Saving Energy in the Netherlands

New EU Directive takes on Energy Efficiency

ING

Colophon

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Foreword

To ING, the importance of sustainable energy is incontrovertible. Our corporate responsibility agenda is an integral component of our strategy. Through a combination of our values and convictions, commercial ambitions and our vision of the future we strive to finance economic growth in a sustainable manner. In 2011 we published a report on renewable energy and increased our deal flow in this area. At that time both politicians, businesses, consumers and financers all focused predominantly on making the production side of energy more sustainable. But as the Trias Energetica so rightly points out, saving energy is the first and best step in the transition to a low carbon economy.

Fortunately, saving energy is increasingly more top of mind. The European Commission is ambitious. The EU Directive on Energy Efficiency aims for a 20% energy saving in 2020. And in the Netherlands the SER is currently working on an Energy Policy in which the more efficient use of energy is one of the main building blocks. At ING we feel that energy saving could generate excellent opportunities to raise the level of investment by companies, consumers, investors and financiers. But in practice saving energy is a bit like world peace: everybody is in favour of it but it is hard to establish! We feel there are still a great many uncertainties. There is for example a conflict between what is politically and socially desirable and what is actually being achieved. Many barriers exist – also in the banking industry – to scale up investments in energy efficiency. We and our clients therefore recognised the need to learn more about the technologies to save energy, the markets in which these products are traded and ways to finance projects that increase the efficient use of energy.

In this study we evaluate the trends that will be decisive for increased energy efficiency. The purpose of the report is to highlight the opportunities and challenges we face in the period up to 2020. ING itself will use the findings to refine its commercial and risk policies in relation to the financing of energy savings. And by sharing our conclusions with you, our intention is to provide input for debate on the topic and to build support for measures that will further help the Dutch economy and the environment.

ING adopts a sector-driven approach which enables us to provide specific advice to parties in the sector. This study has helped us to gain a deeper knowledge and a better understanding of the subject, which will help us to match our services as closely as possible to the wishes of our clients and so achieve ING's ambition of being a strategic partner for its clients.

This report is an initiative of ING, but could not have been written without the help of and input from a great many people. We would like to express our gratitude to everyone who contributed in any other way to this publication.

Hans van der Noordaa
Board Member ING Bank

Content

Executive Summary
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Saving energy in a world that needs more energy

The aim to reduce energy manifests itself in a context of a steady growing energy need. Energy demand in the Netherlands, for example, has grown 1.0% per year in the last 20 years to approximately 3,500 Peta Joule. Within this context it is practically and politically very difficult to actually conserve the amount of energy used. That's why policies so far have focussed on improving the efficient use of energy rather than reducing the amount of energy used (which is called energy conservation). Energy conservation is about reducing energy through using less of an energy service (e.g. driving less kilometres), while energy efficiency means using less energy for a constant service (drive the same distance with a car that does more kilometres per litre). Though the two are often used interchangeably, efficiency is just one aspect of an energy saving-strategy. This study provides on overview of energy consumption in the Netherlands and ways to use energy more efficiently.

Energy efficiency offers an economic bonanza

Using energy more efficiently offers huge benefits, not solely because of its impact on CO_2-reductions, but because saving energy is a lot cheaper than buying it! On an individual level it increases disposable income and energy efficient houses tend to have higher property values. On a sectorial level energy efficiency can increase the competitiveness of an industry. Finally, on a national scale it leads to job creation, lower energy related public expenditure, reduced CO_2-emissions as well as less dependency on energy-imports and scarce recourses. In sum, the efficient use of energy delivers a diverse range of benefits to many stakeholders.

Energy efficiency provides the most cost effective route to a reliable, sustainable and affordable energy supply

In recent years renewable energy production was more top of mind than energy efficiency in the awareness of politicians, businesses, investors and financiers. Renewable energy apparently has a greater 'wow factor'; it is a tangible asset, often sizeable and employing new technologies. The market for renewable energy is much more developed than the market for energy efficiency. However, for all its attractions, renewable energy has its drawbacks as well. Most important, it is a rather expensive way to improve a nation's sustainability. Many technologies such as solar power and (off-shore) wind power depend heavily on government support and public finance is under pressure due to the financial and economic crisis. Research shows that improving the efficient use of energy is in fact the most important, economical and prompt way to provide future energy services but also the most underused, overlooked, and misunderstood way.

On average the Dutch 'save' 1% energy every year

The average rate of energy efficiency in the Netherlands over the 2000-2010 period was 1.1% per year (figure 1). In other words: without improvements in energy efficiency, total energy consumption would have been 12% higher by 2010 than it actually was. This corresponds with almost 400 PJ of energy. Nevertheless, final energy demand in that period increased 10% from 3,400 PJ to 3,700 PJ, so the Dutch have still a long way to go in terms of energy conservation. The rate of energy saving is currently under pressure due to low utilisation rates in manufacturing and the fact that investment and consumer spending are under pressure. As a result, energy efficiency measures are implemented at a slow pace.

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The need for more frequent data

The energy efficiency saving rate in the Netherlands is calculated through the rather complex Protocol Monitoring Energy savings, commonly known as the PME. It is calculated once a year with a time lag of two years and does not target actual energy use. Due to these data issues and the willingness to actually conserve energy some Scandinavian countries, who are front runners on energy saving, increasingly make use of measures and policies that target actual energy use in stead of the energy used per unit of production.

Agriculture is leading the way, transport is lagging

- The agriculture sector shows the largest increase in energy efficiency (3.7% a year in the 2000-2010 period). Without improvements in energy efficiency, total energy consumption would have been an impressive 45% higher than it is today.
- Many industrial companies claim they have invested in as much energy efficiency as they can because of high costs associated with efficiency. However, many opportunities remain, both in new and energy efficient equipment as well as major process change (Fawkes, 2012).
- The built environment offers the greatest saving potential but it has not materialised yet. There is an increasing recognition in commercial property to holistically retrofit buildings in a way that can produce energy savings of 30-80% but still little actual demand. Constraints include the well-known split incentive between landlord and tenant and short-term investor behaviour. Household demand is an even more difficult issue. Although most householders would prefer lower energy bills, their appetite for energy-efficiency retrofits appears to be low.
- Over time, the transport sector has become less instead of more energy efficient. In transport there is a demand for greater energy efficiency but the main constraint is the long equipment replacement cycle as energy use is largely locked in by vehicle choice. Furthermore the Dutch government has hardly any specific national policies as it relies on European initiatives. A stronger national focus on efficient transport planning systems can help improve energy efficiency in transportation.

Figure 1 Change in energy efficiency in Dutch industries, (% per year 2000-2010)

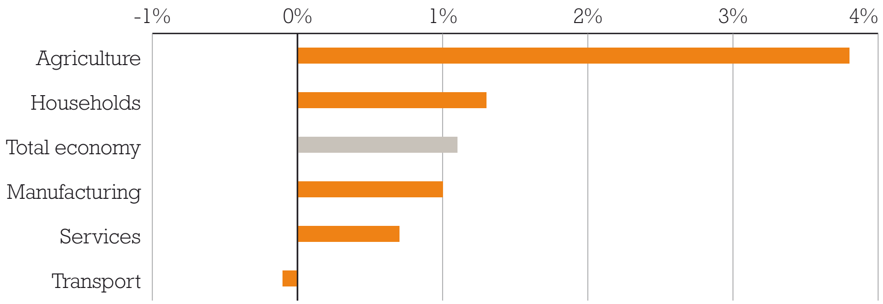
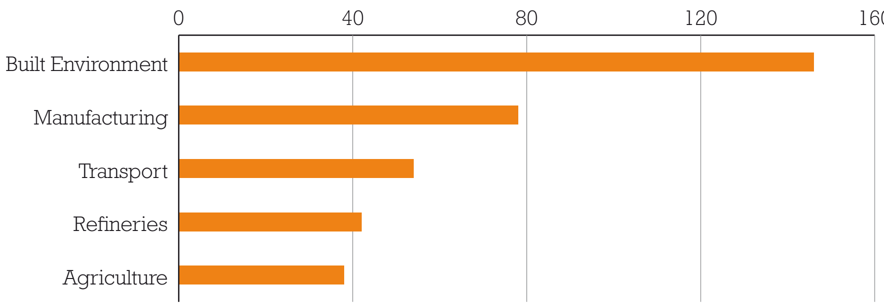


Figure 2 Energy saving potential in Dutch industries (PetaJoule)



Sources: ECN and PBL.

Executive Summary
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In the past years the Dutch progress towards exploiting the economically attractive reserves of energy efficiency remained disappointing. Despite considerable policy initiatives to increase energy efficiency over the years, the results have fallen behind targets by consecutive administrations. Scaling up energy efficiency deployment requires an increase in demand, supply of products and services, and availability of financing.

Lack of demand is main obstacle as simply providing technologies and making finance available does not make people act or invest
Lack of demand for products and services to use energy more efficiently reflects the relatively early stage of development in the sector as well as a lack of confidence in the long-term economic returns on investment. This lack of confidence has been attributed to poor awareness of the opportunities to use energy more efficiently and its risks (apparently perceived to be much higher than they are), as well as lack of certainty over policies and regulations. Policies that stimulate energy efficiency are policies aimed at increasing awareness; the introduction of a clear and ambitious national target for energy efficiency and a credible roadmap to achieve the target; the implementation of sector specific financial and policy incentives that stimulate energy efficiency; more binding in stead of voluntary energy covenants; incorporation of energy conservation in the national energy strategy alongside energy efficiency; a trading system for energy efficiency certificates (so called 'white certificates') and a more binding energy labelling system for which the least efficient products cannot be sold to the public (introduction of a so called 'white list').

Take up a supply chain approach to save energy
Energy efficiency is the low hanging fruit of any energy saving strategy but very few seem to know where the fruit is located. We recommend the following policies to stimulate the supply side of energy efficiency. Complex linkages exist between traditional energy sources, renewables and energy efficiency in general. For example, large energy users under the EU ETS scheme earn more carbon credits if they increase their energy efficiency. But these credits can be stored for later or sold to other companies. When these carbon credits are used the initial energy savings are done away with. The Dutch should, in close cooperation with other EU member states, define a holistic energy strategy that acknowledges these linkages. Further policies that will develop the supply side of energy efficiency are increasing the frequency and detail level of data on energy efficiency; widespread adaptation of smart metering; taking up a supply chain approach to energy efficiency as up to 89% of energy is wasted in end to end supply chains; taking up a product life cycle approach by incorporating the energy use in the production and recycling phase of products in the energy label (so called embedded energy); capacity building in the market for Energy Performance Contracting as well as providing solutions to split incentive problems.

Mobilising finance is key in scaling up energy efficiency
Access to capital is often cited as a major barrier to the uptake of energy efficiency, but this is not the whole story. More significant than access to capital are behavioural attitudes to energy efficiency and the opportunity cost of capital. As a result energy efficiency struggles to compete with investments in established asset classes. Building confidence in the market is key for policy makers, energy service companies, banks and institutional investors. Without a long term plan investors will not have the confidence that scale will be achieved and required volumes of upfront capital will not be forthcoming. Furthermore, the financial industry should continue to work with other stakeholders to develop solutions for problems which are particular to energy efficiency finance, such at the need for standardisation and replicability of contracts in order to facilitate the aggregation of investments in small activities and thereby achieve economies of scale. Examples would be a 'Nationaal Fonds voor Energiebesparing' and ESCO-financing.

Chapter 1.

The macro market for saving energy

- Mitigating global warming: a macro perspective.
- What are we talking about?
- The current status of global energy intensity.
- Opportunities of energy efficiency.
- Barriers to increase the efficient use of energy.
- Energy Efficiency Directive 2012/27/EU.

Mitigating global warming: a macro perspective

Increased energy efficiency is a politically feasible and cost effective way to reduce CO_2-emissions

A macro equation for CO_2-emissions:

CO_2-emissions = Population x GDP/Population x Emissions/Energy x Energy/GDP
(1) (2) (3) (4)

CO_2-emissions are a major cause of global warming.

1) Scientists generally agree that around two thirds of global warming problems is caused by human activity. Population growth is highly correlated with the increase in global CO_2-emissions. But so far there is little appetite for Chinese-style populations controls around the globe to curb CO_2-emissions.

Currently there are two politically feasible policy options at our disposal:

2) Since the invention of the steam engine in the 18^{th} century economies transformed from rural to industrial activities. This increased human productivity tremendously. Income levels have been risen accordingly over the past two and a half centuries. As a result humans have been accustomed to rising incomes for generations now and in the current times of financial crisis getting economic growth back on track is a major policy target. As with population controls, reduction of economic growth is not a realistic instrument to reduce CO_2-emissions.

...increase the use of renewables...

3) Energy sources differ greatly in the amount of CO_2 they emit. Oil and Coal emit a lot of CO_2 per energy unit while Gas emits less. Renewable Energy resources can be CO_2 neutral and are a major policy instrument to lower the carbon intensity of an economy. ING's September 2011 report on Renewable Energy explores the many opportunities for the Dutch transition to a low carbon economy.

...and use energy more efficiently!

4) The most sustainable form of energy is energy that has not been used. Reducing the energy intensity of an economy – that is reducing the amount of energy to produce a unit of national revenue – therefore is a major policy instrument to reduce a country's carbon footprint. In this study we explore the opportunities to increase the energy efficiency of the Dutch economy. Ultimately this contributes to less CO_2-emissions, a better environment, increased energy security and the creation of green jobs.

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What are we talking about?

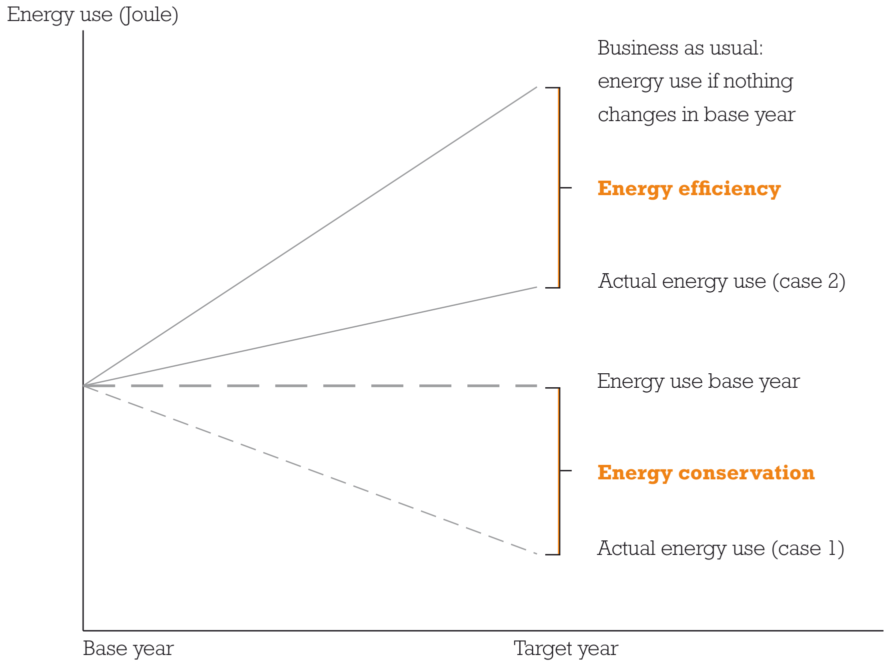
In practice saving energy is mainly about using energy more efficiently in stead of using less energy

Energy conservation is the reduction of service to save energy.

Energy efficiency is using less energy to provide the same service.

- On the previous slide we looked at how much energy is needed to produce a unit of national revenue. This is often called energy intensity. There are two ways to improve this ratio; either by energy conservation or energy efficiency measures.
- Ask 10 people about their definition of energy saving and 9 will associate it with an absolute reduction in use of energy. Most people associate saving energy with what we will call energy conservation (case 1 in figure 3).
- But this is not the way energy saving is defined in practice. The aim to reduce energy manifests itself in a context of a steady growing energy need. Within this context it is very difficult to actually conserve the amount of energy used. For example, Dutch households now use four times more electricity than in 1950 and this trend is still rising (case 2 in figure 3). That's why policymakers and businesses focus on improving the energy efficiency which can be defined as the level of energy consumption to provide a given service. In this context energy efficiency refers to the estimated energy saved through a particular measure. It is difficult to quantify, as it requires an estimation of the energy that would have been consumed if the measure had not been put into place. This is often called the business as usual case (figure 3).
- Though the two are often used interchangeably, efficiency is just one aspect of energy saving (sometimes called energy conservation). The efficient use of energy is an important part of any energy conservation strategy. But reducing energy demand is the primary goal of energy conservation while improved energy efficiency aims to reduce the energy consumed in delivering a given service.
- In terms of energy efficiency we 'save' energy as long as the energy consumption grows at a lower rate than the economy. But the actual use of energy can still be growing.

Figure 3 Energy efficiency versus energy conservation



Note that the European Commission set a target to increase the energy efficiency of the EU by 20% in 2020, projections made in 2007 showed a primary energy consumption in 2020 of 1,842 million tons of oil equivalents (Mtoe). A 20% reduction results in 1,474 Mtoe in 2020, i.e. a target reduction of 368 Mtoe as compared to projections.

Source: IEA (2012a), Algemene Rekenkamer (2011) and EU (2012).

The current status of global energy intensity

Without improvements energy demand would have been much higher!

Energy is used more efficiently...

...but the pace of improvement is slowing down.

Nevertheless, energy efficiency is high on the policy agenda...

...and investment totals € 61 billion in the EU.

- Energy efficiency is difficult to measure. Unlike primary energy demand it does not appear in national energy balances and it is neither traded nor priced. Energy efficiency can be 'measured' at a micro level, which we will do for the Netherlands later on in this report. But in the absence of international protocols to measure energy efficiency we have to use energy intensity for international comparisons.
- Global energy intensity, expressed as the amount of energy used to produce a unit of national revenue (GDP), has fallen over the last decades, primarily as a result of energy improvements. But the pace of the improvement has slowed down considerably in the last decade (figure 3).
- Global energy demand grew from 7,234 million tonnes of oil equivalents (Mtoe) in 1980 to 12,730 in 2010, a 76% increase. Over this same period, global GDP expanded by 137%. Without the improvements in the use of energy that were realised over that period, global energy demand in 2010 would have been 35% higher. This is almost equivalent to the combined energy use of the United States and China! This clearly shows the huge impact of small yearly improvements in the use of energy over time.
- All major regions in the world have introduced new legislation on energy efficiency, making provisions for a 16% reduction in energy intensity by 2015 in China, new fuel-economy standards in the United States and a 10% reduction in electricity demand by 2030 in Japan. The European Union aims for a 20% reduction in 2020.
- The global market for energy efficiency products and services is growing and is estimated an impressive € 144 billion in 2011. The European Union accounts for € 61 billion or 42%. The abundance of investment potential is astonishing and estimated to be € 4.25 trillion until 2050 globally.

Figure 4 Global energy intensity, 1971-2010

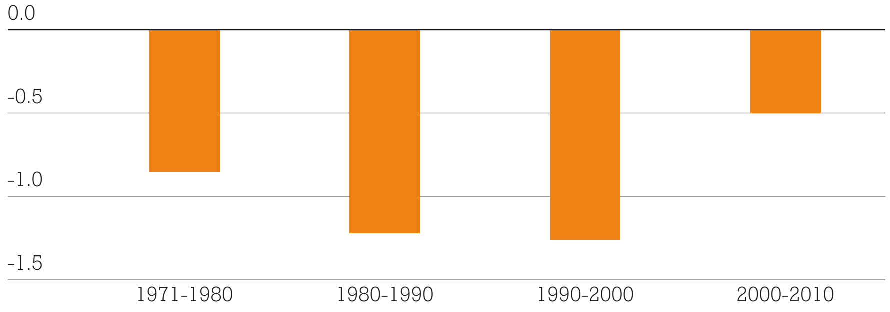
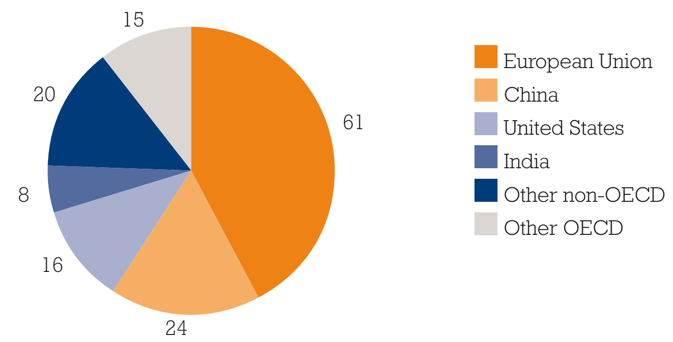


Figure 5 Investment in energy efficiency, 2011



Source: IEA (2012b).

Opportunities of energy efficiency

Improving energy efficiency delivers a diverse range of benefits

The benefits of energy intensity go beyond the primary goal of saving energy.

As a result, energy efficiency policies should be designed with the broader perspective of achieving ‘green growth’.

Individual level

- When an improvement in energy efficiency causes a reduced energy bill for the same energy consumption, there are monetary savings that translate into **increased disposable income** for consumers or profits for business and investors. Energy efficiency becomes a tool for poverty alleviation for the poor as they pay a large share of their income on housing and energy. For business it can be a tool to create a competitive advantage.
- Improved energy efficiency can bring a wide array of appreciable benefits for the **health and well being** of residential occupants and office workers. For example asthma has strongly been associated to cold indoor temperatures and damp and mould in housing.
- Assets with high energy efficiency tend to have **higher asset values** thereby increasing the wealth of the owner. This is particularly true for ‘green buildings’, both residential and commercial properties. The evidence is less compelling for industrial appliances and transportation vehicles.

Sectoral level

- Improvements in energy efficiency often go along with improvements in industrial processes leading to better product quality, lower operational costs, increased profits and saver working conditions. These benefits can improve **productivity** and (international) **competitiveness** of an industry.
- Energy efficiency may appear to run contrary to the commercial interests of energy providers through a reduction of sales. But energy efficiency also provides them with opportunities to reduce costs, increase the reliability of the system and network, increased revenues from **energy services** and CSR or marketing benefits. Evidence shows that energy efficiency can be a win-win for both the energy provider and consumer.

National level

- **Job creation** in for example the building and engineering sector outweighs possible job reductions by energy producers. On balance energy efficiency can contribute to the creation of green jobs and spur innovation and skilled labour.
- Energy efficiency can **lower energy related public expenditure** such as fossil fuel subsidies thereby improving fiscal consolidation.
- Increased energy efficiency makes countries **less reliant on energy imports** and improves the trade balance.

International level

- Better energy efficiency **reduces greenhouse gas emissions** notably CO_2-emissions.
- A more efficient use of energy lowers energy demand and **alleviates upward pressure on energy prices** and helps to keep our energy system affordable.
- Energy efficiency can be an increasingly important measure to **relieve pressure on scarce recourses.** It will extend the period in which we can use our limited supply of fossil fuels.

Sources: IEA (2012a) and E3G (2012).

Barriers to increase the efficient use of energy

Investing in many energy-efficient technologies and practices makes good economic sense, but the level of deployment is much lower than expected

Barriers exist that discourage consumers, business and investors from making the best economic choices.

Low visibility & awareness	• Energy efficiency is **not measured directly** on a national or sectoral level and there are no international protocols to measure it. A lot of companies or households do not measure their energy use. And if they do, information is not always shared with the decision makers. The efficient use of energy is not top of mind due to the often small costs of energy in overall budgets and the intangibility of investments in this field. • Investments in energy efficiency are often **bundled with other investments**. The corporate investment cycle rather than the wish or need to improve energy efficiency determines whether they are carried out or not.
Economy	• **Split incentive problems** refer to the potential difficulties in motivating one party to act in the best interests of another when they may have different goals, costs, revenues or information levels. For example opportunities for improving insulation in buildings is falling behind potential since the investor has to bear the costs and the tenant reaps the full benefits. • Weak investment and finance cases for projects aimed at using energy more efficiently. There is a **lack of visibility on overall long term value creation** as well as on how returns will be delivered. Currently the 'hassle factor' is high for these projects and there is a lack of familiarity. • Current **energy regulations** are not always supportive to increase energy efficiency. In the Netherlands for example, large energy users pay much lower energy taxes per unit of energy than small users.
Capacity	• **Limited know-how** on implementing energy efficiency measures amongst households, firms, governments and investors and differences in the stages of market development for energy efficiency technologies. Some markets are mature and widespread while others are immature and not easy to assess for potential clients.
Fragmen-tation	• Energy consumption is split among a **divers and large pool of users**. See for example the residential housing sector where energy efficiency is impossible to implement collectively. • Business models up till now mostly **focus on energy supply** (renewable energy) than energy demand (energy efficiency). • Energy efficiency transcends the boundaries of an enterprise or household. The biggest improvements can often be made in **end to end supply chains** by optimising the interaction between suppliers and buyers. But supply chains are often fragmented making opportunities for energy efficiency more difficult to implement
Behaviour	• The **rebound effect** or **Jevon's paradox** refers to the behavioural responses to the introduction of energy efficiency technologies. Unfortunately, these responses may offset the beneficial effects of the energy efficiency measures. E.g. people may switch of the lighting less often when leaving a room since LED lighting uses less energy. This type of behaviour can 'backfire' the initial measures to improve energy intensity and can cause energy demand to rise in stead of decline. • Some actors simply **do not want to invest** in energy efficiency due to the initial investment or hassle factor.

Based on IEA (2012b)

Energy Efficiency Directive 2012/27/EU

EU member states must submit National Energy Efficiency Action Plans which - among other things - include the obligation for energy companies to increase energy efficiency 1.5% a year

- Realising the potential and overcoming the barriers will require enhanced efforts both from policymakers, business and financers to create the incentive frameworks to overcome market inertia, secure demand and facilitate public and private capital provisioning.
- The European Union has adopted an energy efficiency directive – to complement its carbon and renewables policies – that envisages a 20% reduction in energy demand by 2020 against a business as usual approach. As a result primary energy demand should not exceed 1,474 Million tonnes of oil equivalent (Mtoe) and final energy demand should be under 1,078 Mtoe (EU 2020).
- Increasing energy efficiency is one of the EU's new strategies for jobs and smart, sustainable and inclusive growth (Europe's 2020 Strategy).

EU requires member states by April 2013 to set national targets for energy savings to 2020.

EU Directive on Energy Efficiency.

Main target: to further decouple energy use from economic growth.

- Define national energy efficiency target. - **Set up National Energy Efficiency Action Plan.** - **Improve efficiency by 1.5% yearly through energy service obligations or alternatives.** – Report on progress each year.	- Increase energy efficiency of buildings. - **Implement smart metering.** - **Governments shall renovate 3% of their buildings yearly.** - Governments and social housing bodies put in place energy management systems.	- Develop and promote the use of energy audits for large companies and SMEs. - Increase energy awareness among households. - **Build and promote the market for energy services.**
- Energy billing should be based on actual energy use as much as possible. - Billing should include historic data on energy use.	- Promote efficient use of energy by small users. - Promote use of (micro)cogeneration. - Encourage efficient heating and cooling. - **Identify inefficiencies in energy infrastructure.**	- **Set up financing facilities.** - **Possibility to set up an Energy Efficiency National Fund.** - Exchange best practices.

Chapter 2.

Energy in the Netherlands

- Energy demand has fallen since the outbreak of the financial crises.
- Dutch manufacturing, agriculture and construction sectors are most dependent on energy for economic growth.
- The Dutch save 1% energy every year.
- Energy Efficiency: creation of a new industry.
- There's considerable room to use energy more efficiently.
- Taking an energy supply chain perspective.

Energy demand has fallen since the outbreak of the financial crises…

…and manufacturing remains by far the largest energy consumer

Manufacturing, transport and energy sectors are largest energy users.

- Energy demand in the Netherlands has grown 1.0% per year in the last 20 years to 3,500 Peta Joule in 2011. Before the outbreak of the financial crisis in 2008 it grew 1.4% per year but growth turned negative in the post-crisis-era. 2010 was the only exception: a year in which the energy intensive chemical industry grew 12%. Apart from this spike in energy demand the recessionary environment has had a negative impact on Dutch energy demand. But energy demand is expected to pick up again as soon as the economy starts to recover (figure 6 and 7).
- The manufacturing sector accounts for 37% of national energy demand. As a result, changes in national energy use are highly correlated with production in manufacturing in general and the chemical industry in particular.
- Households account for 20% of national energy demand, the transport sector for 16% and energy sector for 10%.

Figure 6 Energy demand and industrial production

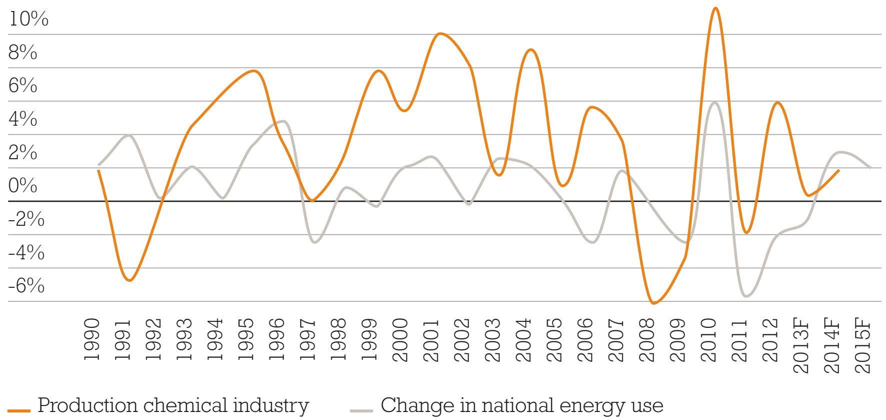


Figure 7 Energy demand in The Netherland, 1990-2015

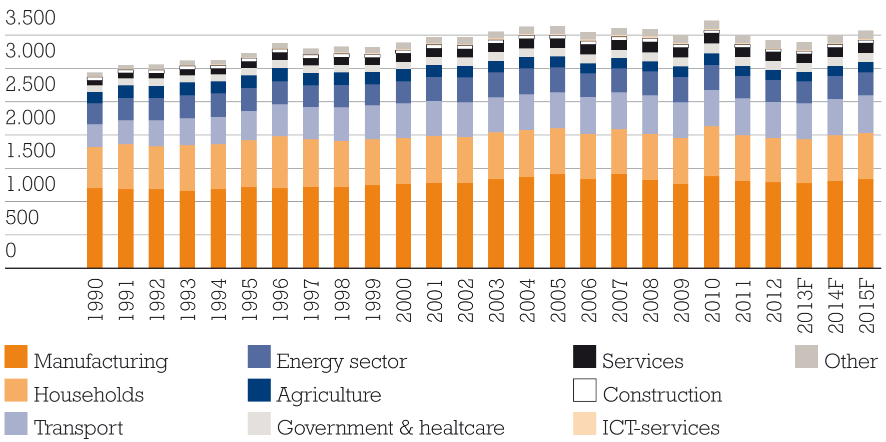
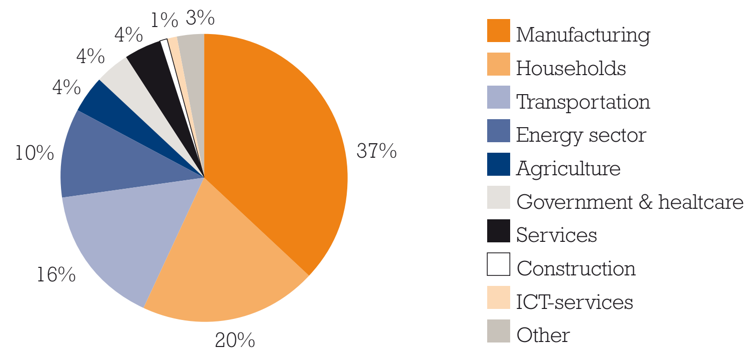


Figure 8 Share in total energy demand per sector, 2012



Source: CBS, forecasts by ING Economics Department.

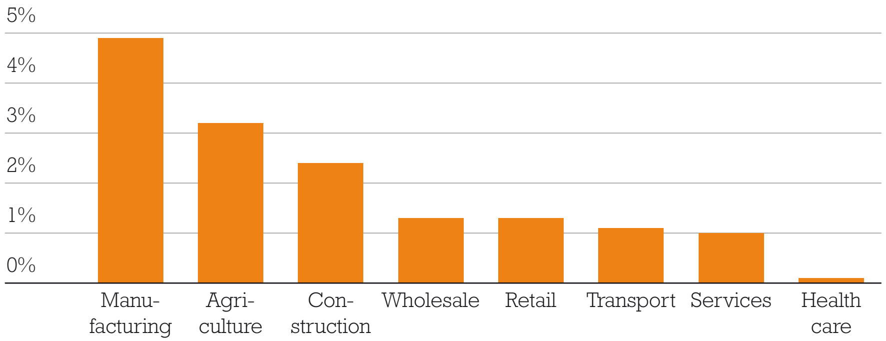
Dutch manufacturing, agriculture and construction sectors are most dependent on energy for economic growth

Entrepreneurs benefit from energy efficiency measures

An increase in energy use explains 0 to 5% of economic growth in an industry.

- Energy is an important factor of production but the degree differs from one industry to another.
- In classical economic analysis economic growth is explained by the use of more or less labour, capital, innovation and the use of services, materials and energy. Capital, labour and innovation explain on average half of the growth in an industry. The other half is explained by the use of more materials, services and energy.
- We calculated which industries are most dependent on energy to produce economic growth. Figure 9 shows that the manufacturing and agriculture sectors are most dependent on energy for economic growth. For example, 5% of the growth in the industry sector over the last 15 years is explained by the use of more energy. In the labour intensive health care sector, on the contrary, only 0.2% of economic growth is explained by the use of more energy.
- Entrepreneurs in the manufacturing and agriculture sector use, relatively speaking, most energy to generate an increase in revenues. As a result they can benefit extensively from energy efficiency measures in their pursuit for economic growth. These industries should be prioritised while improving the efficient use of energy in the Netherlands.

Figure 9 Contribution of the production factor energy to economic growth in an industry



Source: ING calculations based on CBS.

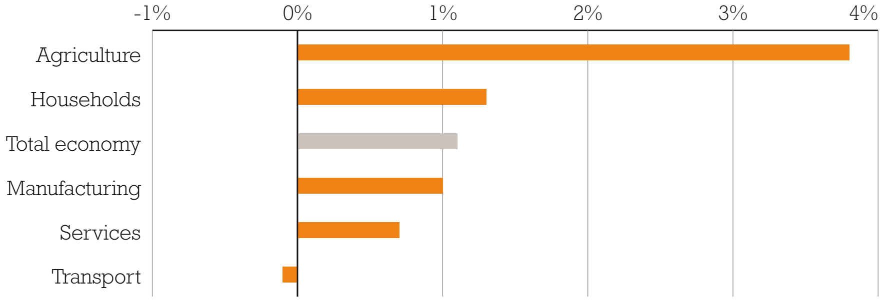
The Dutch save 1% energy every year

Agriculture industry is leading the way

Drop in energy saving rates due to recessionary environment.

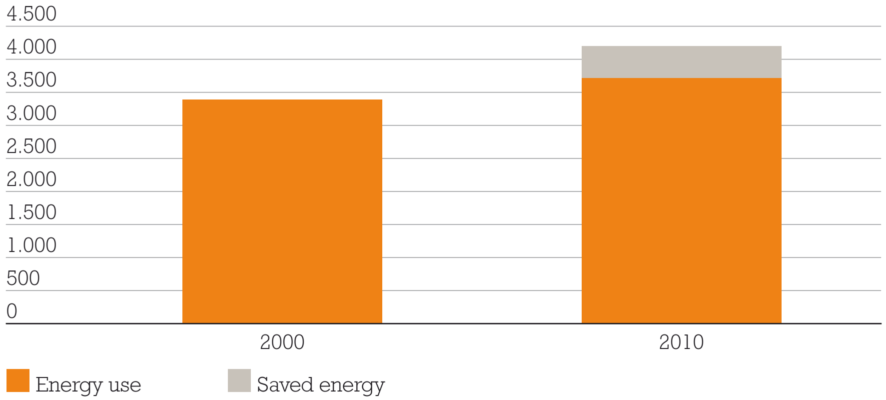
- The average rate of energy savings in the Netherlands over the 2000-2010 period was 1.1% per year (figure 10). In other words: without improvements in energy efficiency, total energy consumption would have been 12% higher in 2010 than it actually was (figure 11). This corresponds with almost 500 PJ of energy.
- The agriculture sector improves its energy efficiency most in comparison to other sectors (3.7% a year). Without energy saving total energy consumption would have been an impressive 45% higher than it is today. But agriculture has a limited impact on the national saving rate because it uses relatively little energy in comparison to other industries.
- Saving rates of the household and industry sector are close at the national level, whereas the services industry has a saving rate of 0.7%.
- Over time, the transport sector has become less instead of more energy efficient which results in a slightly negative saving rate.
- The economic crisis caused the national saving to fall. Lower utilization rates in manufacturing lead to less efficient use of energy. And lower investment spending delays the replacement of old machinery by newer and more efficient ones (ECN, 2012).

Figure 10 Energy Savings in Dutch industries, (% per year 2000-2010)



Source: ECN based on Protocol Monitoring Energy Savings in the Netherlands.

Figure 11 Dutch energy use and saving (Peta Joule)



Source: CBS and ECN.

Cracking the numbers

Data should be available on more industries and with higher frequency

Data availability should be allingned with renewed policy attentiion due to the EU Directive.

- Long-term time series for energy efficiency are lacking. However experts say that the rate of energy saving in the late eighties and during the nineties of the past century was higher at around 1.5-2% a year for the Dutch economy. At that time the Netherlands was a leading country in the world on climate and energy policies. Dutch energy companies implemented energy efficiency measures for households with government support (insulation and 'HR-ketels'). But after the liberalisation of the energy market this was no longer top of mind and subsequent governments did not put CO_2-reduction high on their agenda. Over the years Scandinavian countries have taken over the leading role on climate and energy policies.
- Data on energy savings are available only for a limited number of industries. It would be preferable to calculate it for every industry of which the National Bureau of Statistics has data on energy use available).
- Numbers become available with a large time lag of approximately two and a half years and the error margin is quite large (+/-0.3%).
- Protocols to measure energy savings differ among countries.
- All of this makes timely and accurate measurement of energy savings a difficult task as well as defining and implementing energy saving policies. It is highly recommended to increase the frequency, number of industries and amount of indicators to monitor energy savings effectively, especially in light of the implementation of the new EU directive on Energy Efficiency.

Box 1: Protocol Monitoring Energy savings

Energy Savings rates in the Netherlands are calculated according to the Protocol Monitoring Energy savings, commonly known as the PME. The Ministry of Economic Affairs asks the 'Platform Protocol Monitoring Energy savings' to calculate the numbers periodically. Different organisations cooperate within the platform. The institutions involved are the Central Bureau of Statistics (CBS), the Netherlands Bureau for Economic Policy Analysis (CPB), the Energy research Centre of the Netherlands (ECN) and the Netherlands Institute of Public Health and the Environment (RIVM).

The PME corrects the data on actual energy use for:

- Weather conditions: a mild winter should not lead to increased energy efficiency.
- Use of feedstock: when for example gas is used as an input for an industrial process in stead of heating it increases the national use of an energy source but it is 'not' related to energy conversion. If you do not correct for feedstock the calculated rate of energy saving is lower.

While these corrections make sense in terms of calculating energy efficiency, they don't in terms of energy conservation. That's why some Scandinavian countries increasingly make use of measures and policies that target actual energy use in stead of the energy used per unit of production.

Energy Efficiency: creation of a new industry

Energy saving technologies are growth markets but some have been hit hard by the economic crisis, notably the construction and real estate industry

Activities for insulation of the built environment have been hit hard by the financial and economic crisis.

- Production of energy saving technologies by the manufacturing sector and the implementation and services surrounding these technologies by the service industry have been growing 9% a year since 1995 and represent a production value of around € 4 billion.
- The energy saving industry is a small industry and represents only 0.4% of the Dutch economy, but employment has been growing steadily to 22,000 employees.
- Another major field of activities relates to the production and installation of insulation for the built environment. These activities have a production value of around € 700 million with an average growth of 10% a year.
- With these growth rates the market for energy saving and insulation clearly are growth markets. However, growth has been volatile and is impacted heavily in economic downturns. That's why production is expected to grow at a much slower pace as business and households postpone investments in energy saving.

Figure 12 Production energy saving industry 1995-2015

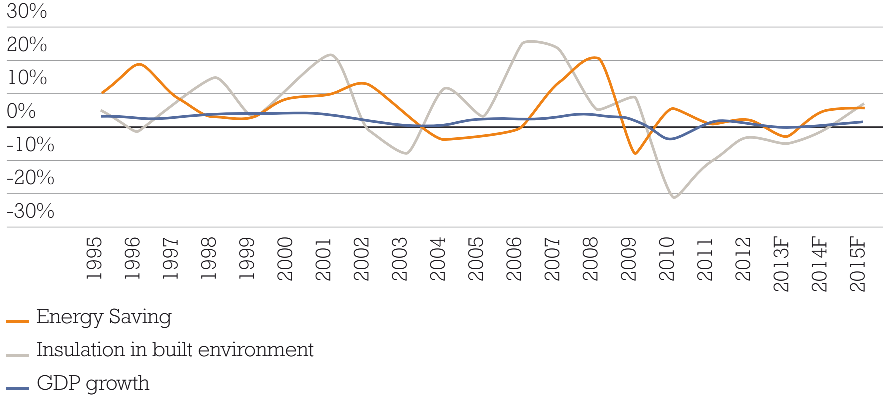
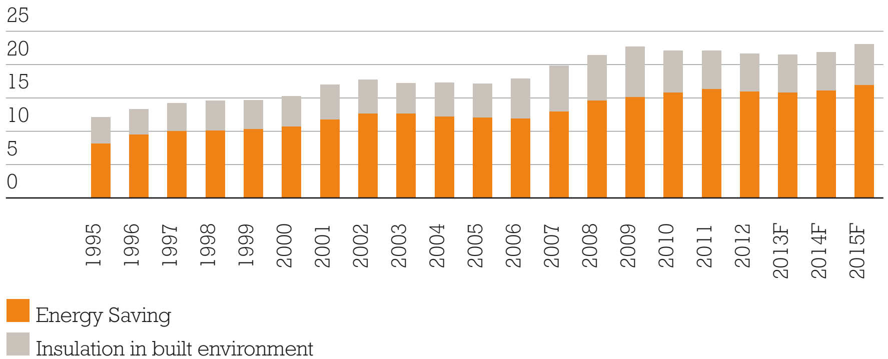


Figure 13 Employment energy saving industry



Source: CBS, forecasts by ING Economics Department.

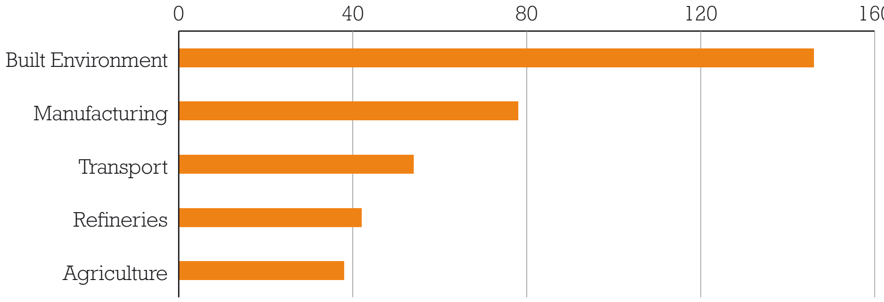
There's considerable room to use energy more efficiently

Potential is highest in built environment, manufacturing and transport

Potential in built environment is highest and some technologies have very short pay back periods.

- The Dutch use around 3.500 Peta Joule (PJ) of energy every year. 350 PJ can be saved yearly until 2020 without limitations for economic growth (1% a year). Technically speaking; a savings rate of 2-2.5% a year can be reached if all the options for energy efficiency would be implemented (ECN, 2006). And finally, even more energy can be saved by policies aimed at limiting energy intensive activities in the economy and changing behaviour by households and businesses. But policies to conserve energy may not politically feasible in the near future. History shows that they are only adopted in times of crisis such as an energy or environmental crisis. Fukushima is a case in point. The Japanese saved over 10% of energy in the year of the nuclear disaster with policies aimed at energy conservation. Note that the EU directive aims at a saving rate of 1.5% a year which seems doable if policies are intensified.
- Most energy can be saved in the built environment (figure 14). The most important technologies to save energy are:
- Built environment: insulation, residual heat, cogeneration (CHP) and energy efficient lighting, ventilation and air conditioning as well as energy efficient appliances.
- Manufacturing and refineries; redesign and optimise processes, residual head, cogeneration (CHP) and recycling of plastics so less energy is needed for feedstock.
- Transportation: reduce maximum speed, lighter and more aerodynamic vehicles, energy efficient tires and highly efficient electric vehicles.
- Agriculture: insulation, cogeneration (CHP), purvey greenhouses with CO_2 so they need less ventilation.
- In the next chapters we have a closer look at saving potential for the built environment, manufacturing and transport sector as well as households.

Figure 14 Saving potential up to 2020 (PJ per year)



Source: ECN and PBL.

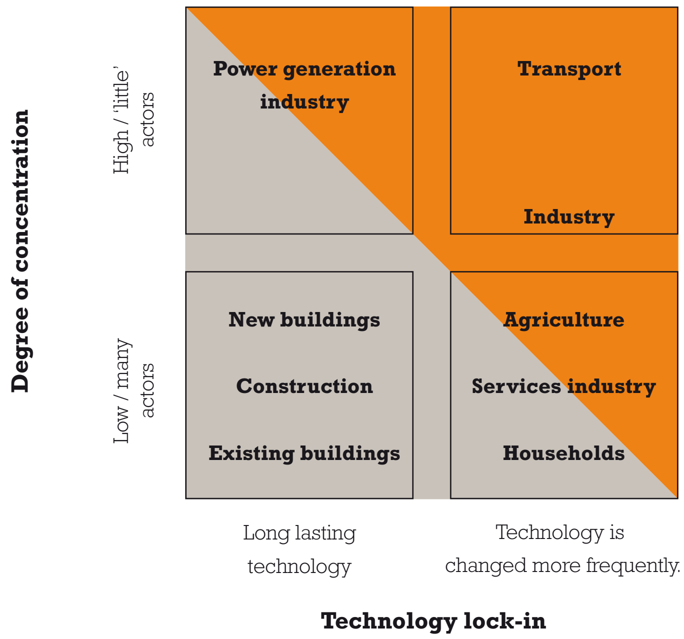
Room for quick wins has diminished

Existing technology locks in saving potentials and it is hard to cope with many different actors

Built environment has largest potential but policies are hard to implement.

- Energy efficiency policies in buildings are generally more difficult to implement, enforce and verify. But the previous page shows that the built environment in the Netherlands has the largest untapped potential to use energy more efficiently.
- Figure 15 explores the ease for policy makers to implement energy efficiency policies in different industries based on:
  - The degree of concentration in an industry: policies can be implemented and monitored more easily if there are relatively few actors. This is for example the case in the power generation and transport sectors which are dominated by a small number of large players. The number of players in the industry sector is larger but still quite manageable. The millions of private and public actors in the built environment from all kind of backgrounds makes it harder to implement energy efficiency measures.
  - The degree of lock-in by technology. The degree to which new technology can be implemented is an important factor to speed up energy efficiency. For example, a power plant lasts for 30 to 40 years. In the meantime only incremental gains in energy efficiency regarding the existing technology can be made. And it is expected that 75% of the buildings in 2050 will be those buildings that already exist today. In comparison, energy efficiency in car engines can be implemented much faster as new car models enter the market every few years.
- In the past, a lot of low hanging fruit has been covered by policies. We now face the challenge to also unlock the difficult saving potentials while at the same time increasing the speed at which we save energy.

Figure 15 Policy convenience for different industries



Source: ING Economics Department based on different sources.

Taking an energy supply chain perspective

Up to 89% of energy can be lost in the supply chain, providing great opportunities to use energy more efficiently

Energy efficiency has different implications along the value chain.

- Given the CO_2-challenges and scarcity of some of the energy resources the ultimate goal of any energy efficiency effort lies in the optimisation of the whole system, ensuring that an increased amount of energy services (and thus human welfare) can be produced from the same amount of energy, or that the same amount of energy services and welfare can be produced from a decreasing amount of energy.
- But energy efficiency has different implications along the chain of energy conversion from the exploitation of primary resources to the delivery of the energy services a consumer desires. Three types of energy efficiency can be differentiated (Energy Delta Institute):
  1. **Conversion efficiency** is related to the transformation of primary energy into secondary energy, as in a power plant. For example an old coal fired power plant has an efficiency of only 35% whereas the most modern gas fired plant has an efficiency of around 60% which means that still 40% of energy is lost in the process of energy generation.
  2. **Distribution efficiency** is assessed on the delivery of secondary energy from the point of conversion (i.e. a power plant) to the point of end use (i.e. a computer). Distribution efficiency is quite high in comparison with conversion efficiency and ranges from 99% to 93%.
  3. **Hedonic efficiency** of converting delivered energy services into human welfare. Hedonic efficiency differs widely depending on the technology used for space heating and the type of appliances a family uses.
- If we include energy losses in mining and final energy use, research shows that up to 89% of energy can be lost in the supply chain. That means that, even with our 'advanced technologies' we have an overall efficiency of only 11%. This shows the huge potential to improve the efficient use of energy when we take a supply chain approach on the subject. Such an approach would bring great benefits in terms of cost reduction, improved energy security, reduced emissions and job creation.

Mining

High energy losses

Generation

Very high energy losses

Transportation

Moderate energy losses

Energy use

High energy losses

Chapter 3.

Efficient energy use in the built environment

- Large potential to increase the efficient use of energy…
- ...and a wide range of technologies is available to save energy in the built environment.

Large potential to increase the efficient use of energy…

…but policy instruments for existing buildings lack credible enforcement

30% of energy consumption is related to buildings.

- The built environment is not an industry of economic activity so it's energy use does not show up in the national accounts. Rather, every public service, private enterprise or household makes use of buildings.
- Buildings account for approximately 30% of the total energy use in the Netherlands (around 1.000 Peta Joule)! It is made up of a heterogeneous group of energy users, from small scale households to heavy energy users such as municipalities that exploit swimming pools or retailers that exploit supermarkets. Energy is mostly used for heating, cooling and for electricity for appliances and lighting.
- Gas related energy use in residential buildings is declining over the years through better insulation. However, electricity use is on the rise due to the electrification of household tasks such as dish washers and dryers, the rapid adaptation of electronic devices and also by the use of electric bicycles.
- Government policy to increase energy efficiency mainly consists of:
  1. Increased energy efficiency norms for new buildings based on the 2010 EU directive for energy performance;
  2. Closing covenants with market participants such as housing corporations and municipalities. However these covenants are to a large degree voluntary and lack hard instruments for effective enforcement. Covenants succeed in increasing awareness for energy efficiency among market participants but they lack credible enforcement rules to guarantee that national targets are met in time.
  3. Green Deals and the implementation of a large scale approach ('Blok-voor-Blok-aanpak').

Figure 16 Energy use non-residential buildings (Mega Joule / m^2)

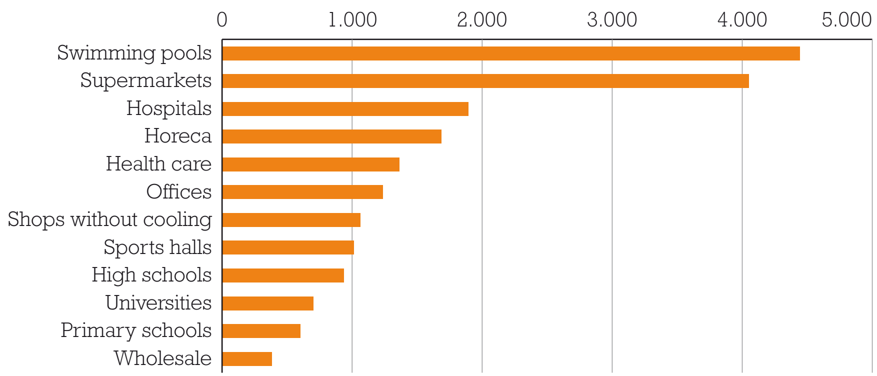
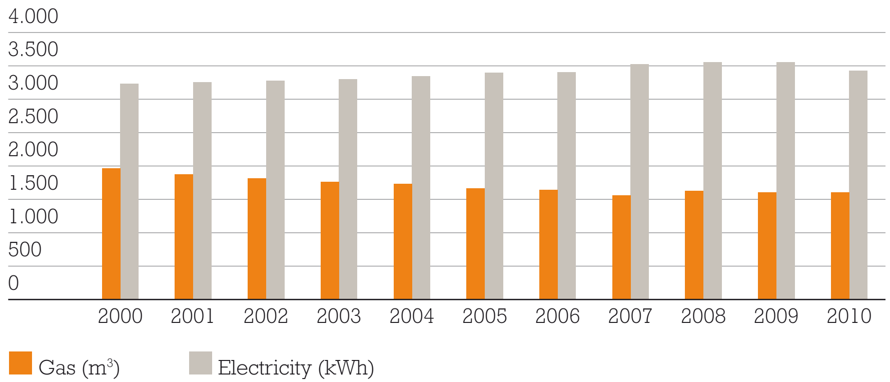


Figure 17 Energy use residential buildings (kWh/m^3 per house)



Source: AgentschapNL

A wide range of technologies is available to save energy in the built environment…

…but mind the rebound effect!

No energy saving without policies to counter possible rebound effects.

Box 2: Examples of mature technologies to save energy in built environment

More efficient new buildings (increased 'EPN-norm')
Retrofits of existing buildings
Insulation
- Wall, floor and roof insulation
- Improved glazing of windows

Energy measurement and management (smart metering)
Heating: heat pump
Cooling: improve efficiency air conditioning
Cogeneration
Lighting:
- CFL
- LED

Waste heat utilization
High efficiency boilers ('HR-ketels')
Behavioural changes: dress warmly

- Measures to save energy do not always deliver the full energy savings predicted by engineering analyses as energy efficiency may evoke undesirable side-effects that are commonly referred to as **"rebound effect"** or **Jevon's Paradox**. Examples of the rebound effect in buildings are:
- Newly built homes are highly energy efficient but they tend to be bigger in comparison to older homes. Sometimes a highly efficient home of 250 m^2 uses more energy than a less efficient older home by 100 m^2.
- More efficient homes evoke a higher comfort level by households. With the money saved households can afford to increase their heating temperature from for example 20 to 22 degrees which (partly) nullifies the initial saving.
- Large uncertainties remain about the size and various components of the rebound effect. The International Energy Agency estimates it to be relatively small (around 10%) and that a significant portion of this can be avoided by policy measures. But there are known cases in practice where the rebound effect removes almost completely the initial saving.

Chapter 4.

Efficient energy use in manufacturing

- The manufacturing sector is a heavy energy user.
- The sector saves around 1% of energy each year.
- Covenants and environmental laws are the main policyinstruments to increase energy efficiency.
- Different ways to increase energy efficiency.

Manufacturing is heavy energy user…

…because majority of energy is used as feedstock

Energy is used for heating and electricity as well as feedstock purposes.

- The manufacturing industry used 1,310 PJ of energy in 2011 which corresponds with 37% of total Dutch energy use.
- The chemical industry is by far the largest industrial energy user (757 PJ or 58% of total industrial energy demand) followed by the refineries (15%) and metal industry (10%). The industry is characterized by a large number of high energy users such as oil refineries, steel plants, paper mills, etc. Hence there is a great leverage on overall energy consumption from proportionally few customers.
- Energy demand grew 0.4% a year while production grew 5.6% a year in the period 1990-2011. As a result, the energy intensity of the industry improved impressively (figure 18). For example the chemical industry used 29 Tera Joule of energy for every million of production value in 1990. Nowadays it uses ‘only’ 17 Tera Joule for the same output. However, this is still very high compared to the overall number for the Dutch economy of 2.4 Tera Joule per million of production value.
- Approximately 60% of industrial energy use in the Netherlands is related to feedstock instead of heating or electricity. Feedstock represents all the raw material that is required for an industrial process. For example natural gas (methane) is used to produce ammonia which is an important raw material for the production of detergents and fertilizers.

Feedstock

Figure 18 Largest energy users (PJ and %), 2011

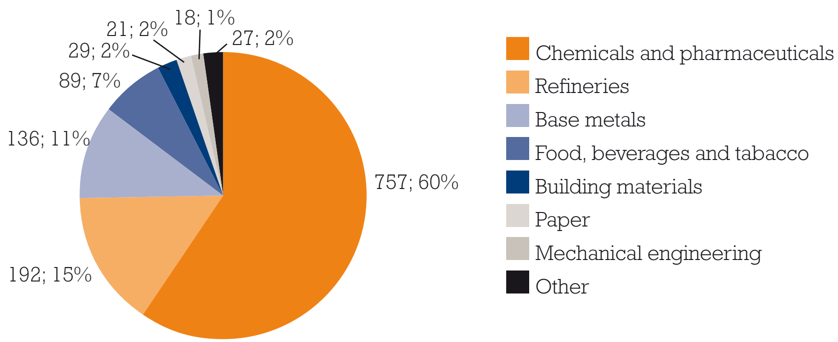
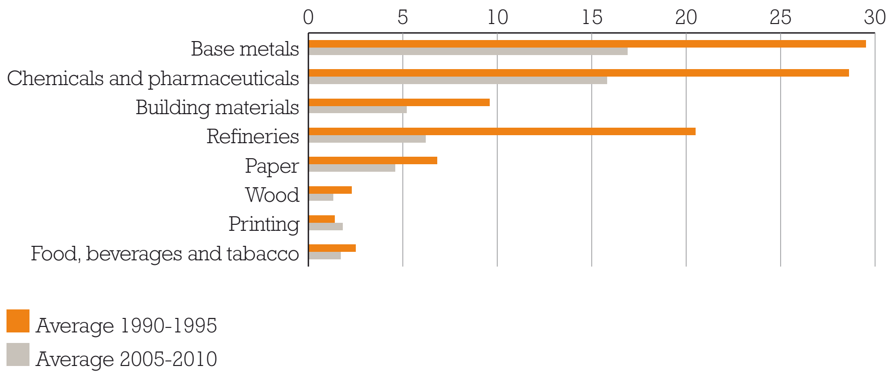


Figure 19 Improvement in energy intensity, 1990-2010 (TJ/€mln)



Source: CBS.

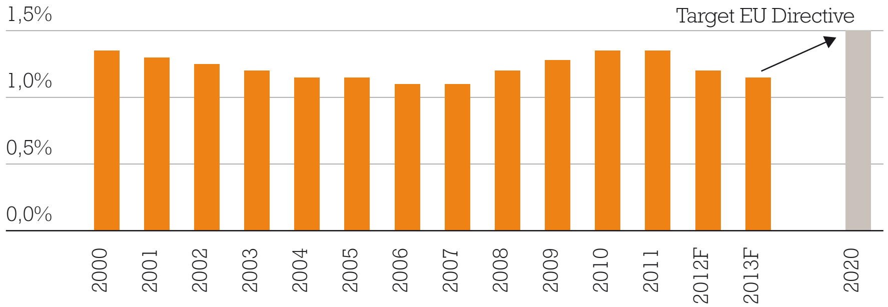
The industry saves around 1% of energy each year

…but EU-target requires a substantial increase to 1.5%

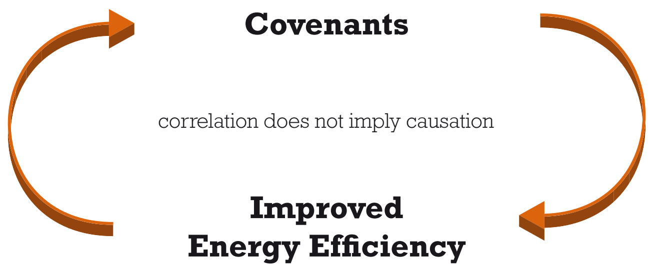
Covenants are main policy instrument but correlation may not imply causation.

- The industry sector saved 1% of energy per year over the period 2000-2010 according to ECN and the Protocol Monitoring Energy Efficiency (PME). In other words: without energy saving total energy consumption would have been 10% higher in 2010 than it actually was. This corresponds with almost 130 PJ of energy.
- The Dutch government has a long tradition in closing covenants with large industrial enterprises that contain voluntary, mutual, and multi-year agreements to improve energy efficiency (see next page). The first covenants date back to 1990. Every year the Ministry of Economic Affairs (AgentschapNL) measures the amount of energy that is saved through the covenants. Most companies that join covenants are operating in the industry or utilities sector.
- Through the covenants companies on average saved 1.2% on energy in the period 2000-2010. Note that this number is higher than the number calculated through the Protocol Monitoring Energy Efficiency. A plausible reason for this is the fact that covenants are voluntary. As a result companies that decide to participate might already have a higher willingness to save energy than companies that do not join the covenants. Since the PME measures energy efficiency on an industry level all companies are included, also the companies that lag behind in terms of implementing measures to improve energy efficiency. Causation need not run from covenants to improved energy efficiency but from high energy efficiency to joining covenants.

Figure 20 Energy saving as measured by covenants



Source: AgentschapNL and RIVM.



Covenants and environmental laws are the main policyinstruments to increase energy efficiency

…but effectiveness can be improved

Large industrial companies are part of a covenant either directly with the government or trough their trade association.

- The first Dutch covenant goes back to 1990 but the ambition evolved over time as new governments took over and new EU legislation was implemented. For example, the Covenant Benchmarking for energy intensive companies was abandoned in 2005 when the EU Emissions Trading Scheme for CO_2-allowances came into effect. As a result, large energy users that fall under the ETS-system no longer had to submit an energy efficiency plan for their activities. Furthermore, the Dutch ambition to have the most energy efficient industrial processes in the world in 2012 was also abandoned at that time. The MEE-covenant (Meerjarenafspraak Energie Efficientie ETS-bedrijven) succeeded the Covenant Benchmarking in 2009 and reintroduced the obligation to submit an energy efficiency plan but left out the ambition to be a world leader.
- The Netherlands Court of Audit has questioned the effectiveness of Dutch policies to stimulate energy efficiency (Algemene Rekenkamer, 2011). First, covenants are mere intentions that are non-enforceable. Second, the environmental law ('wet milieubeheer') has a strong legal base but is not preserved strongly by local authorities. Third, companies are not well aware of all the rules and covenants that apply to them (especially companies with less than 3.000 employees).

Box 3: Dutch policy instruments to improve energy efficiency

- EU Emissions Trading Scheme (EU ETS) for CO_2-emissions. Large energy users that fall under the ETS have to buy CO_2–allowances for their emissions. The higher the CO_2-price the higher the incentive to save energy.
- MEE-covenant between the government and large energy users such as energy companies (Nuon, Essent), large brewers (Heineken, Bavaria, Grolsch), chemical companies (DSM, AKZO Nobel, Dow Chemical, DSM, Shell). Companies have the obligation to edit an energy efficiency plan but the implementation is more an intention than a legally binding obligation. The predecessor of the MEE was the Covenant Benchmarking.
- MJA3-covenant between the government and trade associations of which the majority is related to industrial companies. These companies don't fall under the ETS-system. They are usually smaller and outnumber their counterparts under the MEE-covenant. The goal of the MJA-3 covenant is to implement cost effective energy saving measures. It's predecessors were the MJA-1 (1990-1999) and MJA-2 (1999-2009).
- Environmental laws such as the 'wet milieubeheer' prescribe non-ETS companies that use more than 50.000kWh of electricity or 25.000 m^3 gas per year to implement energy efficiency measures with a pay back period less than 5 years unless the financial situation of the company is insufficient. Execution of the law is a responsibility of the local authorities.
- Different types of subsidies and taxes exist to stimulate investments in energy efficiency or discourage the use of energy.

ING example

- ING takes part in the MJA-3 covenant. The main objective of the MJA-3 is to increase energy efficiency with 30% between 2005 and 2020. Companies that join the MJA-3 have to submit an Energy Efficiency Plan (EEP) in which they indicate how to achieve this 30% reduction. In case of ING the EEP is agreed upon by the municipality of Amsterdam.
- Currently ING Bank Netherlands uses approximately 1,1 PJ of energy, which is already 17% more efficient than in 2005 so ING is well underway in reaching the target of 30%.

The main building blocks of ING's EEP for the 2013-2016 period are:

1. Implementation of Combined Heat and Power (CHP) and geothermal heat systems in ING offices where possible and economically feasible;
2. Smart metering;
3. Concentration of all datacentres in one newly build datacentre which uses 50% less energy. Old and less energy efficient data centres will be phased out in the coming years;
4. Introduction of 'Het Nieuwe Werken' which will reduce energy for commuting and business travelling;
5. ING will ascertain the energy labels of all its privately owned offices;
6. Since 2007 ING uses 'Groene stroom' out of hydropower. As of January 1st 2013 ING Bank Netherlands sources its gas demand of approximately 7,5 million m^3 gas completely from biogas sources.

Different ways to increase energy efficiency

Redefining industrial processes and adopting an energy supply chain approach have the highest potential

Energy saving should go beyond just implementing more energy efficient machinery.

Energy efficiency improvements in industry can be classified into three main categories (IEA, 2012).

1. **Better equipment and technology**. Accelerated adaptation of best available and energy efficient technology by replacing old technology has a huge potential to increase energy savings.
2. **Managing energy and optimising operations**. System optimisation means going beyond component replacement by newer and more efficient ones towards integrated system design and operation. For example, pasteurisation in the food industry is an energy intensive process to prevent spoilage caused by microbial growth in the food. In the process the food, which is usually a liquid, is heated to a specific temperature for a predefined length of time and then immediately cooled after it is removed from the heat. This heating and cooling takes a lot of energy. Luckily new technologies become available that use less energy. For example a membrane is a thin, film-like structure that separates two fluids. It acts as a selective barrier, allowing some bacteria to pass through while others don't. So by redesigning production processes and eliminating energy intensive processes a lot of energy can be saved.
3. **Holistically transforming industrial production systems**. More radical reductions in industrial energy use require an integrated approach to energy management over the whole industrial process and consumption chain. Strategies for transforming production systems include increased use of energy that is wasted (especially heat utilization), sharing energy flows between companies and industries and inventing alternatives for the use of feedstock in industrial processes.

Box 4: Examples of mature technologies to save energy in manufacturing

Early retirement of inefficient existing production facilities
Process innovation: reduce number of steps in process that products have to be heated or cooled.
Insulation:
- Of pipes and appliances
- But also for industrial buildings with floor, wall and rooftop insulation

Energy measurement and management (smart metering): monitor energy efficiency continuously and on the level of individual machineries and discuss outcomes in MT-meetings
Waste heat utilization and energy recovery
Heating: high efficiency furnaces and boilers
Cogeneration
Lighting:
- CFL
- LED

Energy saving in focus

Energy markets turn against energy efficient form of cogeneration in manufacturing

Shale gas revolution in US increasingly puts CHP under pressure.

- The manufacturing industry accounts for 37% of Dutch energy use. Due to its activities and processes it uses four times as much energy for heating as for electricity. As a result it makes extensive use of Combined Heat and Power (CHP) in which heat and electricity are produced simultaneously in an energy efficient way.
- CHP is applied since the 90s on a massive scale and as a result it accounts for no less than 50% of electricity demand and 30% of heat demand in manufacturing. With its high energy efficiency and reliability CHP is a very important technology for manufacturing.
- Unfortunately, it is highly uncertain whether CHP can continue to play its leading role as recent developments in energy markets negatively effect the return on CHP. Figure 21 clearly shows that the costs of CHP (gas prices) have increased more than the revenues of CHP (electricity). As a result CHP in most cases has a negative return despite positive benefits to society (higher energy efficiency and reliability).
- Many factors determine gas and electricity prices but currently the shale gas revolution in the US is a game changer for energy markets across the world. It increases US gas supply rapidly (figure 22) and reduces coal demand in the US. As a result the US exports it's coal reserves to Europe where the price of coal drops. Therefore coal fired power plants can produce cheaper electricity than gas fired power plants or CHP installations. In contrast to coal markets, gas markets are still regional in stead of global markets and European gas prices are not under downward pressure by the production of shale gas in the US. Since many European countries are still against the production of shale gas it is not likely that a similar revolution will take place in Europe soon and gas prices are likely to remain high in comparison to electricity prices.
- It is expected that more and more manufacturers will turn off CHP installations if alternatives for heat and electricity production are available. In the case of 'must-run-installations', CHP will continue to put pressure on manufacturers profitability.

Figure 21 Dutch gas and electricity prices (index, January 2010 = 100)

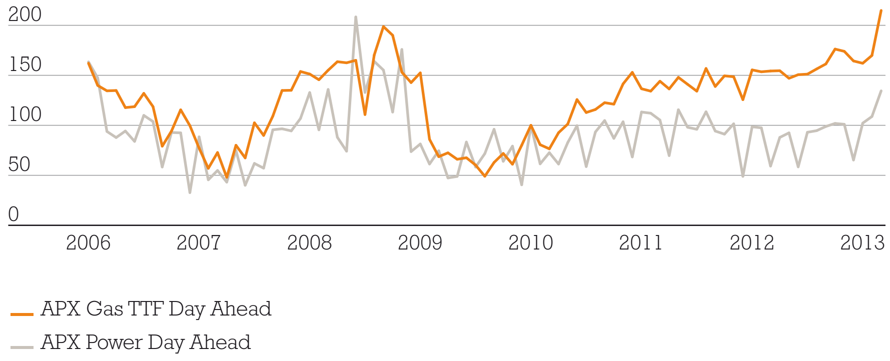
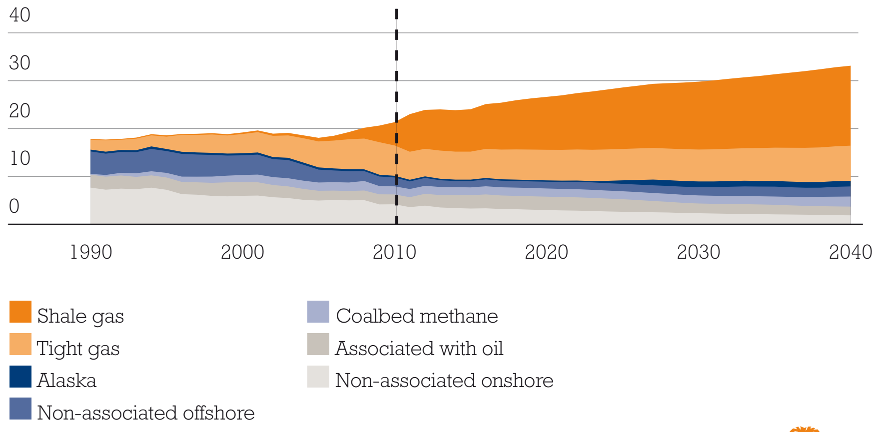


Figure 22 Gas production in the US (trillion ('cubic feet')



Chapter 5.

Efficient energy use in the transport sector

- People, goods and information travel more and over longer distances.
- Aviation is largest energy user in transport sector.
- Potentially large rebound effects exist in transportation.

People, goods and information travel more and over longer distances

Aviation is largest energy user in transport sector

Energy efficiency has decreased in transportation.

- The transport sector uses 411 PJ of energy which represents 12% of Dutch energy use.
- Aviation is the heaviest energy user since it accounts for 43% of all the energy in the transport sector. Road transport uses one third and shipping one fifth of all the energy related to transportation. In the past twenty years road transport has grown 5% a year while aviation grew 20% yearly as the liberalisation resulted in low cost carriers.
- Over time, the transport sector has become less in stead of more energy efficient which results in a slightly negative saving rate of -0.1% a year in the last ten year. Despite initiatives to increase aerodynamics and fuel efficiency the savings rate has worsened cause the trends to heavier cars and more air conditioning are treated as negative saving in the Protocol Monitoring Energy Efficiency. Nonetheless, cars have become more energy efficient in relative terms. For example the share of newly sold passenger cars with energy label A increased from just 4% in 2007 to 43% in 2012 in the Netherlands.
- Transportation has evolved over time to "individualized mass mobility" as an increasingly number of people, goods, information and ideas travel more often and over longer distances.

Figure 23 Energy use in Dutch transportation sector (PJ)

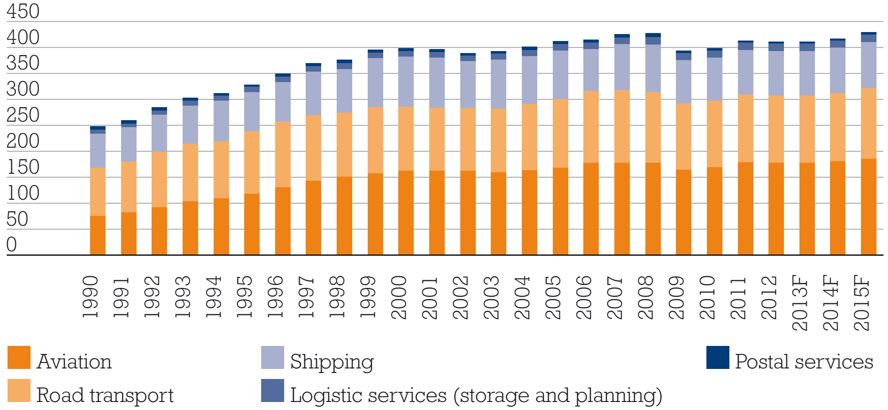
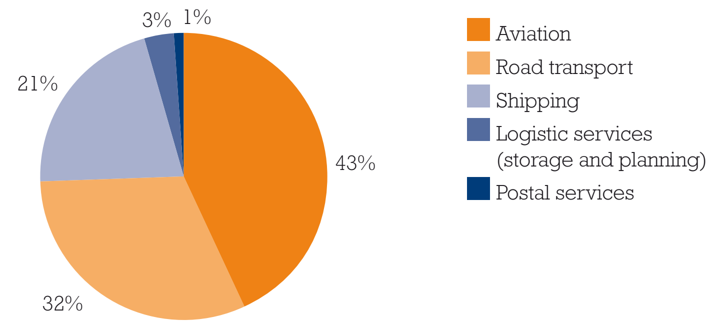


Figure 24 Airplanes are heavy energy users (2012)



Source: CBS

Potentially large rebound effects exist in transportation…

…as well as energy efficient technologies

Policymakers should look at technology and behaviour when saving energy.

- There are substantial opportunities to improve energy efficiency across all transport sectors (road, aviation, maritime, rail and other), mainly through increased deployment of energy efficient technologies, but also by improving the efficiency of transportations systems as well as changing consumer preferences (IEA, 2012).
- There is less scope for freight trucks to improve fuel efficiency in comparison to passenger light duty vehicles. Trucks mostly use diesel engines which are already better optimised for fuel consumption.
- Saving energy in transportation is difficult due to potentially large rebound effects:
  - Car engines, for example, have become much more energy efficient over the last decades but the overall car efficiency has not improved accordingly. Cars are now bigger, heavier, have more power, and new features such as air conditioning and more electronics than 20 years ago.
  - People have used the benefits of better transportation vehicles and infrastructure to increase the distance over which they travel rather than reduce the time they travel. The time people spend travelling is remarkably stable over the years, regardless the distance they can travel during that time. So if we want to conserve energy in transportation we cannot rely on technology alone but we have to incorporate mobility preferences as well.

Box 5: Examples of mature technologies to save energy in transportation

Improve aerodynamics of transportation vehicles
Engine downsizing
Lower weight of vehicles with high quality steel or other materials
Make use of tyres with less rolling resistance
Early retirement of old and less efficient cars, airplanes, trains and ships
Set fuel economy norms for manufacturers for individual vehicles:

- Increase efficiency of car engines (for example 3 cylinders in stead of 4 in a passenger vehicle)
- Hybrid technologies
- Electric vehicle

Set fuel economy norms for manufacturers on portfolio level so they have an incentive to increase the efficiency of ‘all’ cars in stead of only their ‘eco’-models.
Regenerate energy that is released while breaking
CFL and LED lighting
Cooling: improve efficiency air conditioning
Improvements in traffic management systems
Make use of navigation systems for most efficient routing

Chapter 6.

Efficient energy use by households

- Households continue to use more energy…
- ...and the saving rate is slowing down as consumers buy less new and energy efficient appliances.
- Energy for information and Communication Technology is on a rise.
- As with the other sectors, substantial rebound effects exist for households too.

Households continue to use more energy…

…and the saving rate is slowing down as consumers buy less new energy efficient appliances and houses in times of economic uncertainty

Households use less gas but more electricity.

- Households use almost 700 PJ of energy (20% of Dutch energy use). Despite several policy instruments geared at saving energy by households in the past decades, households now use 9% more energy in 2012 in comparison to 1990.
- Note that only the in-house energy use is accounted for. For example, transportation by households is accounted for in the previous chapter on the transport sector.
- Dutch households use on average 3,500 kWh electricity mainly for cleaning, cooling, lighting, heating and ICT. They use on average 1,500 m^3 gas mainly for heating purposes.
- Energy use of households became a major concern after the first oil crisis in 1973. Therefore it has been high on the policy agenda of politicians and households in the 70s till mid 80s. Better insulation of houses and the massive adaptation of high efficient boilers have lowered average gas consumption from 3,200 m^3 gas a year in 1980 to 1,500 m^3 in 2012. An impressive result but total energy use continues to rise due to the 'electrification of households' (washing machines, dish washers, TVs, dvds, computers, mobile devices, etc).
- Despite the fact that households use more energy in absolute terms they have improved their energy efficiency. On average energy efficiency improved 1.2% a year in the period 2000-2010 (ECN, 2012). But this number is under pressure since the outbreak of the financial and economic crisis as (1) consumers buy less new and energy efficient appliances and (2) the construction of new and energy efficient houses has fallen and (3) relatively little policy measures by the latest governments to increase energy efficiency.

Figure 25 Electricity use by households, 2011

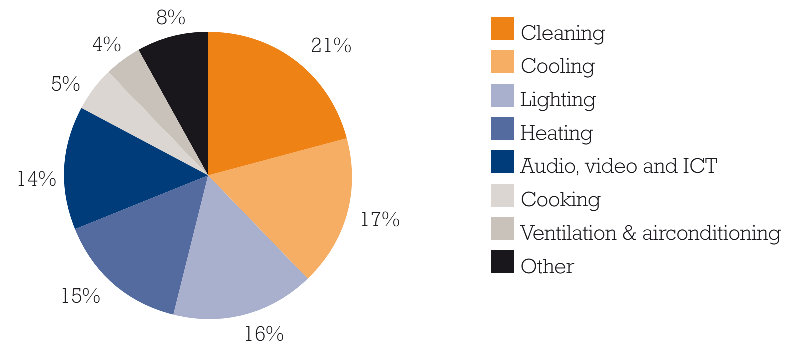
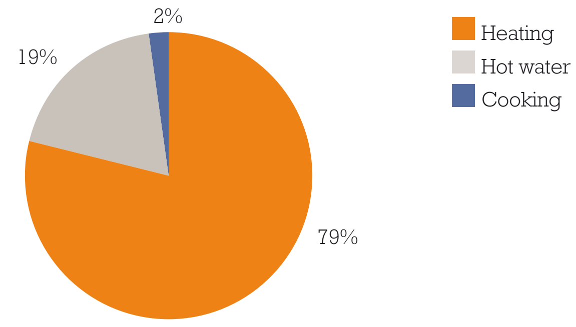


Figure 26 Use of gas by households, 2011



Source: CBS.

Information and Communication Technology...

...a heavy energy user on the rise as the electrification of households continues

Consumers are unlikely to consume less information through gadgets.

- Currently ICT-devices account for approximately 14% of electricity use of Dutch households. This will continue to rise as the energy use for these gadgets grows at 7% a year in the Netherlands. And there are no signs that this will slow down as the use of electronic gadgets at home grows rapidly. In only a few years time households have adopted new devices such as laptops, netbooks, notebooks, tablets, smart phones, routers, modems, printers, scanners, interactive TVs, set-top boxes, computers for gaming, digital camera's and video's. And according to leading futurologists there is much more to come.
- The International Energy Agency expects global ICT-related energy use to double in 2020 and triple in 2030. This requires a 280 gigawatthour of electricity or the equivalent or almost 600 times the yearly energy production by the nuclear power station in Borssele (Ganzefles et al, 2011). For Dutch households the energy use will double in 2020 to 12 terrawatthour and this only includes the energy to use these gadgets, not the primary energy needed to produce them (called embedded energy). Embedded energy is quite large for gadgets in comparison to other products as the production of microchips is highly energy intensive and the product life cycle of gadgets is relatively short (2 to 3 years) in comparison to the technological lifespan (7 to 10 years).
- While these new ICT gadgets enrich the life's of many households, they increase energy consumption as well. For example, an analogue TV rarely uses more than 100W of energy while a LCD uses 213W, a plasma screen 339W and a set-top box for digital television 7W. These differences may seem small but taken together they add up to a large amount of energy, also because of increased screen size and an increased number of TVs per household.
- Standby energy use for digital devices is much higher than for analogue devices. There's also a behavioural component to it: nobody turns off the router or modem if they don't use the internet! It is expected that 25% of ICT related energy use by households is related to the standby mode. And very few people realise that every time they send an email or browse a webpage they increase the energy use of the servers that host these websites somewhere in the world or the computers that receive the mail.
- The production of ICT appliances is subject to a classical split incentive problem. The producer has no strong incentive to make energy efficient gadgets since he does not bear the energy costs of using the gadget. And consumers are triggered by the latest fashion and price, not the energy use of the gadgets. Private actors won't solve this problem which calls for government intervention. Incentive and rules to increase the energy efficiency of ICT products are the main building block; there are simply too many inefficient products available to consumers. These incentives and rules should also incorporate energy use in standby mode. Smart metering of ICT appliances can increase energy awareness by consumers which on average saves 10% of energy. Policies aimed at consuming less information through ICT gadgets seem less effective in the current digital age, unpopular and difficult to implement in practice.

ING Example

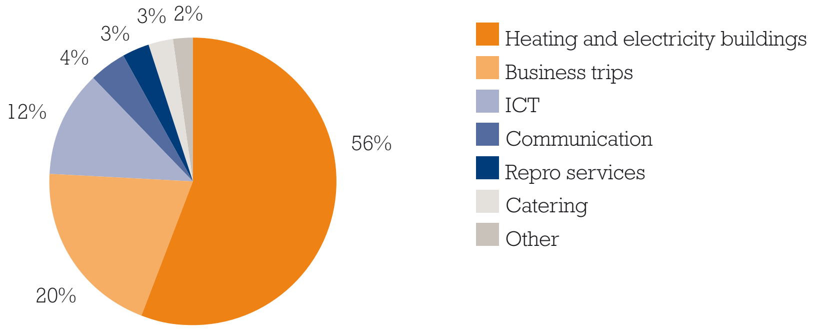
- ING makes extensive use of ICT. As a result 12% of ING's energy use is ICT related. ING's strategy to reduce ICT related energy has three building blocks.

Energy
- Virtualization is a computing technology that enables a single user to access multiple physical devices. Virtualization results in 60% less power consumption by less idle computing power.
- ING is building new data centres that consume 50% less energy.

eWaste
- ING takes on a life cycle approach with regard to ICT related energy. As a result ING actively collects old appliances such as desktops and mobile devices. It makes them available for re-use (for example in schools) or makes them available for recycling since they contain small amounts of rare earth elements such as gold and silver.

Travel
- 24% of INGs energy use is related to travelling and commuting. We reduce travel related energy by introducing telepresence. Of course this leads to an increase in ICT related energy but the reduction in travelling related energy outweighs this effect.

Figure 27 Energy use of ING Bank Netherlands



As with the other sectors, substantial rebound effects exist for households too…

…but many technologies to save energy are available as well

Technology and behaviour should be aligned.

- Measures to save energy do not always deliver the full energy savings predicted by engineering analyses as energy efficiency may evoke undesirable side-effects that are commonly referred to as ''rebound effect''. Examples of the rebound effect by households are:
- People tend to leave on the light from CFL or LED-lighting more often since they use only little energy.
- Energy efficiency of ICT equipment is improving but people use them more.
- If people buy new appliances such as a LED TV, the old appliance is not thrown away but used in the bedroom or the children's room causing the overall energy use to increase. Or worse: an old refrigerator is used in the pantry or garage after it has been replaced by a new one in the kitchen. Televisions and refrigerators have also become bigger over the years increasing the energy need.
- Highly efficient boilers in combination with better insulation reduced the amount of energy needed to heat houses. In stead of saving the money people increased the comfort level in house and some now watch the telly in January in a T-shirt in stead of a warm sweater.

Box 6: Examples of mature technologies to save energy for households

Insulation
- Wall, floor and roof insulation / building retrofit
- Improved glazing of windows

Energy measurement and management (smart metering)
Heating: heat pump
Cooling: improve efficiency air conditioning
Replace low efficient appliances by high efficiency ones with a good energy label
Lighting:
- CFL
- LED

Increase building efficiency new buildings
Waste heat utilization
High efficiency boilers ('HR-ketels')

Chapter 7.

Mobilizing the finance for energy efficiency

- Mobilising finance is key in scaling up energy savings.
- Energy efficiency is widely regarded as "low-hanging-fruit" but many barriers exist.
- Private equity partners, governments, banks and institutional investors all play a different role in providing finance for energy efficiency.
- The challenge is to increase the awareness of the strenght of the business cases for energy efficiency projects.
- In focus: 'Nationaal Fonds Energiebesparing' (NFEB).
- In focus: ESCO financing.

Mobilising finance is key in scaling up energy savings

Energy efficiency provides huge opportunities as banks take their approach to sustainability to the next level

Sustainable lending is becoming top of mind.

- Energy efficiency is not yet considered an established asset class by investors or a standard lending product by banks. But the energy efficiency market will not reach scale without the involvement of the financial industry to meet its demands for capital. Therefore this chapter focusses on the role of financial institutions in general, and banks in particular, in financing energy efficiency projects.
- The energy efficiency market provides huge opportunities for banks. First, it is a growing market which is rare in the current context of low economic growth. Companies are viewing the rising focus on energy efficiency as business and investment opportunities. Energy efficiency is a topic that simply affects every industry. Banks are now receiving specific requests for funding in this area and this is expected to increase. Secondly, it is a market that fits into the sustainability approach of many banks. This approach has evolved over time. Starting from mitigating environmental and social risks to supporting sustainable business and integrating it into the core business and strategy. Banks are recognizing the opportunities of sustainability more and more. Clients addressing issues like energy efficiency pro-actively in an ambitious sustainability agenda show even better financial performances and credit ratings. Directing more assets and capital to sustainable businesses therefore creates a healthy portfolio for the banks. In addition, direct lending to energy saving projects can stimulate and facilitate the transformation to a low carbon economy.
- Traditionally energy saving projects were financed by businesses at a corporate level and by households out of savings, through mortgage finance in case of a refurbishment or with a personal loan in case of the purchase of a new and more efficient car. This is all very straightforward and energy efficiency was often a small part of a larger financing deal with the bank. Nowadays businesses and households implement standalone energy efficiency projects and are looking for tailored finance arrangements in this area. In this chapter we will explore these arrangements a bit further.

But it ain't easy…

Energy efficiency is widely regarded as "low-hanging-fruit" but many financial barriers exist that prevent money from flowing into the industry

The challenge is to finance a reduced cash out flow, aggregate small projects and educate staff.

Financing reduced cash out flows

Energy efficiency measures result in a reduction of the cash outflow related to energy in a household or company. Of course this has a financial return but it is not backed by solid cash inflows that are the basis for paying interest and principle of a loan. The challenge is to structure a business case in energy efficiency in such a way that the potential increase in free cash flow is realised and used for interest and repayment requirements instead of discretionary spending by households or businesses.

Split incentives

The entity investing in energy efficiency is often not the same one that is benefiting from the investment, making the business case difficult to develop. The classical example can be found in real estate where the landlord has no incentive to improve the energy efficiency of his building as the tenant reaps the benefits of his investment. But the problem is much more widespread as any producer of machinery or devices such as tablets or smartphones does not benefit directly from improving the energy efficiency of its products whereas the consumer does.

Many small i.s.o. large scale investments

Saving energy is often about simple and small projects for every single household or company such as better insulation, energy measurement systems, changing behaviour, LED-lighting, replacing old machinery, etc. Together they add up to impressive savings. So the value in energy efficiency tends to be in aggregating small projects to enable scale and greater savings.

Perceived higher risk

Perceived risks of energy saving projects appear to be limiting investment in the sector and are due to investors' unfamiliarity with energy efficiency project structures and economics, low levels of specialist technical capacity and the lack of investment track record.

Availability and source of finance

The finance challenge for many energy efficiency projects will be to fund a structure which accommodates a combination of financing sources.

Banking risks In real estate

The built environment provides the largest potential to save energy. But in the Netherlands real estate is also one of the largest domestic risk exposure for banks as they have € 80 billion debt outstanding in commercial real estate and € 670 billion in mortgages. As commercial and residential property values continue to decline the built environment poses an increasing risk to banks balance sheets. Therefore Dutch banks are reluctant to increase their exposure to real estate finance even though there is strong evidence that property values of energy efficient buildings hold up relatively well in comparison to less energy efficient buildings. At the moment the opinion prevails that a reduction in real estate exposure is required to restore financial stability of the Dutch banking industry.

Lack of knowledge and capacity

Energy efficiency requires highly specialised knowledge on technologies to save energy, market developments and financial products. Although banks do have a lot of knowledge on these issues, it is limited to highly specialised teams and individuals in stead of every relationship manager that is dealing with clients. The challenge is to raise general levels of awareness with client relevant relationship managers and ensure that the financial sector expertise within most banks is used to good effect.

Banks play a role in providing debt finance for mature technologies…

…private equity and government programmes are best suited for innovation in energy efficiency and start up companies

Activities and technologies to save energy differ in risk and return. In order to get effective and efficient financing structures for energy savings projects, the risks have to be allocated to the parties that can bear them best. Banks cannot finance the high risk activities of R&D activities to invent new ways of saving energy and the introduction of these technologies to the market. These risky activities need equity finance and can be financed best out of own resources, through venture capital or subsidies. Banks have a major role to play in the commercialisation phase of proven technologies (figure 28). In this phase debt financing can be used to scale up the use of these technologies for example by providing corporate loans, project finance, lease arrangements, securitisation programs or the debt part in public private partnerships.

Figure 28 Banks have a major role to play in the commercialisation phase of proven technologies to save energy

Risks need to be allocated to the parties which can bear them best.

R&D-phase
(prototype)

Parties involved
- Governments
- Venture capitalists
- Family offices
- Energy companies

Type of finance
- Subsidies
- Seed or Venture Capital
- On balance sheet finance
- Own resources / free cash flow

Market introduction phase
(proven technology but market. Is not mature yet)

Parties involved
- Banks
- Energy companies and service providers
- Government
- Private equity

Type of finance
- Structured Finance / Project finance
- Corporate lending
- Leasing
- Mezzanine finance
- Securitisation

Exploitation phase
(proven technology and mature stage product life cycle)

Parties involved
- Banks
- Institutional investors
- Funds for infrastructure
- Sovereign wealth funds
- Governments

Type of finance
- Debt and equity finance
- Public Private Partnerships

Since the outbreak of the financial crisis which has led to a restructuring of the financial sector, alongside the adoption of Basel 3 capital adequacy requirements for banks, the commercial bank sector appetite for long-term project risk has reduced. However, once energy efficiency projects are completed they offer good quality, long-term, predictable cash flows which are very interesting for institutional investors in the debt capital markets. However institutional investors normally do not take start-up and project completion risk. The finance challenge for many energy efficiency projects will be to fund a structure which accommodates a combination of financing sources as well as to aggregate small projects to enable scale and greater savings. Without aggregation it is difficult for banks and institutional investors to finance individual projects because the economics for small projects on standalone basis cannot compensate for the costs of structuring and legal due diligence required in project finance.

Banks are developing financial products that encourage households and business to save energy…

…and incorporating financial incentives will scale up investments further

Scaling up energy efficiency requires both retail and commercial banking products.

- Currently banks are developing and implementing several products tailored to energy efficiency projects. In doing so, a distinction is made between retail banking products for households and SMEs and commercial banking products for large companies and investors. Figure 29 gives an overview of possible financial products though it is not an exhaustive list.
  - Green Bank or fund: most Dutch banks have a so called Green Bank which attracts savings from households and lends the money to environmentally friendly projects such as energy efficiency projects. The Dutch government supports the scheme with fiscal incentives.
  - On bill financing is usually set up in close corporation with an energy company. Households borrow money to increase the energy efficiency of their house and repay interest and principal through their energy bill where the savings achieved should more than compensate for the costs of finance.
  - Energy Performance Contracting (EPC): debt finance for Energy Service Companies (ESCOs) which will be explained in more detail later.
  - Debt finance for specialist energy efficiency investment funds (see for example the 'Nationaal Fonds voor Energie Besparing' which will be explained later)
  - Carbon trading: facilitating the trade in carbon credits between companies or countries with emissions reductions obligations and project financing for emissions reduction project which qualify for carbon credits.
- For a massive adaptation banks need not only have to mobilize the funding and develop the financial products for energy efficiency initiatives. Banks can also provide the incentives in their regular products to encourage households and business to save energy. For example, the 'Tijdelijke Regeling Hypothecair Krediet' and 'Gedragscode Hypothecaire Financieringen' in the Netherlands allow for a slightly higher Loan to Value and Loan to Income on a mortgage for the purchase of an energy efficient house or the retrofit of an existing house that results in a better energy label.

Figure 29 Examples of possible banking products

Retail Banking (Households and SMEs)

Households
- Green Bank or fund offering green savings products
- Personal Loan
- Mortgage finance
- On bill financing in cooperation with energy companies
- Financing of co-operatives

SMEs
- General lending
- Real Estate finance
- Green Bank: financing energy efficiency projects
- EPC and ESCO financing
- Financing of companies specialising in energy saving solutions

Commercial Banking (Large companies and investors)
- General lending
- EPC and ESCO financing
- Cofinancing with public banks, investment funds or governments (PPP)
- Lending to a National Fund for Energy Efficiency
- Finance of initiatives of energy companies like setting up an on bill finance program for their customers
- Carbon trading for large energy users that fall under the Emission Trading Scheme

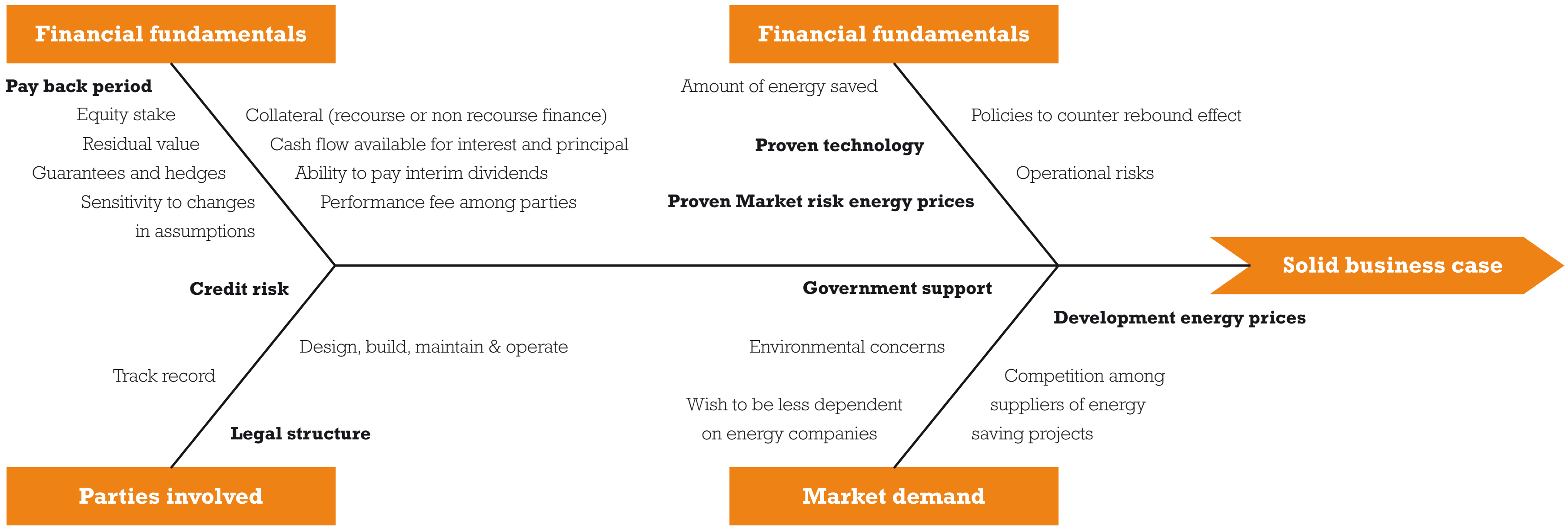
The challenge is to increase the awareness of the strenght of the business cases for energy efficiency projects…

…finding the right balance between risk and return

- Energy saving has great potential due to the variety of available technologies, relevance to all types of industries including households and the increased government focus to save energy. But that dos not mean by all means that every single project to save energy is bankable.
- Private actors will only invest if the expected return matches the expected risk of the project in comparison to alternative investment and finance options. The decision to finance a project is based on a business case that weighs revenues and costs. Whether the business case is bankable or not depends on a lot of factors (see figure 30 in which the key factors are highlighted). Companies and households looking for finance for their energy efficiency projects do well if they consider these things before applying for a loan.

Figure 30 Factors influencing business case solidity for energy saving projects

Bankability depends on business case solidity.



In focus: 'Nationaal Fonds Energiebesparing' (NFEB) 1/4

A national fund to save energy in up to 1 million homes in a cost efficient way

EU stimulates countries to set up a National Energy Efficiency Fund.

- Article 20 of the EU Energy Efficiency Directive states the following regarding the finance of improved energy efficiency: ''Member States shall facilitate the establishment of financing facilities, or use of existing ones, for energy efficiency improvement measures to maximise the benefits of multiple streams of financing. As a result, Member States may set up a National Energy Efficiency Fund. The purpose of this fund shall be to support national energy efficiency initiatives.''

- In 2012 ING joined a market based initiative[1] to conduct a feasibility study for the establishment of a revolving fund to finance energy efficiency measures in owner-occupied housing in the Netherlands – the Nationaal Fonds Energiebesparing (NFEB). The ambition of the NFEB is to improve energy efficiency for up to 1 million homes by 2020, by providing householders with a favourable cost of finance which will allow the implementation of energy efficiency measures which conform with the ''Golden Rule'' (see next page).

- The NFEB feasibility study was given a Green Deal award by the Dutch government in The Hague on 14th June. The completed study was presented to Minister Blok of 'Wonen & Rijksdienst' on 9th January 2013.

- The study shows that up to 920,000 private households could be raised from energy label red (D-G) to green (A-C) through the implementation of measures such as loft, wall and floor insulation, draught proofing, new windows and boilers. The measures may be financed by a loan from the NFEB, which is repaid via the household energy bill. Assuming a 6% interest rate, the measures will pay for themselves through the savings realised within a maximum of 10 years. Moreover, up to 15,000 man-years of employment could be created in the building, installation and technology sectors.

- If the full ambition of the NFEB is realised, the national energy consumption would be lowered by 21 petajoule, requiring a total investment for the NFEB of € 2.7 billion. In this scenario the NFEB can play an important role in helping the Netherlands achieve its 1.5% a year efficiency improvement commitment under the Energy Efficiency Directive.

- The report concluded that the NFEB proposal is feasible subject to (i) government participation in the funding to attract debt funding from commercial banks and keep the cost of finance to the consumer within Golden Rule requirements, and (ii) further investigation to confirm that actual consumer demand will match the indicated potential (PWC, 2012).

1 Together with ABN AMRO, Rabobank, Delta, Eneco,Essent, NUON, FME-CWM, Stichting Spaar het Klimaat, UNETO-VNI and Dura Vermeer, with PwC and Clifford Chance as advisers.

In focus: 'Nationaal Fonds Energiebesparing' (NFEB) 2/4

Critical success factors

It is essential to get the basics right.

Golden Rule	• The "Golden Rule" must always be met at the outset when an assessment is made for the eligibility of a household to finance energy efficiency measures with a NFEB loan. It is designed to ensure that the expected savings on household energy bills should be at least as big as the total repayments of the NFEB loan, including interest. After the loan is repaid the householders should benefit significantly from lower energy bills However, ultimately the householders take the risk that reality may turn out differently e.g. because of changes in household behaviour, government energy policy or energy & network costs affecting the actual energy bill.
On bill financing	• "On-bill financing" is the mechanism proposed for the NFEB to counter the concern that if householders move they would still have to repay a loan to finance energy efficiency measures from which they no longer benefit (another example of 'split incentives'). On-bill financing ties the NFEB loan to the energy meter in the house, rather than to the individual householder. The NFEB loan repayments form part of the household energy bill and when a house is sold the new owner simply takes on the on-bill NFEB loan repayment obligations, even if they choose s new energy supplier. Currently the Dutch legal framework does not easily accommodate this scheme and would have to be adjusted. British law allows for on-bill financing and this is being used by the Green Deal Finance Company, a similar scheme for households in the UK.
Behavioural and organisational factors	• Behavioural and organisational factors are likely to have the greatest influence on the success of the NFEB, rather than availability of finance. Finance is a necessary, but certainly not the only factor for householders when it comes to household energy efficiency. A low sense of urgency, fear of perceived administrative complexity and physical inconvenience, and a lack of confidence that savings will be realised and reflected in the value of their property are at least equally important in determining success or failure.
Debt overhang households	• Dutch house prices have been falling steadily by 23% since their peak in 2008. Currently the value of the property is lower than the mortgage for 1 out of 5 households. As a result households are concerned about reducing their debt and might be reluctant to take on a NFEB loan even if it is Golden Rule compliant.

In focus: 'Nationaal Fonds Energiebesparing' (NFEB) 3/4

Mobilizing the money: bringing the benefits of scale to finance many small activities

Through the NFEB risks and revenues are allocated to those who can bear them best.

- The NFEB provides loans to households to improve the energy efficiency of their homes. In order to be revolving and cost efficient the fund will only finance energy efficiency measures with a maximum pay-back period of 10 years. These are generally basic measures (e.g. insulation) which employ established technologies and tend to have highly predictable results.

  Households select a NFEB certified contractor to implement the energy efficiency measures. The cost of Golden Rule compliant measures is paid for by a loan from the NFEB, so households do not have to pay for the upfront investment (see figure 31 on the next page). Households repay the NFEB loan through their energy bill. The Golden Rule should ensure that the costs of repaying the loan over up to 10 years is lower than the financial value of the energy saved. Households can benefit from reduced energy consumption without having to pay for an upfront investment and having to bear higher monthly household bills.

- Energy companies collect interest and principal payments through the energy bill to their customers and transfer them to the NFEB. In doing so the NFEB makes use of on-bill financing by energy companies.

- The NFEB funds itself with debt from the commercial bank and institutional investor markets, leveraging a 20-25% base layer of primary risk bearing funds lent or invested by the government. Increasing the energy efficiency of 920,000 homes would require approximately € 2,7 billion funding by the NFEB. Although due to the revolving character of the fund (the early loan repayments can fund new household) the actual sixe of the fund at any one time will be much less. Without the participation of the government as the base layer risk taker, the costs of private equity or venture capital required to attract debt finance from from the commercial bank and institutional investor markets would increase the cost of the NFEB loans to the householders to above 10%; similar to regular consumer finance. An investment or loan from the government, that would be repaid within the 10 year NFEB project life would enable commercial banks and institutional investors to lend at rates that would enable the NFEB loan offering to households to be between 6 to -8%.

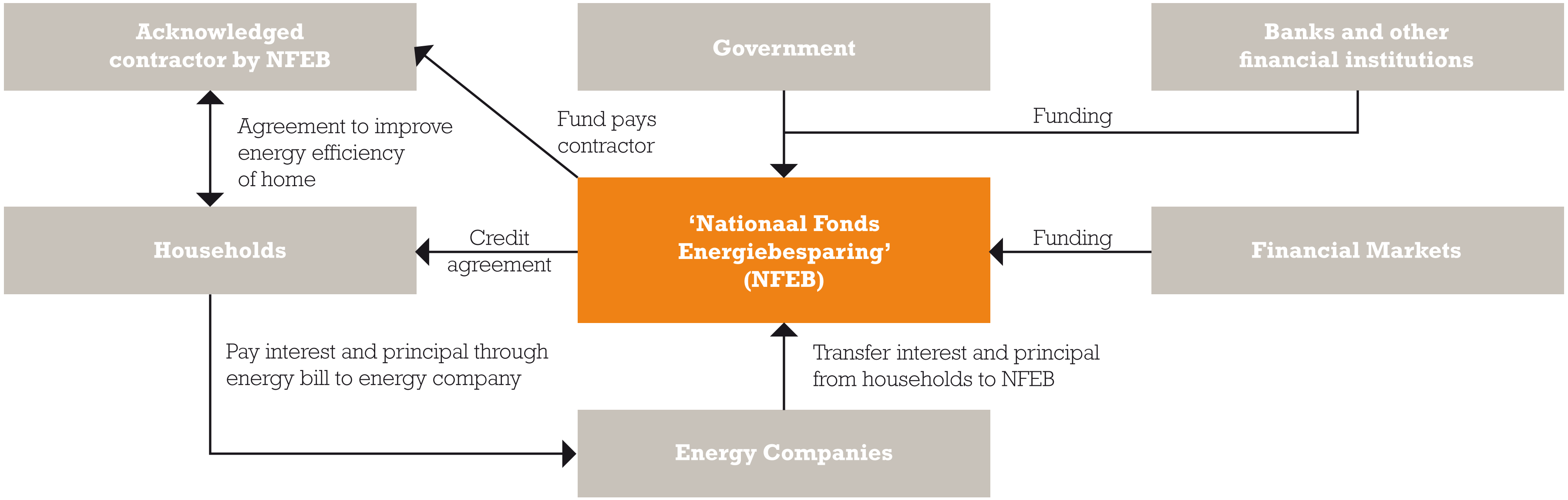
- Commercial banks and institutional investors provide debt to the NFEB. It is the NFEB that provides the individual loans to households. Through focus, standardisation and replication, the NFEB acts as an aggregator, and brings the benefits of scale (low costs of finance, ease of use, higher levels of awareness) to an issue on which current retail banking products are arguably not having a great effect.

- Note that this proposed structure is specifically designed to increase the energy efficiency of privately owned family houses. The concept of the NFEB could be feasible for other sectors and target groups as well.

In focus: 'Nationaal Fonds Energiebesparing' (NFEB) 4/4

Mobilizing the money: bringing in commercial finance in a retail market

Figure 31 Proposed structure for the 'Nationaal Fonds Energiebesparing'



Source: PWC, 2012.

In focus: ESCO financing 1/2

ESCO company organises and finances energy saving in commercial properties

A separate entity is created to manage the energy supply of a building.

- An energy service company (ESCO) is a commercial business providing a broad range of comprehensive energy solutions to the commercial property markets. ESCO-activities involve the design and implementation of energy savings projects, energy conservation, energy supply, and energy risk management. It is a form of Energy Performance Contracting. This market seems attractive and works well in the US and some Scandinavian countries but is still an underdeveloped market in the Netherlands.
- An ESCO is a special purpose vehicle which is established to manage the energy system of a building. The benefit of this approach is that the energy flows of the building are isolated and the split incentive problem - where the landlord invests in energy saving project but the tenant reaps the benefits - can be solved.
- In all instances, The ESCO starts by performing an in-depth analysis of the property, designs an energy efficient solution, installs the required equipment, and maintains the system to ensure energy savings during the payback period. Research shows that 70% of equipment in buildings operate under suboptimal settings. In practice an ESCO can save a large amount of energy by simply optimizing the current settings of installed equipment.
- An ESCO structure allows capital to earn a risk adjusted return through energy savings. The savings in energy costs are often used to pay back the capital investment of the project over a five- to twenty-year period, or reinvested into the building to allow for capital upgrades that may otherwise be unfeasible. If the project does not provide returns on the investment, the ESCO is often responsible to pay the difference.
- The Energy Efficiency Directive will stimulate the ESCO-market since end users have to save 1.5% energy yearly and the government needs to renovate its stock of buildings by 3% a year.

Box 7: Critical Success Factors for ESCOs

Critical success factors for ESCOs are:

- Standardisation of Energy Performance Contracts.
- Since the market is still in its infancy stage and there is little commercial finance available to fund ESCOs there's a need to combine public and private funds with bank lending. The government can allocate budgets or act as a launching customer.
- The construction industry is rather segmented. There are not many contractors that have the skills to handle all the equipment in buildings and to reduce the hassle factor for the landlord (one stop shopping).

Recent trends and developments in the ESCO-market:

- Real-time integration and visibility of building management systems, metering subsystems, and asset management applications.
- Automated, real-time analysis and reporting of key energy performance indicators.
- Recommendations for results-oriented energy usage.
- On-going monitoring of subsystems to continually expand energy conservation efforts and maintenance management improvements for further cost reductions.
- Independent verification of ESCO programs.

In focus: ESCO financing 2/2

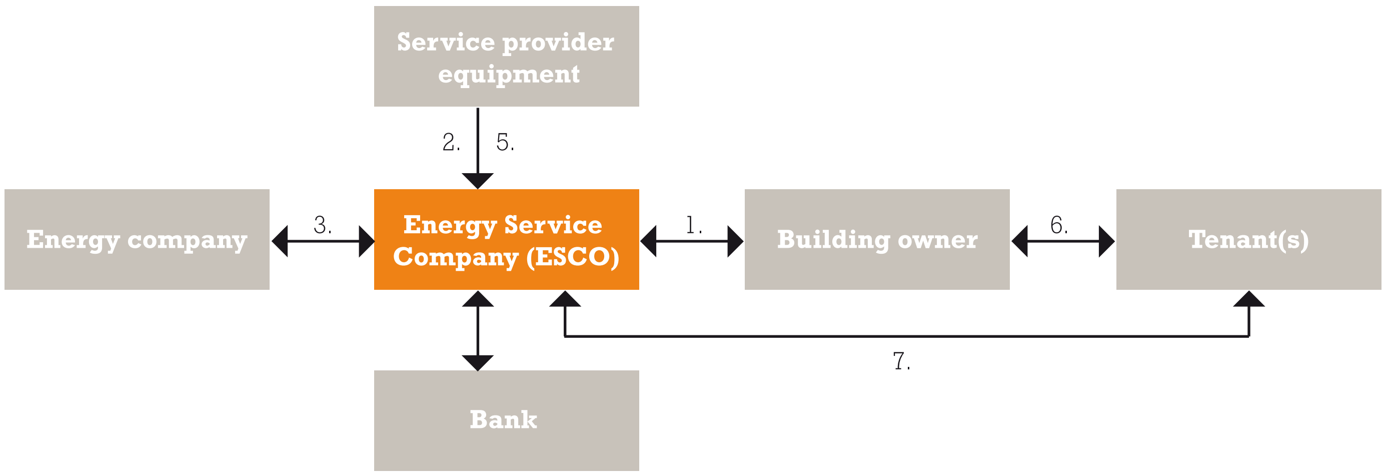
ESCO company can provide off balance finance for energy saving projects

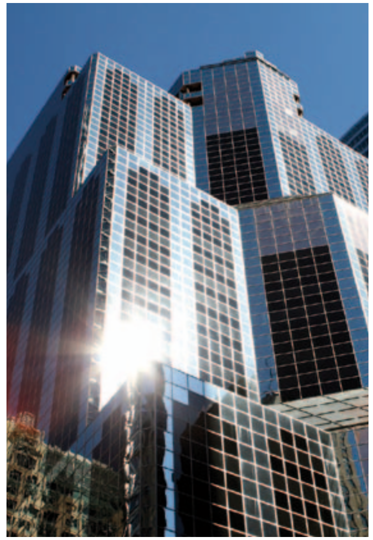
ESCOs are designed to reduce total energy costs of buildings.

- A newer breed of ESCOs evolving in the US and UK now focuses more on innovative financing methods. These include off-balance sheet vehicles which own a range of applicable equipment configured in such a way as to reduce the holistic energy cost of a building (lighting, heating, ventilation, air conditioning, et cetera). The tenants and landlord benefit from the energy savings and pay a fee to the ESCO in return. At all times, the benefit (saving) is guaranteed to exceed the fee. In the Netherlands a few ESCOs have been implemented successfully but the market is still in its infancy phase compared to the US, UK and Scandinavian countries.

- Different options for financing an ESCO company are available. Figure 32 shows a common model:
  1. Agreement to outsource energy management from landlord to ESCO;
  2. Shareholder agreement between service provider and ESCO (e.g. contractor or vendor of equipment) including transfer of equity into ESCO;
  3. Contract between energy company and ESCO for energy supply;
  4. Debt finance of ESCO by bank or other financial institution(s);
  5. Contract for exploitation and maintenance of equipment;
  6. Lease between landlord and tenant;
  7. Agreement between ESCO and tenants for energy delivery.

Figure 32 ESCO structure





Chapter 8.

Policy recommendations to simulate energy savings

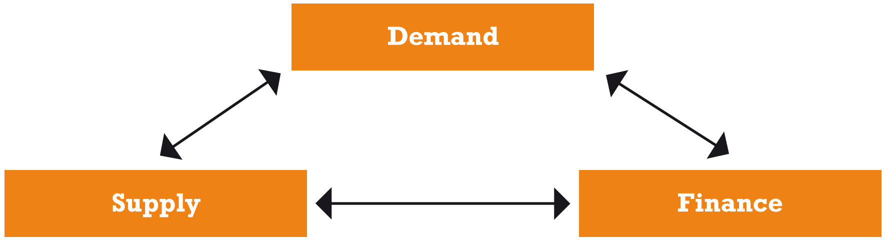
- Policy implications involve demand, supply and financial side of energy efficiency.
- The role of the government in stimulating demand.

Policy implications involve demand, supply and financial side of energy efficiency

Policies should address the main obstacle which Is the lack of demand.

- In the past years the Dutch progress towards exploiting the economically attractive reserves of energy efficiency have been intermittent. Despite considerable policy initiatives to increase energy efficiency over the years, the results have fallen behind targets set by consecutive administrations. Energy efficiency has seen a fairly stable 1% improvement a year and the national energy consumption has been growing. In order to achieve a greater effect, government will have to put in place stable policies and schemes that stimulate greater demand for energy efficiency measures and build market capacity. Experience with the renewables market shows the importance of consistency and stability in setting policy and establishing a new market. But an ambitious and consistent policy agenda for energy efficiency is still lacking. In the words by Ecofys and the Wuppertal Institute (2013) ''The Dutch energy efficiency (EE) policy has to be considered a mixed bag….While some innovative measures and policies can be recognised, the overall lack of ambition and low priority the Dutch government gives to EE is worrisome….The consequentially unstable outlook regarding energy efficiency further inhibited private investment.''
- Luckily energy efficiency is rising up the Dutch policy agenda and it is very promising that it is one of the building blocks of the Dutch 'Energieakkoord' – the national agreement on sustainable energy growth – on which the SER is currently working and which is expected te be finalized mid-2013. The implementation of the new EU directive puts energy efficiency top of mind for Dutch policy makers as well.
- National energy demand is determined by complex interactions between the macro-economy, mostly sectorial driven policies to increase energy efficiency and the collective behaviour of many businesses, households and financiers. Scaling up energy efficiency deployment requires an increase in demand, supply of products and services, and availability of financing. These preconditions need to occur across all sectors of the economy.
- On the next pages we group our policy implications into these three main categories.
  - Demand which represents awareness and desirability for energy efficiency and the resulting priority for investment.
  - Supply which represents available technology, goods, services and production capacity to make efficient use of energy.
  - Finance (third party equity & debt).
- Each factor contains barriers to growth – actual or potential - but most research and market commentary points to fundamental lack of demand as the main obstacle, as simply the availability of energy saving technologies or finance does not make people take action or invest in the activity. In that respect, the availability of technologies and finance to save energy are merely an enabler whereas demand ultimately determines the pace towards an energy efficient and low-carbon economy.

Figure 33 Building blocks for policy implications



Policy implications to stimulate demand (1/2)

General remarks

Energy conservation is the ultimate answer to a reliable, sustainable and affordable energy supply.

- Lack of demand for products and services to use energy more efficiently reflects the relatively early stage of development in the sector as well as from a lack of confidence in the long-term economic returns on investment. This lack of confidence has been attributed to poor awareness of the opportunity and its risks (apparently perceived to be much higher than they are), and lack of certainty over policy & regulations and how this will affect the often marginal business cases for investment.
- Energy demand is to a large extent determined by behavioural factors, such as the chosen level of thermal comfort or the preference to use a private car for personal mobility. In many cases, savings that arise from behavioural changes are classified as energy conservation, rather than energy efficiency. The main difference between the two is that reducing the absolute level of energy demand is the primary goal of energy conservation (if necessary at the expense of personal comfort or satisfaction), while improved energy efficiency aims to reduce the energy consumed while maintaining the same level of service.
- The reduction of national energy use is currently not a goal of the Dutch energy strategy. It is all about increasing the efficient use of energy for a given service or product. The demand for these products is not questioned. To use the analogy of a car journey, policies are focused on reducing the fuel use per travelled kilometre, not the total amount of kilometres travelled. This is a blessing for the economy but the flipside is that we continue to use more energy overall. While this may not be a concern given the abundance of energy in the world for many decades to come, it should be a huge concern in term of CO_2-emissions. Policies that focus on energy efficiency alone no longer seem sustainable in the long run and therefore we have to implement energy conservation policies as well. Energy conservation ultimately is the answer to a reliable, sustainable and affordable energy supply.
- Energy efficiency has a huge behavioural aspect to it. But behaviour and the routine which governs the majority of our lives is hard to change. A lack of energy efficient behaviour is often not related to reluctance but a form of ignorance. Therefore energy efficiency projects should also raise awareness of the wide range of benefits of energy efficiency and incorporate actions to counteract possible rebound effects. This requires firm policies and a high commitment to educate society out of locked-in behavioural patterns. However, drying your clothes on a clothesline instead of the dryer or encouragement to use consumer electronic equipment for longer instead of buying the latest models is not in line with modern marketing strategies.

Policy implications to stimulate demand (2/2)

One size does not fit all

The government continues to provide carrots, but should consider providing a stick as well.

- Dutch government policies mainly provide a carrot to stimulate energy efficiency by businesses and households. If the Dutch really want to transform to a low-carbon economy politicians should consider providing a stick as well. An example is that while many markets make use of energy labelling, in the end it is the consumers and businesses that choose the products, some of which can have (very) inefficient labels. Although these often have higher life cycle costs which should prompt the consumer not to buy them, in practice the consumer is often triggered by the up-front purchase amount which is often lower for inefficient products. If we really want to increase the efficient use of energy, the labelling system should be more binding. In analogy with the health care market one could introduce a 'white list'. In health care a new medicine can only be sold if it is on the white list that guarantees certain health care standards. In the same way a product can only be sold if it adheres to minimum energy efficiency standards and is put on the white list. A white list requires a strong political commitment to increase energy efficiency which is currently not strong enough and limiting freedom of choice is always a sensitive issue. With that respect a system based on energy efficiency certificates that can be traded (white certificates) can be a stepping stone to a white list in the future.
- Implement financial incentives that lead to a faster adaptation of energy efficient technologies.
- Develop and implement policies that transform investment in energy efficiency measures into an established asset class for investors. Thereby giving access to a broader range of (non-specialist) investors.
- Policy measures have to be tailored to the specific issues in an industry. The adagio 'one size does not fit all' clearly applies to stimulating demand for energy efficiency projects. Here are some examples that show how to do this.
  - In the residential sector it is hard to get households interested for retrofits that improve energy efficiency even if it can be demonstrated to be self-financing out of savings on energy bills within a few years. Very few people wake up and think of buying some energy efficiency. They are more likely to think of buying an object of desire such as a new car or a new computer (Fawkes, 2012). Policies towards fiscal incentives and providing information are promising in such a context as well as policies that may link the maximum rent increase to the energy label for housing.
  - In the commercial property market barriers as the well known split incentive between landlord and tenant has to be solved, for example by policies that stimulate ESCO finance such as standardization in Energy Performance Contracting.
  - In the manufacturing sector energy efficiency competes with investments in the core activities of a company and policies should incorporate process of optimization throughout the supply chain. But the strong focus by many manufacturers on their own core activities hinders the implementation of smart supply chain solutions that would ultimately benefit their industry sector and society. Energy is often not seen as a core activity and as a result the benefits of using energy more efficiently are often not addressed.

The role of the government in stimulating demand

Be ambitious on energy efficiency and consider energy conservation measures as well

The Dutch should define a clear ambition w.r.t. energy efficiency and conservation...

...as well as providing a credible roadmap.

- The Dutch government should define and make public a clear ambition to increase energy efficiency in a National Energy Efficiency Plan. It should be committed to the implementation of the plan by setting credible and enforceable targets, define a roadmap and help establish – together with the private sector – the mechanisms to attract investment and bank funding for energy efficiency. Where necessary investing (not subsidising) its own funds to help stimulate demand.
- An effective implementation of such an energy efficiency strategy has proved problematic in the past since multiple Ministries are involved causing all kinds of coordination problems. For example, the Ministry of Economic Affairs deals with energy efficiency for agriculture, energy companies and manufacturing; the Ministry of Infrastructure and Environment for transportation and the Ministry of Interior and Kingdom relations for the built environment. We advise the SER to not only define an ambitious 'Energieakkoord' but also to give policy recommendations for an effective implementation.
- Governments can act as a launching customer for energy efficient technologies, especially in the built environment since it has a large demand for office space.
- The long standing tradition of using covenants should be intensified by making them more binding since (1) currently covenants are mere intentions that are non-enforceable and (2) companies are not well aware of all the rules and covenants that apply to them.
- An increase in the energy tax has only limited effect since energy demand is quite inelastic to price changes. Pricing policies seem less effective in stimulating energy efficiency.
- Energy efficiency alone won't suffice in lowering national energy consumption. At high energy efficiency rates it will be increasingly difficult to improve it further. And due to rebound effects, energy efficiency policies are sometimes the cause instead of the solution to a higher national energy use. Therefore energy conservation must form part of the national energy strategy. Not by a dramatic policy change but by slowly incorporating it into the energy strategy for the coming years. A start could be made with sectors that are most promising and less dependent on a level playing field in international competition such as households or domestic transport. Consuming less is a popular slogan for years now, but very few people succeed in doing so.

Policy implications to stimulate supply

Many small projects collectively yield great results

Improve energy efficiency of end to end supply chains.

- We can measure the impact of renewable energy quite easily but energy efficiency is not so easily measured. As a result regular government audits on the energy efficiency performance of the Dutch economy and its many industries are lacking. We highly recommend to increase the frequency and level of data-availability on energy efficiency, preferably on a quarterly basis and linked to clearly set targets.
- Define a holistic energy strategy for the Netherlands that acknowledge the linkages between policies for energy efficiency, renewables and support for traditional energy sources. On the supply side some policies reinforce each other. For example, improving energy efficiency reduces energy demand for the Dutch economy and as a result the share of renewable energy rises. Since the Rutte-II administration has increased it's already ambitions target for renewable energy from 14% to 16%, increasing energy efficiency is of utmost importance to support this.
- The biggest opportunities for energy efficiency lie in the efficiency of the total energy supply chain where up to 89% of energy can be lost. We simply waste too much energy and money. The energy efficiency of the Dutch economy is improved tremendously if we use energy more efficient in end to end supply chains. But changing a supply chain requires a strong leader and collaboration since often no single party has the means or an incentive to influence others in the supply chain.
- Energy efficiency is the low hanging fruit but very few seem to know where it is located and can be picked. Smart metering is key in putting a spotlight on opportunities to make more efficient use of energy and should be implemented throughout the whole economy.
- Develop the market for Energy Performance Contracting and build capacity in the energy service industry as well as the ESCO market.
- Develop and implement solutions to split incentive problems. Think of on bill financing, Energy Performance Contracting in the built environment and loans to improve the energy efficiency of privately owned houses that are tied to the house and not the householder.
- Develop the market for energy labelling. Currently the label only looks at energy use in the exploitation phase so the label does not provide information on the energy use in the production or recycling phase of the product. For example a life cycle approach reveals reveals that the charging of a mobile phone only accounts for 5-15% of the life cycle energy of the product as 50% is used during production and 35-45% in the GSM network. This type of labelling stimulates the adaptation of a supply chain approach in improving energy efficiency and helps to raise awareness with consumers and producers.

Policy implications to stimulate the capital for energy efficiency

Availability of capital is not a problem but investors must have more confidence in the market

Uncertainty of long term policies for energy efficiency dampens investment.

- Access to capital is often cited as a major barrier to the uptake of energy efficiency, but it is not the whole story. More significant than access to capital are behavioural attitudes to energy efficiency and the opportunity cost of capital. Energy efficiency struggles to compete with investments in established asset classes for a variety of reasons (E3G, 2012):
    - For many investors there is a lack of visibility on the overall long-term value proposition and how returns will be delivered. In essence this is what the government and the industry must now work to address. It is particularly important because some energy efficiency technologies (particularly those that take a supply chain approach) are not cost competitive without some form of explicit policy support – this dependence on policy support means that investors pay even closer attention to public policy risk than when they invest in established asset classes.
    - Demand is suppressed because a low value is placed on energy efficiency. For example, energy costs are often a small portion of total costs, energy efficiency projects are physically hidden and yield intangible or hard to identify results.
    - The 'hassle factor' of energy efficiency projects, a lack of familiarity as well as higher perceived risks and complexity.
- As a result, building confidence in the market is key for policy makers. In the past energy efficiency programmes have been characterised by stop-start funding and no long-term outlook. Without a long-term plan investors will not have the confidence that scale will be achieved and required volumes of upfront capital will not be forthcoming. Investors need a clear sense of market size as well as transparency, longevity, and certainty in policy design – including detail on the role of 'carrots and sticks' will play in driving a healthy trajectory for market growth (E3G, 2012). Our experience in banking has shown that uncertainty of long-term policy for the renewables sector has had a similarly dampening effect on investment. In our view when the appetite for investment is stimulated and grows, the demand for debt finance will follow, and through closely following and playing a part in market developments, the financial industry will be on hand to meet this need with new product and service developments where necessary.
- Furthermore, clients have to build solid and bankable business cases for energy efficiency since currently many proposals do not present an appropriate alignment of roles and risks. It is often the case that debt is asked for where an equity or development capital investor is required.
- The financial industry should work on removing barriers to financing energy efficiency projects such as: the complexity of energy performance contracts and the means to aggregate many small investments into portfolios for example by setting up a 'Nationaal Fonds Energiebesparing' in close cooperation with the government and institutional investors.
- But all in all, the limited demand for energy efficiency projects has been the biggest issue as simply promoting the availability of finance to save energy does not make business and households to invest in energy efficiency measures.

Closing remark

The potential benefits from greatly scaling up energy efficiency are made clear in this report as well as the barriers. As US Secretary of State for energy Steven Chu so rightly said: ''The next few years will review how successful policy makers, businesses, households and the financial sector will be in picking the low hanging fruit of energy efficiency that in many cases isn't just low hanging, it is lying on the ground.''

Appendix 1.

List of interviewees

Piet Boonekamp	Energie Centrum Nederland (ECN)
Marcel Galjee	Price Waterhouse Coopers
Joost Gerdes	Energie Centrum Nederland (ECN)
Hans van der Spek	FME
Frits van der Velde	VEMW
Jacques van de Worp	VEMW

Appendix 2.

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