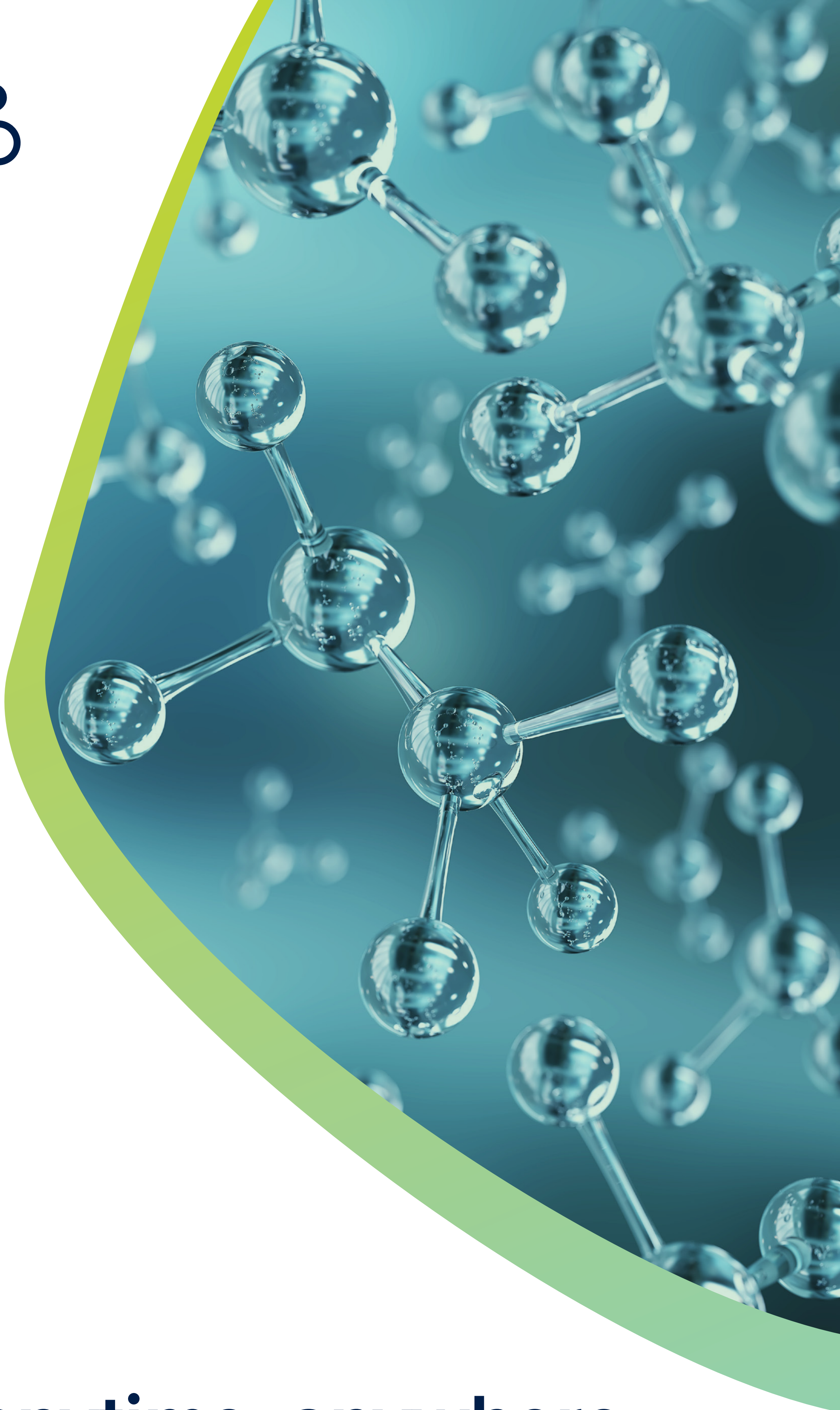
fluxys



March 2024

Energy anytime, anywhere. Green and low-carbon. With one energy system.

The energy landscape is being transformed. What does this mean for our citizens, our industry and our society?

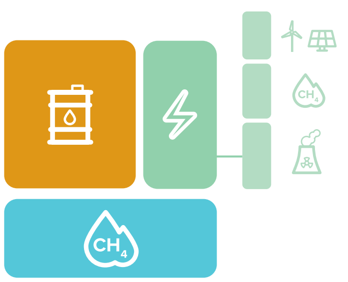
How do we tackle these challenges?

The European supply crisis has made it crystal clear: Belgium and Europe must take urgent action to achieve a low-carbon, reliable and affordable energy system. Natural gas, electricity and oil currently account for a large proportion of the energy mix in Belgium's total annual consumption of 550 terawatt-hours[1]. By 2050, consumption by Belgian households and businesses is expected to drop to 350-400 terawatt-hours[2]. Furthermore, by 2050 our energy mix will be a combination of electrons, molecules and biofuels.

> **Boundaries between our current energy systems are detrimental to our security of supply and our energy affordability.**

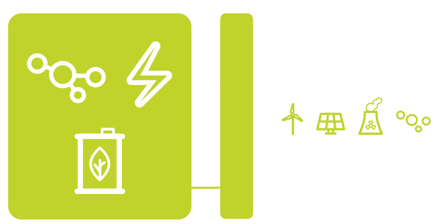
A low-carbon energy mix is possible. **A low-carbon integrated energy mix** is better. An integrated long-term approach in which expected energy consumption is linked to an optimised energy mix with the aim of achieving carbon neutrality. Optimising the entire chain (production, transport, consumption) in terms of costs and implementation times, while maintaining security of supply. An integrated vision right from the start.

Now



550 terawatt-hours
energy mix in silos

2050



350-400 terawatt-hours, of which 100-200 in molecules
a low carbon energy system

molecules
electricity
biofuels

Terawatt-hour/gigawatt-hour is the quantity of energy consumed
Watt is the unit of power of an energy source.
1 terawatt-hour is 1000 gigawatt-hours
1 gigawatt = 1 nuclear power plant

What roles do green and low-carbon molecules play in an integrated energy system?

Crucial roles. Our future cannot exist without green and low-carbon molecules, or without CO_2 capture. CO_2-neutral energy carriers such as hydrogen, ammonia, biomethane and synthetic methane will be necessary. The following facts speak for themselves.

We need green and low-carbon molecules …

… as raw material for industry

The chemical industry needs green and low-carbon molecules as raw materials for its processes. Products such as fertilisers, which are crucial for the food and agricultural industry, or plastics, for the manufacturing industry, among others, require molecules in the production process.

… as fuel for industry

There are industrial processes that require very high temperatures, for example in the glass, ceramic, cement and steel industries. With electrification you cannot usually make these processes efficiently sustainable, but this is possible with green and low-carbon molecules.

You should also know that …

…industry can benefit from carbon capture technology and infrastructure. CO_2 capture is an alternative option for industries that require high temperatures and/or where CO_2 is released as part of the process. For example, the steel industry requires these high temperatures and making cement from limestone inevitably releases CO_2.

… as fuel for long-distance transport

Heavy freight traffic, commercial shipping and aviation are difficult to electrify. Green and low-carbon molecules can also play a role here, directly or as raw materials for synthetic fuels (such as e-fuels).

… as fuel for power stations

Green and low-carbon molecules can be used to generate electricity at any time because they can be stored relatively easily and used flexibly. For example, at times when wind and solar cannot meet the demand for electricity.

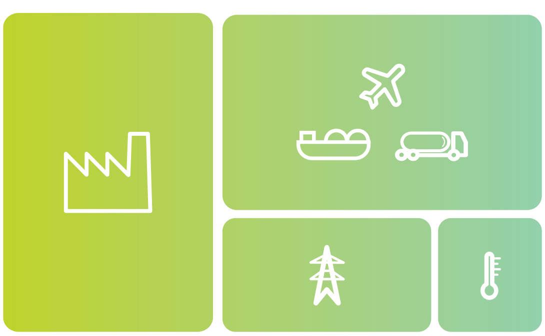
… as heating sources for our buildings

Green and low-carbon molecules can be used as a source of heating for large office buildings, schools, shopping centres and large apartment buildings.

… to ensure security of supply and affordability in the future.

How much demand[3] will there be for green and low-carbon gases by 2050?

100-200 terawatt-hours



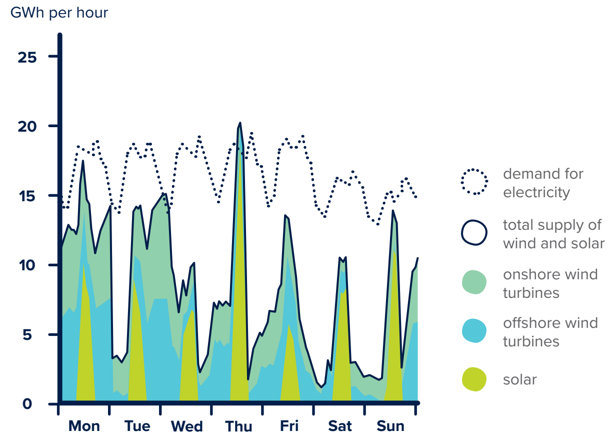
> **Our energy system of the future with green and low-carbon molecules as raw material, fuel and energy carrier.**

One integrated energy system to deal with the bottlenecks of our sustainable energy supply

Bottleneck 1
Renewable generation is not always available in Belgium...

If there is **no wind or solar power** for a prolonged period of time, we must be able to utilise energy from other sources quickly. The same applies during cold periods when demand for electricity is high. At those times, green and low-carbon molecules are an important addition to wind and solar energy, precisely because they can be utilised at any time. This would also be useful during periods with an **oversupply of wind and solar power**. If there is more electricity than required, storage in molecules offers a solution.

Molecules are cheaper to transport than electricity over long distances and in large volumes.



Simulation of hourly supply of and demand for renewable wind and solar energy for one week in November 2050[5]

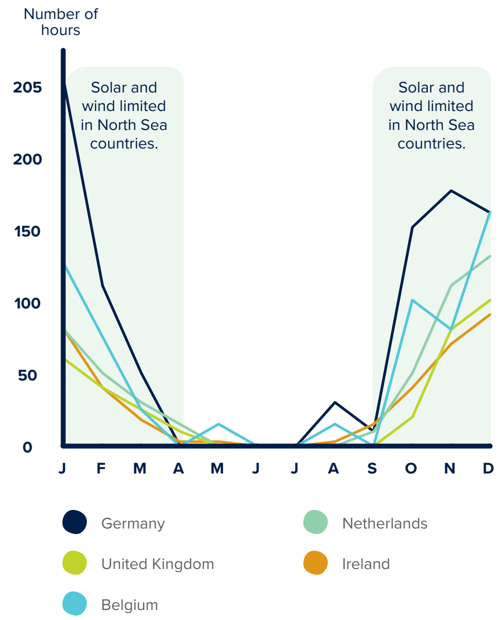
Cumulative

Bottleneck 2
... and not in neighbouring countries either

If there is **no wind or solar power** in Belgium for a prolonged period of time, **can we import electricity** from neighbouring countries? Our neighbours largely experience simultaneous periods when virtually no wind and solar power can be generated due to lack of sunlight and wind. For example, during cold days in winter when these periods can last for several consecutive days.

So, which sustainable energy sources do we then fall back on? Are we as a society prepared to live with periods of energy scarcity?

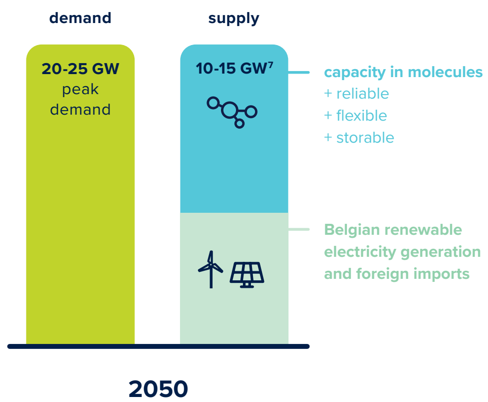
Low supply = higher prices, unless...
If there is little wind or solar energy, electricity prices will rise. In these instances it is advisable to stabilise prices by relying on energy stored in molecules, in addition to demand management and the use of electric batteries.



Number of hours per month when the generation of wind and solar power is lower than 20% of capacity[6]

Bottleneck 3
Higher peak demand

By 2050, it is expected that 20 to 25 gigawatts[4] of electricity will be needed in Belgium at peak times, i.e. double the current peak demand. At times during the winter period when there is little wind or sun, installed renewable capacity will in practice only be able to generate part of what is needed to meet peak demand. We need a different source for the other part because neighbouring countries also have the same problems at the same time. Molecules offer an ideal solution: not only are they reliable and flexible, but they are also storable.



Molecules as the biggest buffer in the future because they are a very efficient way to store renewable energy, limit price fluctuations and facilitate energy availability.

Pertinent questions

- Can we keep paying our energy bill?
- How do we build a climate-neutral economy?
- Are we as a society prepared to live with periods of energy scarcity?

With one answer:
Include green and low-carbon molecules, as well as CO_2 capture into one integrated energy vision.

As an infrastructure group, Fluxys wants to contribute to an efficient, reliable and realistic energy system, with green and low-carbon molecules and CO_2 capture as a supporting and additional solution. An energy system which is open to the necessary import and export flows of those molecules to and from our country. All for an energy system that ensures CO_2 neutrality, security of supply and affordability.

Green and low-carbon molecules are not only reliable and flexible, but also storable.

They are crucial for:
- preserving local industry;
- absorbing fluctuations in the power grid;
- having affordable, sustainable energy that is available anytime, anywhere.

> **With infrastructure for green and low-carbon molecules, and CO_2, we are helping to build an energy vision that makes sense.**

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[2] Calculation based on: ENTSOG-ENTSOE TYNDP (2023) https://2022.entsos-tyndp-scenarios.eu/visualisation-platform/

[3] Extrapolation based on:
Boston Consulting Group (2022) A Five-Step Plan towards Growing the Role of Hydrogen in Belgium's Economy.
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[4] Demand at peak times based on Demand Time Series from the Distributed Energy and Global Ambition scenarios from ENTSOG-ENTSOE TYNDP (2023). https://2022.entsos-tyndp-scenarios.eu/download/ - taking account of demand-side management.

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Towards one integrated energy vision

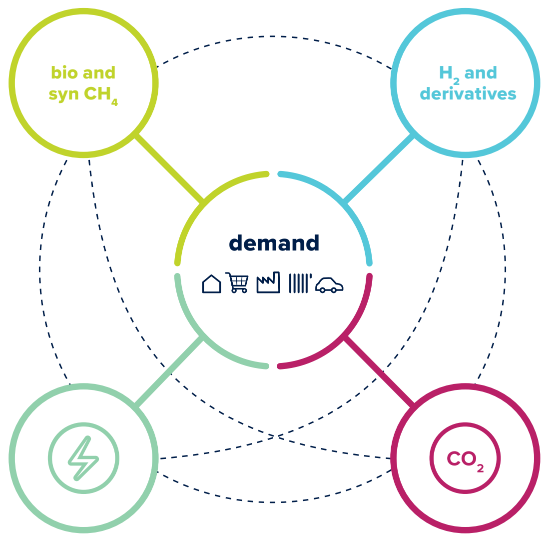
The challenges posed by the energy transition require the development and use of new energy system models. Today, the goal must be to optimise the whole, while minimising costs for society and ensuring security of supply.

Fluxys has developed such a system model in collaboration with the University of Liège. This model shows that significant cost optimisations in our future energy mix are realistic.

With this kind of holistic system-based thinking, we can anticipate how electricity, hydrogen (and derivatives), methane (biomethane, synthetic methane and natural gas with CO_2 capture) and carbon streams work together optimally at the lowest cost.

A path for carbon infrastructure

In the system model, Fluxys considers CO_2 extraction technologies to offset remaining emissions. With annual emissions of 100 million tonnes of CO_2 in Belgium, our highly industrial character (responsible for 40 million tonnes of CO_2 per year) and the presence of an active process industry, carbon capture is an efficient way of reducing CO_2 emissions. Having infrastructure for carbon capture, transport and storage in place makes a great deal of sense. It is one way of securing our industry and preserving the workforce in Belgium.



Fluxys: facts and figures

- Independent infrastructure group
- 28,000 km of gas pipelines
- Terminals in Belgium, France, Greece and Chile
- Underground gas storage in Belgium
- Active in Belgium, France, United Kingdom, Netherlands, Germany, Switzerland, Albania, Greece, Chile, Brazil and Oman
- First hydrogen gas pipeline ready for use in 2023
- 1,300 employees worldwide

More about Fluxys

Want to find out more?

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Fluxys 2024 Memorandum

Energy anytime, anywhere. Green and low-carbon. With one energy system.

Achieving climate neutrality in Belgium by 2050 is possible. However, this challenge requires a fundamental change of the system.

Fluxys advocates an integrated system-based approach, since in a climate-neutral energy system we need **molecules** (hydrogen, ammonia, methanol, biomethane, synthetic methane or natural gas with carbon capture) and electricity, as well as carbon capture, transport and storage.

For all energy applications, the most optimal technology must be applied to achieve climate neutrality.

In addition to electrification, new technologies with green and low-carbon molecules and carbon capture, use and storage will play an essential role in the sustainable transition.

We have all the ingredients for developing an integrated energy vision in our country. Together with the Belgian government, grid operators have the expertise required to design and build the best future energy system, while taking into account the interests of society.

To achieve this, we ask policymakers to:

- **Embed a structurally integrated vision in grid planning** for molecules and electrons. This will help to optimise our future climate-neutral energy system based on minimising social costs and maximising security of supply.

- Provide the necessary **flexible energy availability** to cover expected energy peak consumption by 2050. Given the non-continuous nature of renewable energy generation, power stations that operate on molecules (hydrogen, biomethane or natural gas with carbon capture), for example, will play an essential role.

- Support the **development** of the necessary **infrastructure** for transporting clean hydrogen and captured CO_2. This can be achieved by limiting financial risks in initial investments such as hydrogen and CO_2 pipelines and hydrogen import and CO_2 export terminals.

- Facilitate the production of low-carbon hydrogen (including in Belgium and the North Sea) by developing a regulatory framework that promotes the **optimal combination of electricity and hydrogen production**. It is important that transmission system operators (TSOs), such as Fluxys, are involved in the planning of offshore renewable energy right from the start, to enable them to help shape the future integrated energy system.

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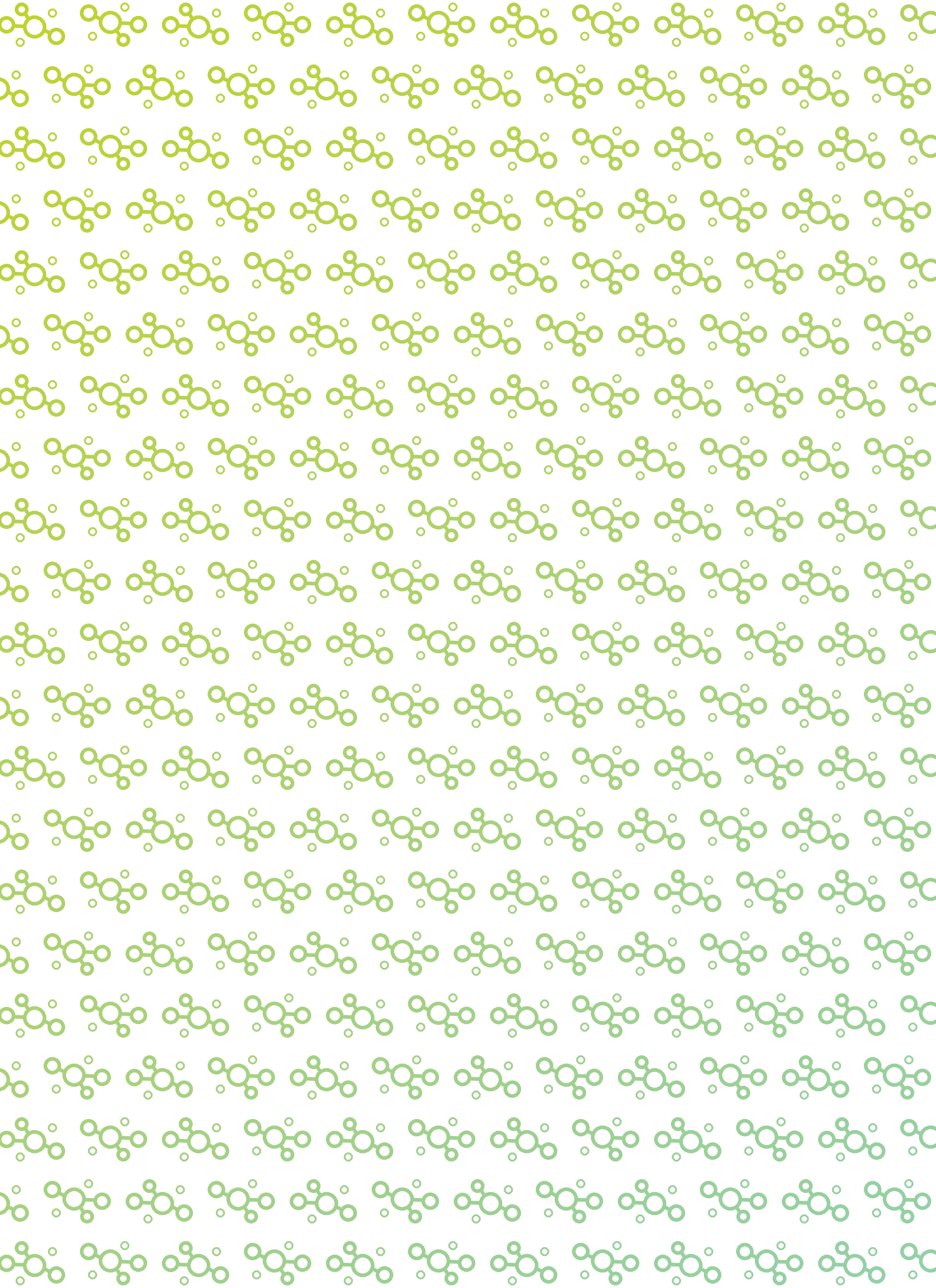

Fluxys 2024 Memorandum

Energy anytime, anywhere. Green and low-carbon. With one energy system.

Achieving climate neutrality in Belgium by 2050 is only possible through an integrated system-based approach. A climate-neutral energy system will need both molecules and electrons. New technologies with green and low-carbon molecules and carbon capture, use and storage will play an essential role in the sustainable transition. An integrated long-term approach in which expected energy consumption is linked to an optimised energy mix with a view to achieving carbon neutrality. Optimising the entire chain (production, transport, consumption) in terms of costs and implementation times, while maintaining security of supply. An integrated vision right from the start.

For the construction of infrastructure we are asking for the following:

Limiting financial risks in initial infrastructure investments

Large investments will be required to build infrastructure for hydrogen and CO_2. Hydrogen will need to be transported from production sites or import points to end users. CO_2 will need to be transported from industry to storage or reuse sites.

In terms of cost efficiency, it is important to build infrastructure from the initial phase of which the dimensions consider not only the initial needs but also the future needs for transporting hydrogen and CO_2.

To facilitate the development of these ecosystems to the maximum, it is important to establish stable and feasible tariffs for end users. In particular, it must be ensured that initial users are not overcharged.

As a result, there will be a revenue shortfall for the initial investments of the hydrogen and CO_2 transportation network operators. This shortfall should eventually be compensated by the expected growth in transported volumes.

It will therefore be important to develop investment models that involve some degree of initial risk sharing, as is already the case in some neighbouring countries. These investments are ultimately essential in achieving the energy transition.

Changing the regulatory framework

At federal and regional level

Develop and then complete the appointment procedures for CO_2 and hydrogen network operators.

At European level

Develop an EU Carbon Capture Utilisation & Storage (CCUS) regulatory framework for short-term CO_2 transmission.

Conclude bilateral agreements within the framework of the London Protocol with countries where CO_2 can be stored and with countries that can export captured CO_2 via Belgium to storage countries, such as Norway and Germany.

Establish a mutual recognition agreement between the EU and UK Emissions Trading Schemes (ETS) to ensure that EU companies can store captured CO_2 in the United Kingdom.

Ensuring permit processes are in line with our ambitions

Ensure a short and efficient permitting process for open-access hydrogen and CO_2 infrastructure projects (no more than 9 to 12 months).

Recognise open-access hydrogen and CO_2 infrastructure as a 'public utility' to grant stronger location, right of way and access rights and to establish an adequate security framework to accelerate the sustainable transition.

Ensuring a competitive and liquid hydrogen market

To preserve our local industry, the energy system must be able to continuously supply large volumes of competitively priced green and low-carbon hydrogen as quickly as possible from as many sources as possible. Therefore, it is necessary to:

- Fully utilise the potential of the North Sea as a power station by concluding cooperation agreements with countries such as the United Kingdom and Norway to maximise the production and import of green and low-carbon hydrogen from the North Sea.
- Promote the rapid expansion of available hydrogen with an open policy toward technological alternatives such as the production of low-carbon blue hydrogen (hydrogen production with methane and CO_2 capture).
- In line with our neighbouring countries, ensure that customers can count on adequate support mechanisms to bridge the price gap between green and low-carbon hydrogen and fossil hydrogen.

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