Rough outline of WUR Energy Transition 2050

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Introduction

With the Climate Agreement and the new European ‘Fit for 55’ policy, the laws and regulations concerning the use of natural gas, electricity and CO_2 emissions are in constant flux. Moreover, it has become urgent to take action to combat climate change. Considering these developments, it is vital for WUR to act as well, and to outline its ambitions for dealing with the energy transition. In this document, we aim to outline where we will stand as an organisation by 2050.

The rough outline for the energy transition describes a vision that WUR considers feasible and acceptable for our entire real estate portfolio. Given the uncertainties concerning the future energy landscape, this rough outline remains a work in progress. The further we look to the future, the greater the technical, financial and policy-related uncertainties. However, this document allows us to draw an initial picture of our ambitions.

Introduction

We can use this outline to adapt to technological and policy-related developments concerning the energy transition, so we can make sensible, effective and necessary investments at the right time.

In addition to investing in our real estate portfolio, process and user-related energy consumption can and must make a major contribution to the energy transition. It follows that, in order to achieve the set targets, an integrated approach to building-related, process-related and user-related energy consumption is necessary. As a result, our behaviour plays an important role and we must act accordingly.

It is also important that we address the focus of our primary activities, operational management and material use in laboratories together. The centralised E-team and decentralised E-teams play a crucial, leading role in this.

Introduction

The outline asks the organisation to brainstorm, join the discussion and actively contribute to the future of WUR in reducing our carbon footprint. We will reduce our CO_2 emissions by phasing out the use of natural gas, reducing our building-related, user-related and process-related energy consumption and further utilising our sustainable energy generation potential as well as energy storage techniques (using sun, wind, water and the subsurface).

This outline gives an idea of the developments WUR is responding to, when and how we are doing so, and what our ambitions are.

The outline for the energy transition consists of an integrated package of measures that, over time, will jointly achieve our goals. The measures and ambitions are largely based on laws and regulations, knowledge of our properties and expected policy and technological developments. The measures can be divided into those that will certainly be implemented, those likely to be implemented and those whose implementation is uncertain.

Introduction

The measures in the outline will be developed in an implementation plan that has intermediate concrete targets, every five years. The outline and intermediate goals are reviewed every two years, owing to the fast-moving energy landscape.

WUR publishes the total CO_2 emissions of all its organisational elements yearly in the Sustainability Report.

Despite the long time span and rough nature, the outline indicates the proposed measures, the corresponding investment estimate and the expected CO_2 emission reduction where possible. The uncertainty of these two parameters was also estimated. Furthermore, an indication is given of how the costs (investments) and benefits (CO_2 emission reduction) will develop over time. The cost estimates were made based on the quality of the available information and the certainty of the measures.

Introduction

Two important issues in the outline implementation and the implementation agenda development are communication and participation. To address these issues, a communication plan will be drawn up and a participation process will be organised. Involvement and information on three levels will be used:

1. Informing employees;
2. Involving and correctly positioning E-teams in and in relation to the implementation of the outline and the reduction of user-related energy;
3. Interviewing employees (researchers and specialists) for the expertise they can offer to specific sub-topics.

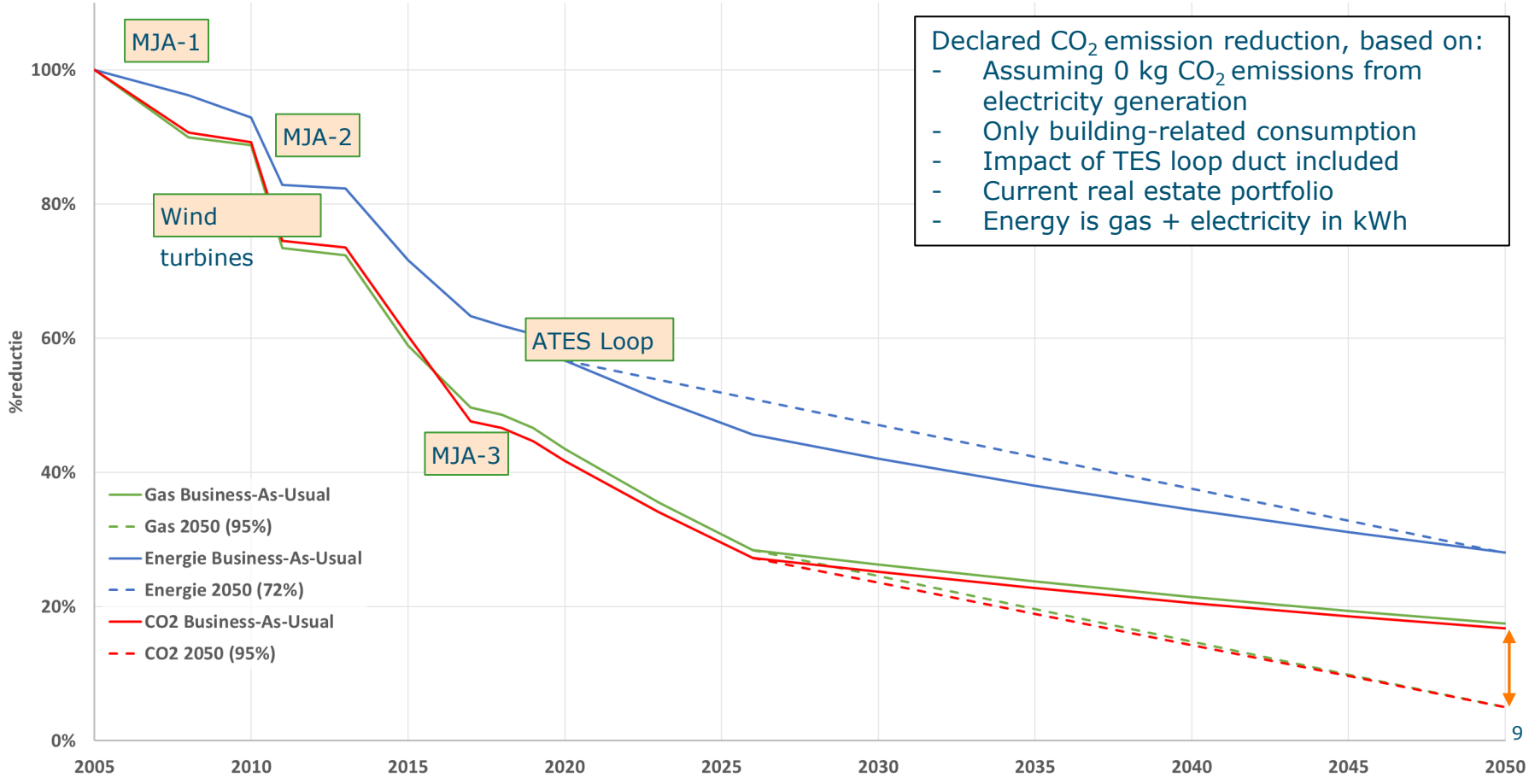
Scope of the energy transition

- Using the energy transition outline, we can keep abreast of the technological and policy developments relating to energy transition, so we can make considered and effective investments at the right time.
- CO_2 reduction will be achieved by **phasing out natural gas**, **reducing** our building-related, user-related and process-related **energy consumption** and further utilising our **sustainable energy generation** as well as **energy storage** potential (using sun, wind, water and soil).
- The scope of this outline is to develop a vision for the transition of WUR's energy system. This means that we will look beyond the buildings and develop and integrated perspective on energy that includes facets like infrastructure, energy generation and storage, collective facilities and electric transport. Operational management and the primary processes also play an important role here. In doing so, we ask the organisation to brainstorm with us, discuss and contribute to reducing WUR's carbon footprint.

Scope of the energy transition

- Given the uncertainties concerning the future energy landscape, this outline remains a work in progress. The further we look ahead, the greater the technical, financial and policy-related uncertainties. To accommodate for changes in these areas and make sure our ambitions remain grounded, we are constantly improving our policies. In principle, we do this every two years.
- We follow the WUR Mobility Vision for matters related to mobility. Where possible, necessary and/or desirable, steps and/or measures are considered and implemented in an integrated way.
- In addition to the energy transition of the building environment, the reduction of emissions from the testing farms (greenhouses, livestock, other agriculture) also plays a major role in achieving climate targets. Although these reductions are not mentioned in this outline, we are investigating where and what types of collaboration with the testing sites is needed to achieve the climate targets.

WUR energy > 2050: Task with current ambition



Legal framework

- The EU has legislated that no more greenhouse gasses can be emitted by 2050.
- The European *Fit for 55* plan aims at a European greenhouse gas reduction of 55% compared to 1990. The implementation of this plan may lead to far-reaching changes in policy.
- The Climate Act stipulates that the Netherlands must have reduced its greenhouse gasses by 49% compared to 1990 by 2030.
- The current energy legislation consists of:
    - Implementing energy-saving measures with a return period of less than 5 years (duty to report and inform on energy efficiency)
    - Carrying out an organisation-wide energy audit (EED Energy Audit)
    - Energy label obligation for offices (Label C in 2023, Label A in 2030)
    - Energy-neutral new construction and, in the future, energy-neutral renovations according to BENG standards
- The Climate Act target for the built environment is to achieve an emission reduction of 3.4 megatons of CO_2 in 2030 compared to 2017. This target is not expected to be met (KEV 2021). The targets also seem difficult to meet in the agriculture and land use sectors.

Directing ambition

- The rough outlines for real estate are in line with the Trias Energetica:
    - WUR natural gas free by 2050 (a CO_2 neutral built environment)
    - Continued focus on sustainable energy generation
    - A total energy reduction of 72% by 2050, compared to 2005*
- Concrete, validated intermediate goals and an implementation agenda follow from this outline every five years.

* European legislation is based on 1990, but we at WUR use 2005 as we do not have reliable data on building-related CO_2 emissions before then.

Intermediary goals 2025 and 2030

	Savings targets in % reduction compared to 2005		Generation*
Year	Energy (MWh total)	Greenhouse gas emissions (tons of CO_2)	MWh
2020	43%	40%	1,900
2025	48%	68%**	5,000
2030	55%	75%	10,000

* Solar panels on roofs, above car parks and solar parks
** Within reach rates through construction of ATES loop.

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Trias energetica plus

In making WUR real estate sustainable, we follow the Trias Energetica according to the steps described below, as previously described in the EED energy audit.

In doing so, we pay particular attention to sustainability, security of supply and affordability.

~~6~~5-step plan from the EED energy audit:

1. Reducing building-related (technology) and user-related (behaviour) energy use
2. Maximise solar panels on roofs, geothermal energy and heat pumps
3. Flexibility in electricity supply and demand
4. Heat transition vision[1] (Wageningen, but also opportunities for Bleiswijk and Goutum)
5. WUR wind turbines and solar park
6. N/A for WUR

[1]Heat transition Vision (Transitie visie warmte) is a dutch policy instrument description the stragety of a residential area to become carbon neutral

Security of supply and **Affordability**

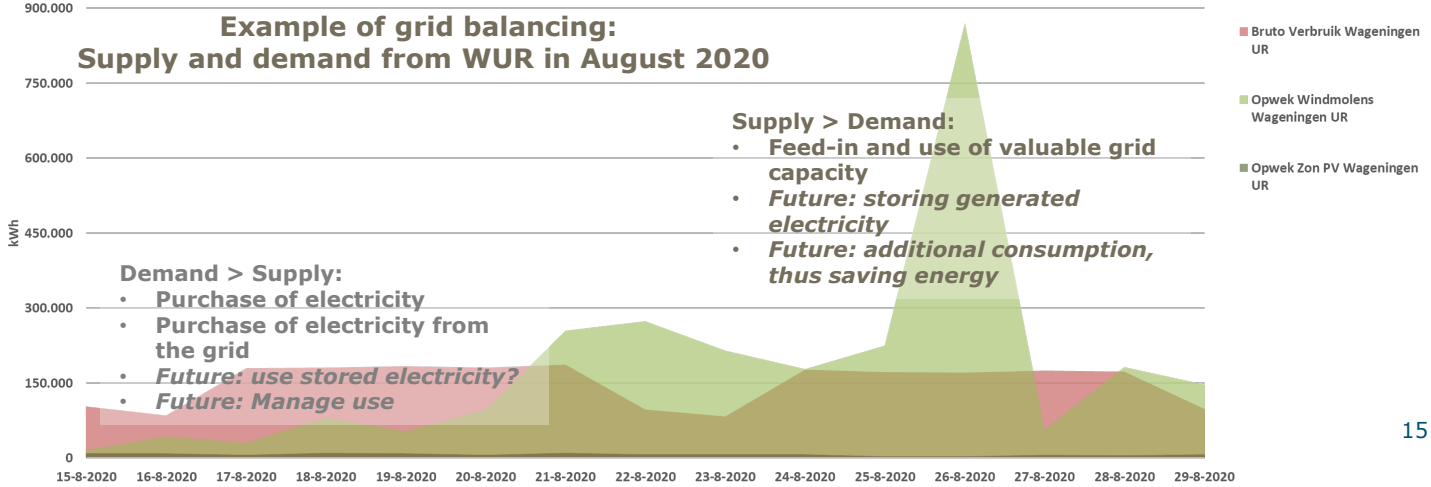
- The transition to a sustainable energy system requires us to thoroughly rebuild the existing system (gas and electricity).
- This leads to a number of things, including:
    - Grid congestion problems* as a result of which e.g. renewable generation facilities (solar and wind) cannot be connected to the grid.
    - Reduced affordability and security of the gas supply and an increase in the price of electricity.
- The pace and direction of solutions for these issues lie with national politics and EU-wide developments.
- As WUR, we have little influence on national developments, but we can do the following: *'behind-the-meter' generation and electricity storage, grid balancing and reducing our use of gas.*

(See next slide)

* In the event of grid congestion, the total supply of electricity from renewable and traditional sources exceeds the grid's capacity

Security of supply and **Affordability**

- *'Behind the meter' generation & energy storage:* In order to be as independent as possible and to guarantee the security and affordability of supply, we will have to generate as much of our own energy as possible at each WUR location. In order to match local supply and demand, and to keep the grid load manageable, energy storage will also be necessary.
- *Grid balancing:* In the event of excessive demand and/or high energy prices: do not switch large installations (e.g. freezers, heat pumps) on at the same time or run them at full capacity. In the event of oversupply and/or low energy prices: run large installations more in order to store energy. This will save costs with the expected flexible contracts.
- *Reducing our use of gas:* If we stop using gas, WUR will be independent of developments in the gas market: we will save costs and our CO_2 emissions will fall dramatically.



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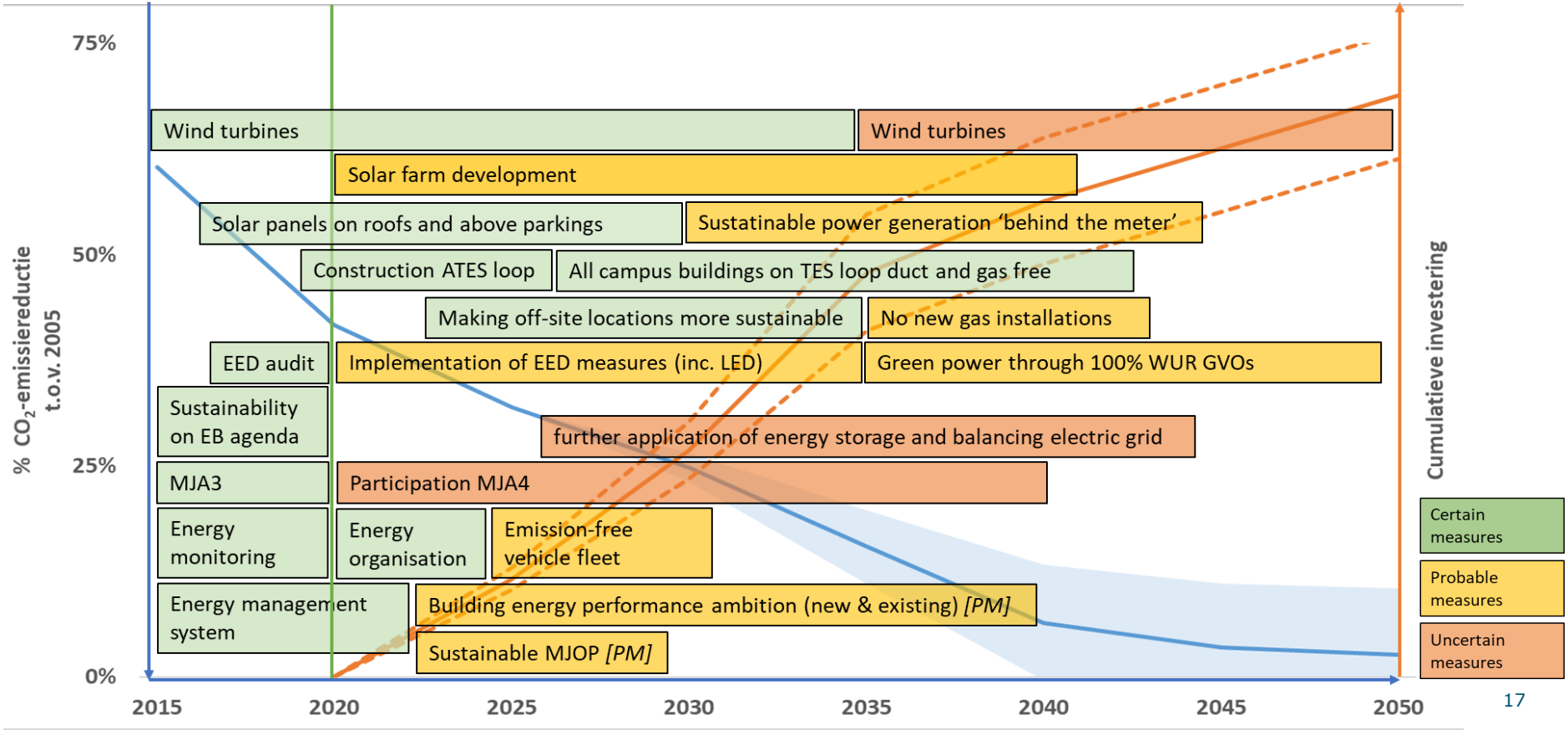
Structure of the outline energy transition

- The outline for the energy transition consists of an integrated set of measures that will collectively lead to the set goals over time.
- The measures are categorised along two axes:
    1. Security. The feasibility of measures can be certain, probable or uncertain.
    2. Trias energetica. A single measure contributes to one of the five previously mentioned steps, which are subdivided into: development of energy demand (step 1), sustainable energy generation (steps 2 and 5) and infrastructure (3 and 4). There is also a fourth category that has organisational aspects.
- While the ‘development of energy demand’ and ‘sustainable energy generation’ measures mainly concern sustainability, the infrastructure measures contribute to the affordability and security of supply.
- A cost indication with an uncertainty band is given where possible.

Rough Outline WUR Energy Transition 2050



Categorisation of measures

Category	Measure/ambition
1. Development of energy demand (step 1)	MJA3; MJA4; no new gas installations; energy monitoring; off-site locations; LED lighting everywhere; carry out EED energy audit measures;
2. Sustainable energy generation (steps 2 and 5)	Green power via WUR Guarantee of Origin (GvO) certificates; solar panels on roof; sustainable 'behind the meter' generation; development of solar parks; wind turbines;
3. Energy infrastructure (steps 3 and 4)	Construction of ATES loop; further implementation of energy storage; balancing electric grid; emission-free vehicle fleet
4. Organisational aspects	Sustainability on the Executive Board's agenda; EED energy audit; energy organisation; energy management system

Measures with the greatest impact

CO_2 emission reduction	CO_2 emissions [ton]	Energy reduction* [MWh]	Total energy* [MWh]
Level 2020	9,987		101,274
1. Making off-site locations more sustainable**	3,294	1. Making off-site locations more sustainable	10,247
2. EED Measures	1,279	2. EED Measures	8,670
3. Campus 95% gas free	1,248	3. Potential for solar panels on roofs	7,400

Not included:

- ✓ ATES loop step 1 (75% gas reduction compared to 2019; 8,234 MWh and 2,337 tons of CO_2); financed and under implementation.
- ✓ Energy management (5,000 MWh); approximate and difficult to measure.
- ✓ Solar park ambitions (6,000 MWh); ambition, potential not mapped

* Total energy is the combined energy content of electricity and gas in MWh.

** See relevant slide for substantiation number

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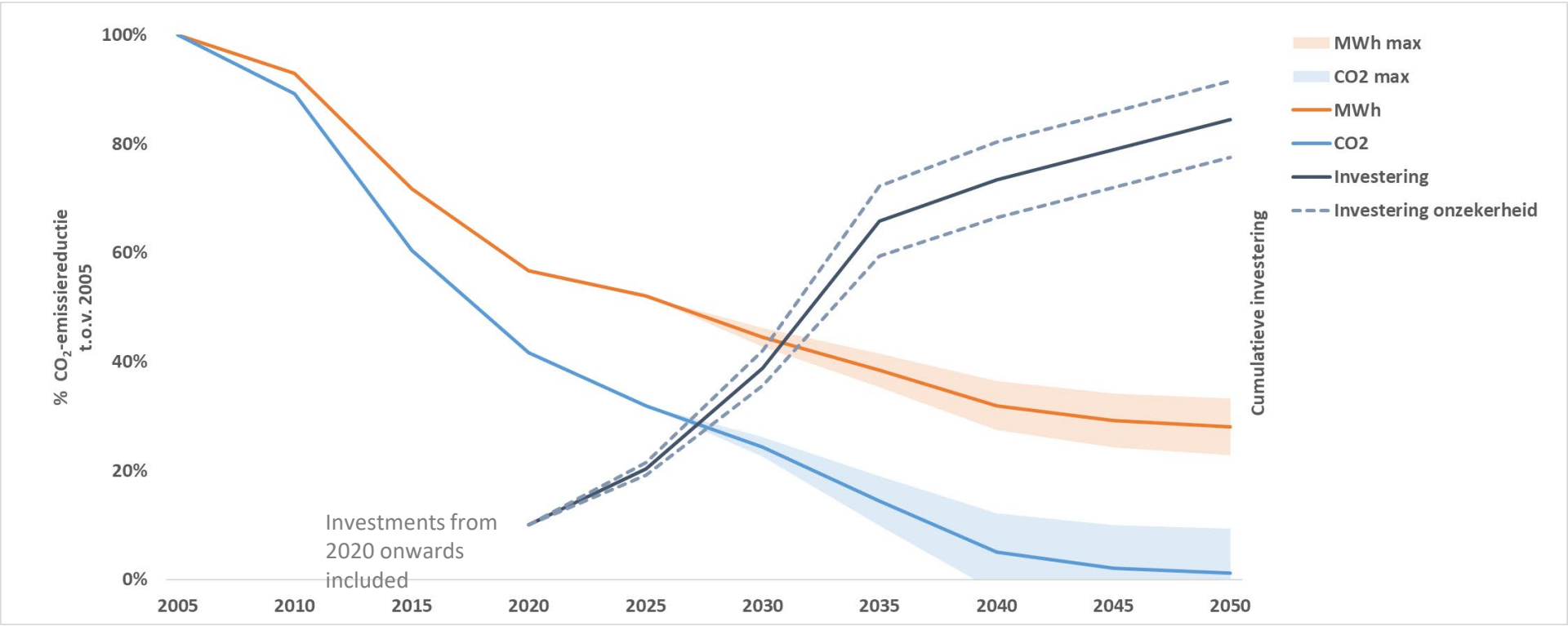
Rough outline Energy and CO_2 Reduction versus Investment



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Financial savings

- Developments in the energy market are currently difficult to predict. The price of gas, for example, has skyrocketed in recent months after years of being very low. Since our power generation still depends on gas prices, the price of electricity has also risen. With today's high prices, the savings become considerable quickly.

Tarieven grootverbruikers stijgen komend jaar 9 tot 15 procent door verzwaren hoogspanningsnet

>>> *Verdere stijging verwacht in komende jaren*

- A 1% gas reduction compared to 2005 (or approx 130,000 m^3) with the current gas prices would easily represent savings of between €120,000 and €150,000.

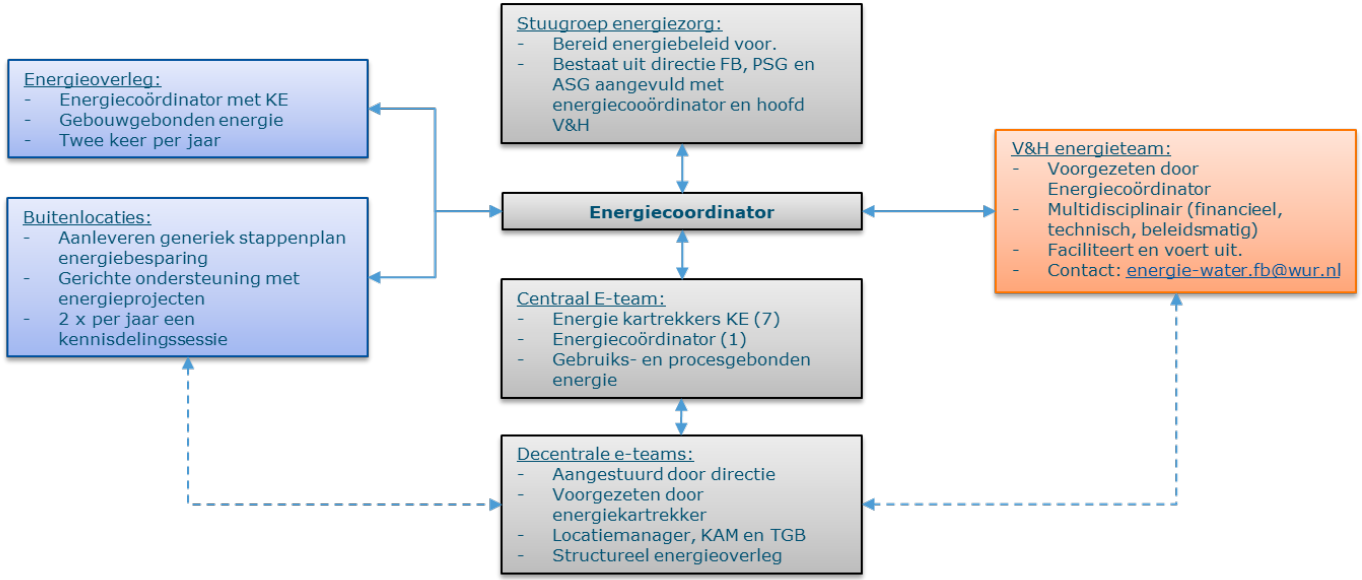
- Electricity is more complex. Price volatility will increase in the coming years, and this will also be reflected in contracts. More importantly, we will need greater capacity in the future. This capacity is very expensive and takes years to realise. Consequently, reducing electricity consumption while simultaneously balancing supply and demand results in cost savings too.

We save energy together: the energy organisation

- The energy organisation develops, implements and executes energy policies. The aim of the energy organisation is to work on saving user-related, building-related and process-related energy. The organisation is such that both bottom-up and top-down initiatives are possible. The energy organisation includes the following key roles:

- *Decentralised E-team*
  - Collaborates on the implementation of central policies.
  - Shares information on current projects, initiatives and plans.
- *Centralised E-team*
  - Initiates policy and tackles joint central themes.
  - Exchanges knowledge and ensures the coherence of plans.
- *Director of Operations*
  - Steers policies for energy and CO_2 savings.
- *Energy coordinator*
  - Represents central policy and ensures its translation to the science groups.
  - Provides insight into energy use and can advise on potential issues.

Energy organisation



Doel en scope centraal E-team overleg:
- Elkaar informeren en delen van kennis en ervaring
- Integraliteit en samenhang borgen
- Prioriteren en gezamenlijk beleid voorbereiden
- Gezamenlijke thema's en projecten oppakken en initiëren
- Alle WUR locaties inc. buitenlocaties
- In eerste instantie gericht op gebruiks- en procesgebonden energie

V&H 'energie' faciliteert:
- Opleiding energiekartrekkers KE's
- Bruikbare energiedata en analyses met terugkoppelmechanisme
- Doorbelasting en facturering energie
- … en veel meer b.v. beheer en optimalisatie wko-ring, advies energieprojecten, inkoop energie, verslagen en rapportages, onderhoud, etc.

Making off-site locations more sustainable

- **The ambition for realised energy savings in 2035 is 10,000 MWh compared to 2020.**
- **The ambition is a 90% reduction in CO_2 emissions in 2035 compared to 2005. This will lead to a reduction of 3,294 tons of CO_2 emissions compared to 2020 (4,445 tons of CO_2).**
- The savings potential of the EED Energy Audit has been assigned to the relevant measure. This is 341 tons of CO_2 emissions and 1,644 MWh. This excludes solar PV and heat networks.
- Focus on a general and simple energy reduction plan per site with support from Facilities and Services (Real Estate).
- Extra attention for large consumers, WBVR (31% CO_2 emissions) and Bleiswijk (9% CO_2 emissions).

Locatie	m3 G	MWh E	MWh T	ton CO2	% CO2	% kWH T
Wageningen	3.102.476	38.499	41.227	5.510	55%	72%
WBVR	1.717.082	6.529	8.038	3.076	31%	14%
Bleiswijk	475.723	3.454	3.872	852	9%	7%
Nergena	133.365	820	937	239	2%	2%
IJmuiden	87.460	502	579	157	2%	1%
Goutum	18.256	693	709	33	0%	1%
Overig	94.553	1.596	1.816	89	1%	3%
Totaal	**5.628.915**	**52.094**	**57.178**	**9.955**	**100%**	**100%**

2020 numbers = without ATES loop

Sustainability Action Plan - headlines

1. Make an inventory of the current situation of the building and its usage, using a simple form.
2. Based on the results, identify one of three scenarios with measures for making the site natural gas free and reducing the energy consumption as much as possible. The three scenarios:
    1. Quick wins
    2. Natural gas free (all electric)
    3. Natural gas free and maximal energy savings
3. Inclusion of promising subsidies and financing opportunities into the realisation of the scenario.

Ambition for external locations:

- Maximal energy savings (10,000 MWh by 2035)
- As natural gas free as possible (90% reduction by 2035)
- As much sustainable energy as possible

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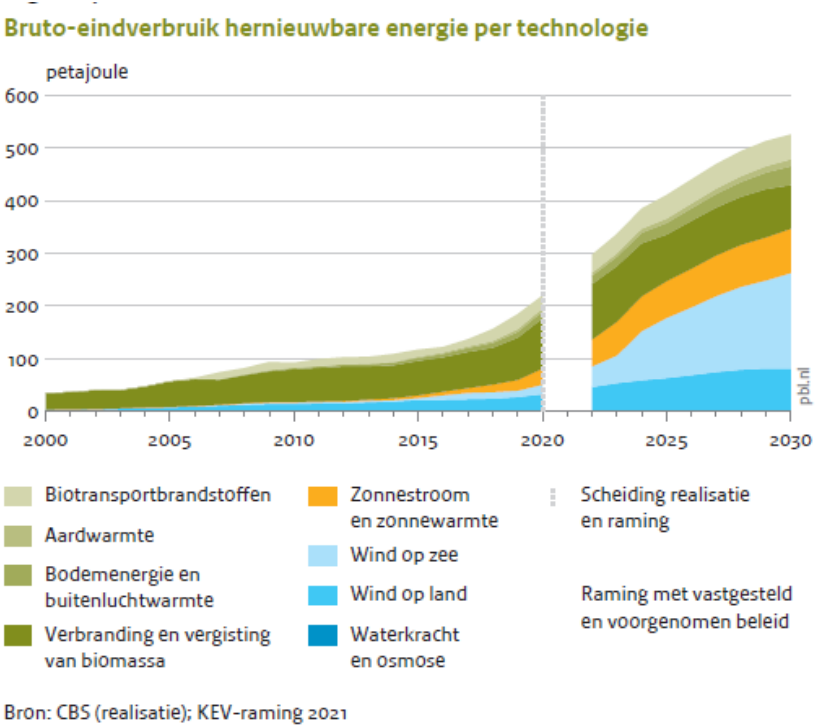
Solar parks and onshore wind

- In the energy transition, societal resistance to different renewable energy sources arises for a variety of reasons. Think, for example, of the occasionally heated debates surrounding woody biomass, onshore solar parks, onshore wind and geothermal energy.
- It is also clear that all forms of renewable energy should contribute towards achieving climate targets. Both solar energy and wind energy play an important role in this.
- Some energy generations are temporary (10-15 years) to meet short-term objectives; others are more permanent.
- In order to realise its ambitions in the transition, WUR will focus on both solar and wind energy. We carefully consider whether sustainability gains outweigh social impact in every project.



Ambition: Maximising solar PV

- Potential for solar panels on roofs:
  - Current yield (2020): 1,900 MWh/year.
  - Potential (technical) yield: 10,800 MWh/year, of which 4,800 MWh/year on Wageningen campus and 6,000 MWh/year on external locations.
- Potential for solar on car parks Wageningen Campus (p1 tm p4) is 2,600 MWh/year.
- WUR electricity consumption in 2020 53,000 MWh.
- The next step is to determine the actual potential.

Nieuwe studie: 85 procent grote daken na kleine aanpassing geschikt voor zonnepanelen

>>> *Potentieel van 1,1 terawattuur tot 2030*

85 procent van de grote daken in Nederland is na een kleine aanpassing geschikt voor zonnepanelen. Dat blijkt uit een nieuwe studie van de TKI Urban Energy naar constructieve beperkingen voor zonnepanelen op daken. Vooral agrarische gebouwen en oude panden zijn volgens de onderzoekers kansrijk. Het