up with the objectives and clearly reduce emissions. Financial windfalls, such as the reduction of the required grants for offshore wind turbines, should be able to flow back to research institutions. In addition to technical innovation, the sustainable economy will be rewarded with accelerated public support.

Regulation means setting the what, not the how

While sustainability is a focal point, there must be appropriate regulation, with two components: on one hand, the government should set specific objectives that stakeholders should adhere to, but on the other, parties should not be limited in finding creative solutions to achieve them.

Yes, the objectives must be ambitious, but stakeholders must be given ample space to find the most cost-effective solutions. Thus transition can remain as cost-effective as possible and keep up the pace.

> Instead of telling each other smart but untruthful stories you have to really believe each other, understand, trust. Then you should get exactly that approach that makes companies think: I am being run ragged, but I am going to make sure it works, and which makes the government think: this is a beautiful story, but it is also achievable."
>
> Atzo Nicolaï, President, DSM Nederland

Yet today, some rules are neither future-proof, nor agile. Companies are often having to invest a lot of effort in energy transition. This limits the pace, as innovative initiatives have a greater chance of failure if licensing schemes do not fit well.

Regulation should boost innovation, not hold it back

Again, laws should be formulated in a way that they do not dictate to companies how to make the energy transition, but give space to experiment. This will result in more variations - and the market will decide.

For Pieter van Oord, it is via economic forces that best solution for energy storage will emerge: "If you ask me now, what would it be, batteries or hydrogen, then I will say: I don't know, and I think nobody knows. *It's the stupid economy*, the economy will determine it." Work with positive measures instead of just taxes, says Wim Pelsma. "You can simply levy a tax, that's not so difficult, but you can also say: *how can we bring that carbon footprint down together? What is your responsibility, what is our responsibility?* It should be a long-term vision, because you cannot arrange that in 3, 4 years. Why don't you see it positively, why don't you invest? The Netherlands is so incredibly rich."

Too much restriction will suffocate change

It is difficult to achieve the sophisticated balance needed for legislation to work well. Companies that fail to keep up can trip up, so over-restrictive requirements can backfire and damage the economy.

Atzo Nicolaï: "It means finding exactly that point where the business community is of good will and in the leading position, being able to meet requirements with an extra push. That is a problem for the more polluting, or less innovative parts of businesses." Hence the Netherlands must be honest about the measures that fit the goal of reducing at least 80% of emissions by 2050. Nicolaï: "Instead of telling each other smart but untruthful stories, you have to really believe each other, understand, trust. Then you should get exactly that approach that makes companies think: I am being run ragged, but I am going to make sure it works, and which makes the government think: this is a beautiful story, but it is also achievable."

The Netherlands is poised to lead the way

If the government works strategically, the result will be a leading position in which objectives are achieved, innovation encouraged, and we dare to make investments. If the Netherlands gets focused entirely on taking steps to have its emissions addressed by 2050, a positive business climate will emerge. The Netherlands will become a hub of innovation and sustainable energy and an attractive place for companies to establish there – and stay. Mutual cooperation between the companies heading in the same direction further reinforces this effect.

Case In Point | The Biofuels Incentive Policy

The scale achieved by a development can make or break an innovation. Innovation needs time to reach a critical mass before becoming profitable. Yet promising innovations are sometimes not given the right opportunity to realize their potential and can raise other problems. One example is biofuels, set to play a major role in industries struggling to get rid of liquid fuel. The first generation, however, uses edible plant components, so biodiesel production competes with food production. This creates an economic and moral issue. "Here you get a competition for fertile land - and we also have a global food problem," says Ingrid Thijssen.

That's why Peter Brabeck-Letmathe supports biofuel from algae: "It is the only biofuel that does not require fresh water. The issue for biofuel production in general is that the water consumption is much too high. We will run out of fresh water long before we will run out of oil, so biofuels are not an answer to the sustainable energy question. Algae are a different approach, as they are grown in salt water and we have sufficient salt water in the world."

Alternatively, DSM has developed the technology for a second-generation biofuel, enabling the processing of the non-edible parts of corn, for example. In the US, the first factory had been set up for this purpose. Atzo Nicolaï, President of DSM Netherlands, explains that the balance between the public and private sector has been a key lever. The US combination of policy and regulations was such that it made sense to set up such a factory there. "It was a combination of physical possibilities, raw material availability of nearby farmers and tax facilities available in America to do this. The regulations for obligatory biofuel blends were such that they allowed it to become profitable. That combination of money, and especially of policy and regulations, made the business case to do it there.

> "Europe sometimes wants to be 'more Catholic than the Pope' by imposing certain requirements on combined biofuels regulation that just do not work."
>
> Atzo Nicolaï,
> President,
> DSM Nederland

I personally have hoped and even tried a bit to get this off the ground in Europe, too, but that proved to be just unattainable, apart from the fact that it was difficult spatially. Here, the combination of regulations and tax facilities prevents it from becoming profitable. For example, Europe sometimes wants 'to be more Catholic than the Pope' by imposing certain requirements on combined biofuels regulation that just do not work. To make it work properly, you have to keep in mind the fact that the first generation of biofuels still presents the food-fuel issue. Yes, Europe wants to do it properly, but then, again, it does it overly nicely. There can be well substantiated reasons for this and its NGOs could be the biggest in the world, nonetheless, the result is that it just does not take off. For me, this is an almost classic example of how, as government and business, you have to collaborate closely together in a very smart way to make the energy transition work."

Credits

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