

The Dutch Energy Transition

Use all low carbon sources to meet
ambitious goals

Ad Louter

Managing Director
Urenco Nederland

Chairman
Nuclear Netherlands

Why do we need nuclear energy?



IPCC conclusions



United Nations Intergovernmental Panel on Climate Change 2021 report:

- Relation between CO₂ and temperature rise, caused by human kind
- Temperature rise of 1.5°C is manageable; above 2°C is irreversible
- Faster fossil fuel phase-out; 2050 is too late

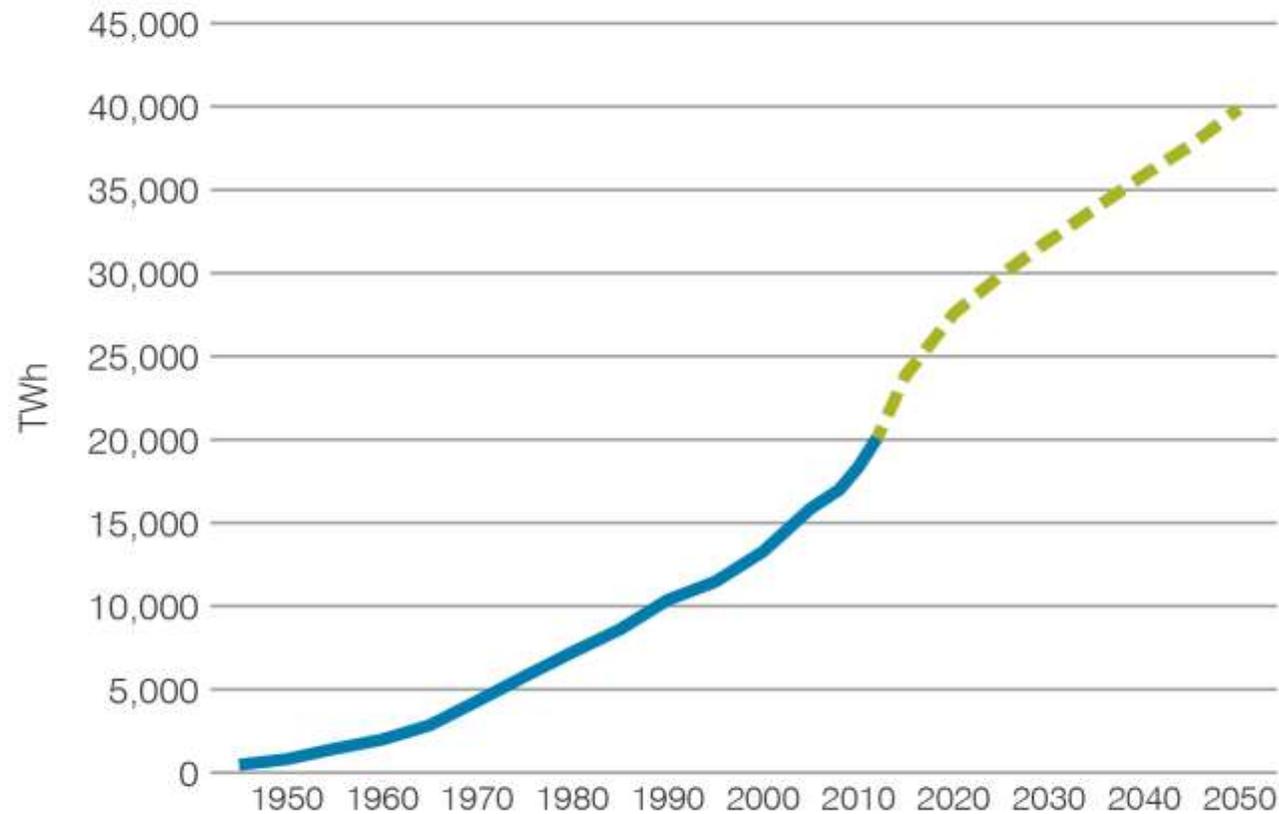
Probably, we are the first generation to notice and the last generation able to make a change (Barack Obama)

Global energy demand is increasing and electrification is growing even faster

Phasing out fossil fuels

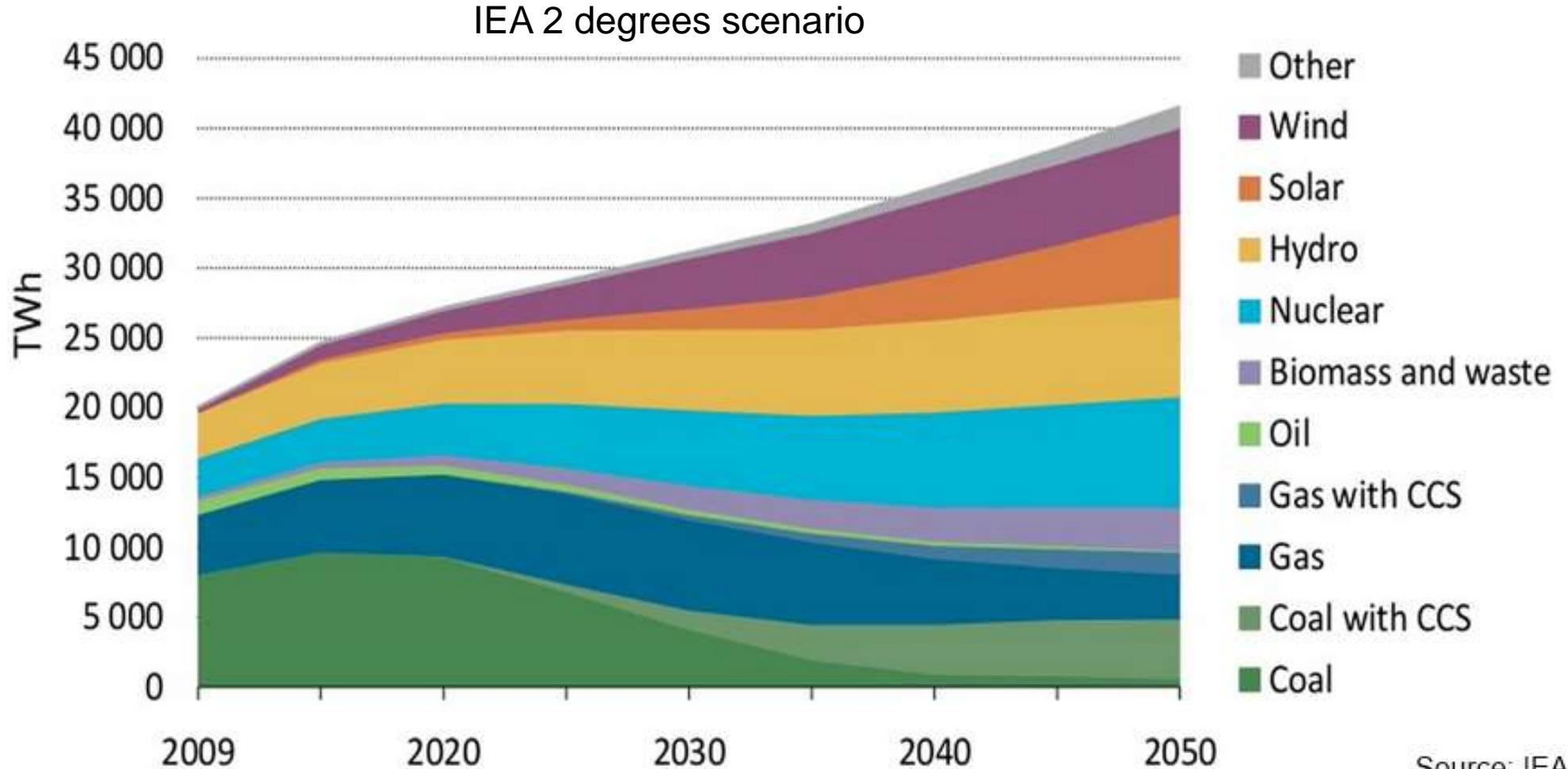
WORLD NUCLEAR
ASSOCIATION

Electricity Consumption Growth in a Low Carbon Scenario



Source: 1945-1979, IEA databases and analysis
1980-2012, Energy Information Administration
2013-2050, IEA Energy Technology Perspectives 2016

All low carbon sources are needed



Source: IEA

The Dutch Energy Transition



2013 national **Energy Agreement:**

- 14% renewable energy by 2020 and 16% by 2023
- 100 PJ energy saving by 2020

2018 national **Climate Agreement:**

- 49% CO2 reduction by 2030 and 95% reduction by 2050
- Target: 70% renewable energy by 2030 (in reality 11,1% renewables end 2020)

2019 ngo 'Urgenda' lawsuit verdict:

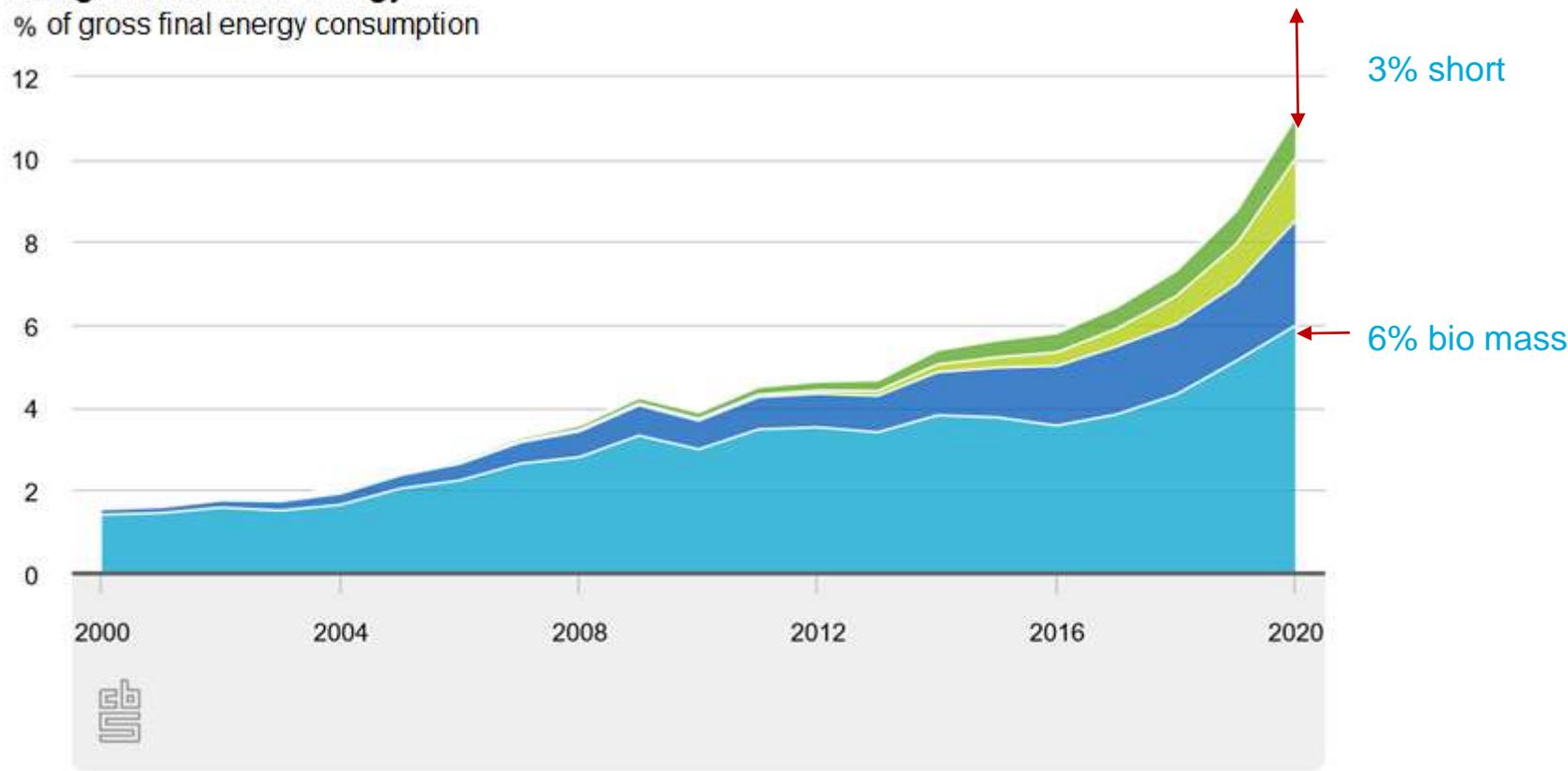
- 25% CO2 reduction by 2020

2021 acceleration is necessary:

- EU Fit for 55
- IPCC: zero carbon by 2040

Renewable energy in the Netherlands

Usage renewable energy
% of gross final energy consumption



■ Bio mass ■ Wind energy ■ Solar energy ■ Other sources

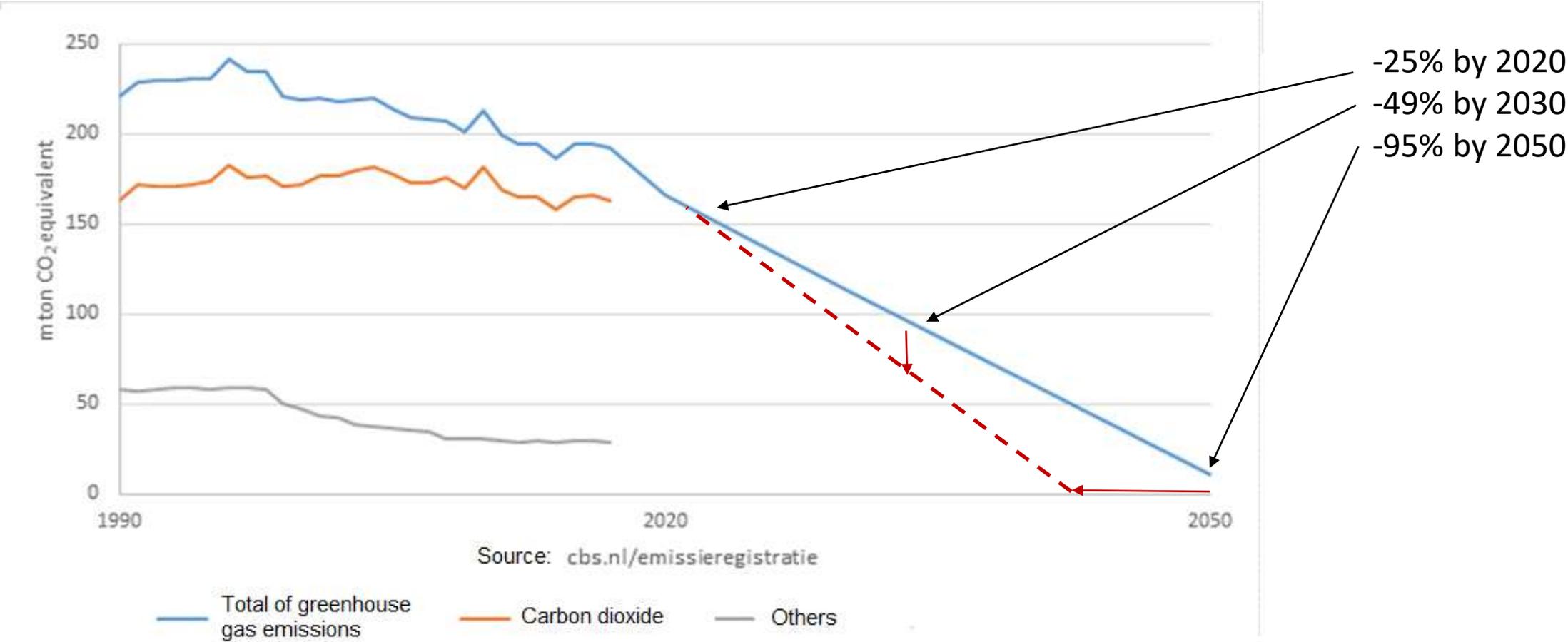
Climate Agreement: over 100 stakeholders at the table

Mission: Reduce CO₂-emissions in the Netherlands

- 49% reduction by 2030 (in relation to 1990)
- 95% reduction by 2050



Emissions in the Netherlands



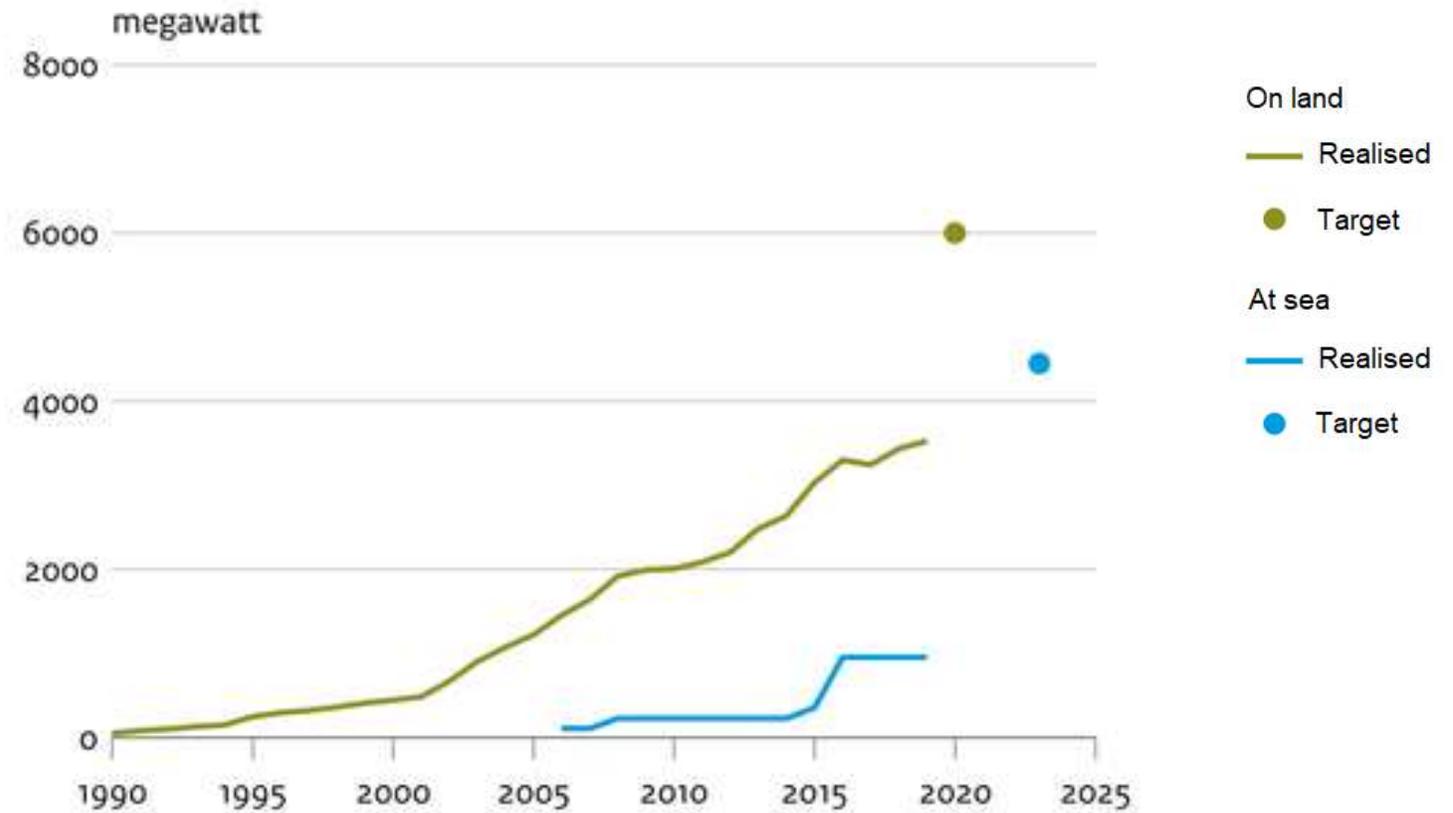
Energy transition just with **solar and wind**?

Wind and solar power are intermittent and unpredictable. Large-scale energy buffering is complex and expensive. Nuclear can provide a reliable and dispatchable carbon free source.

Wind energy in the Netherlands

Generated capacity
is about 1/3 of
installed capacity

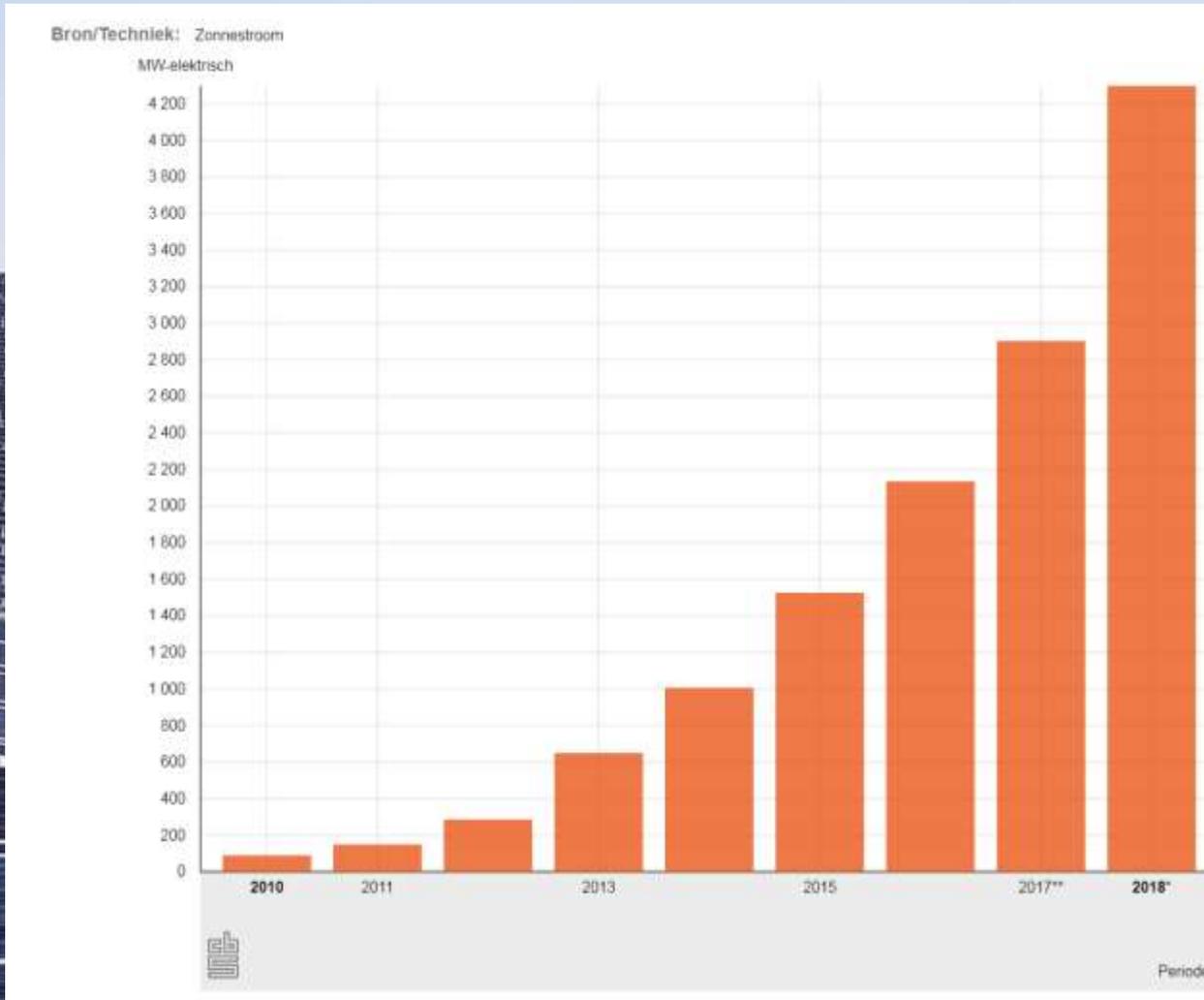
Wind power on land and at sea



Source: CBS

Solar energy in the Netherlands

Generated capacity
is about 1/10 of
installed capacity

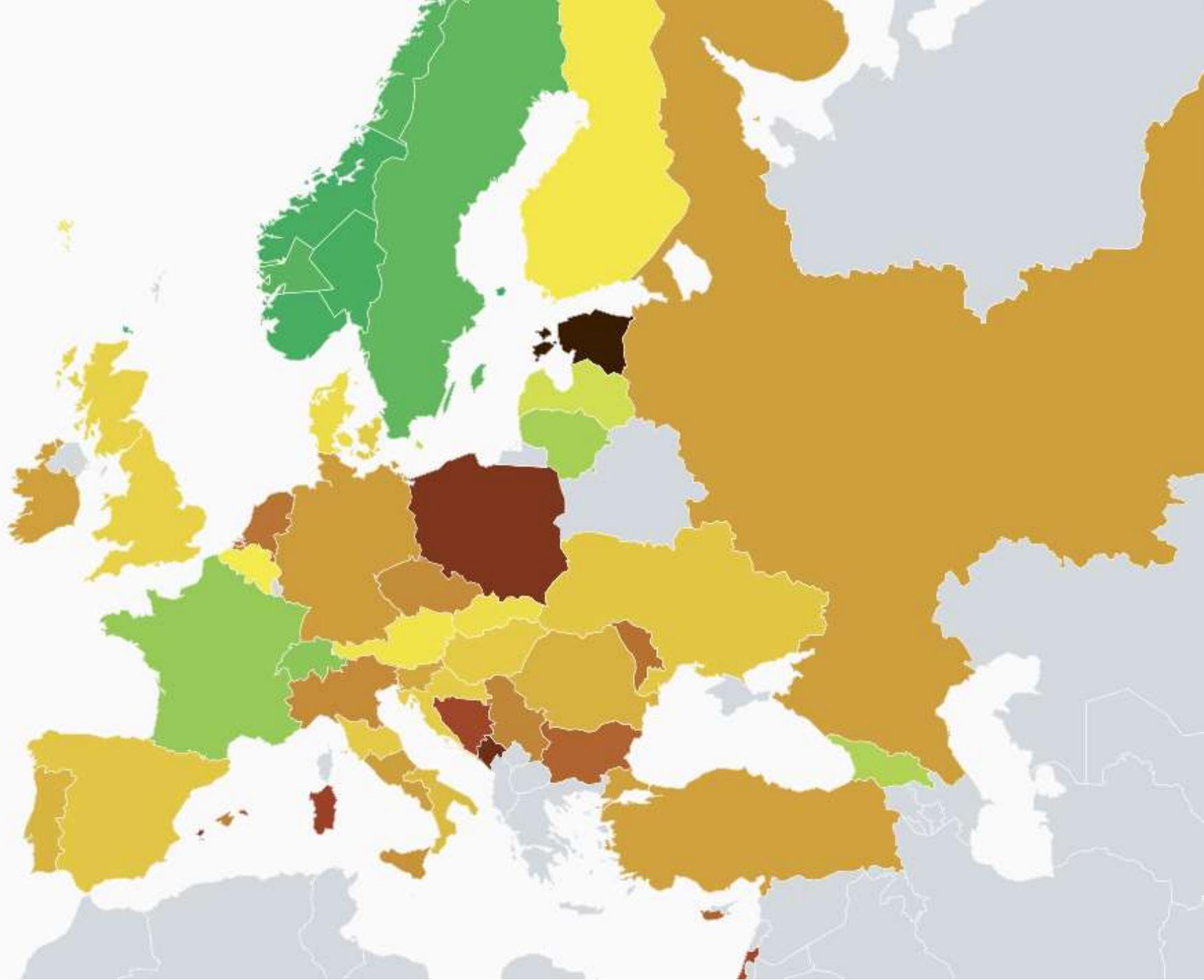




**Download the app
electricityMap.org**

A live visualisation of
where your electricity
comes from and how much
CO2 was emitted to
produce it.

Export of CO2 emissions
does not solve the problem



Hydrogen is the solution for 'difficult to decarbonise' sectors



- Use of hydrogen as a clean energy carrier and as a feedstock for other synthetic fuels such as ammonia.
- Promising for industry with high temperature heat requirement, for heavy and long range road transport, for shipping and aviation
- This would be a complement to all those renewables being deployed, not an alternative.
- Current projections for renewable-generated hydrogen estimate prices of \$3-4/kg by 2030, and \$2-3 by 2050. Price reductions are constrained by low capacity factors
- By contrast, conventional nuclear can deliver clean hydrogen for as low as \$2/kg today and less than \$1/kg using advanced reactors in 2030

How to Decarbonise with a Mix of Renewables and Nuclear

Decarbonising hydrogen in a net zero economy

Executive summary

August 2021

Aurora Energy Research was commissioned by Urenco to investigate the benefits of the deployment of both RES and nuclear to support decarbonisation and reduce reliance on fossil fuels as a transitional fuel source **in Great Britain.**



Authored by:



Commissioned by:



Additional inputs from:



1. Renewables + nuclear ensures a rapid decarbonisation & reduced reliance on fossil fuels
2. Achieving Hydrogen volumes required for net-zero is challenging without support of RES and nuclear
3. Nuclear along high RES is economically efficient (6-9% lower spend from 2021-2050)
4. Nuclear can provide cost competitive and scalable source of zero carbon electricity and Hydrogen
5. Careful market design and policy support structures required for net-zero
6. Broader potential benefits of technology mixes for e.g. shipping and aviation.

Recap: Potential for nuclear in the Netherlands



- Reliable, dispatchable energy source
- Efficient with small land use impact
- Versatile and high quality nuclear supply chain, incl.
 - best in class waste disposal organisation
 - R&D into new types of nuclear (GEN IV)
- Aim for 25% nuclear and eventually 75% renewables in electricity mix
- Excellent combination with renewables and hydrogen (electricity and heat)
 - Solution for difficult to decarbonize sectors
- Quick wins by:
 - Expanding current NPP's lifetime
 - Two additional NPPs in Borssele (PIMBY)

What do we need to expand nuclear?



- Licensing body equipped and ready
- Clarity on funding/investment rules
- Clarity on CO2 reduction progress and targets:
EU calls for 55% reduction in 2030 and IEA/IPCC report that zero-carbon should be achieved by 2040 instead of 2050

From 2030 onwards, reductions will be much more difficult to achieve

- Electricity generation must completely decarbonise, demand will double and grid reliability must remain high
- Hydrogen demand from industry and transport sector

Political climate on nuclear

Dutch Parliament has approved several resolutions on nuclear



- 23 september 2021: Request the government to explore the realisation of a **new Gen III+ NPP within 10 years**
- 10 juni 2021: Request the government to team up in EU with France and other like minded countries **to include nuclear in the EU taxonomy**
- 4 maart 2021: **Location Eemshaven** in the province Groningen **should be discarded** for new built NPP's
- 17 september 2020: Request the government to do a **market consultation** to determine what conditions have to be met for investors in NPP's and which governmental support is needed
 - This resolution has resulted in the **KPMG report**.
- 10 juni 2020: Request the government to **adjust the law** in order **to enable LTO for NPP Borssele**
- 26 juni 2019: Request the government to determine the **potential role of nuclear in the future energy mix** and to provide information on cost of new NPP's in other countries and necessary other conditions for new built
 - This resolution has resulted in the **ENCO report**
- 15 november 2018: Resolution was rejected to exclude nuclear energy from public funding

EU Taxonomy: Brussels 'Planning to Delay' long-awaited decision on nuclear



How to classify nuclear energy and natural gas under the EU's sustainable finance taxonomy

- Regulations that govern investment in environmental friendly activities in the EU
- To help meet climate and energy targets for 2030 and meet the objectives of the European Green Deal
- Is key for more public and private funding so that the EU can become carbon neutral by 2050 and to prevent greenwashing
- Europe needs around €260bn/year extra investment to achieve initial climate and energy targets 2030.

EU Taxonomy

It started technical (Do-No-Significant-Harm)...



- **JRC** report April '21: nuclear qualifies as sustainable and does no more harm to human health or to the environment than other electricity production sources already included in the taxonomy.
- Two more expert groups – **Euratom Article 31**¹⁾ and **Scheer**²⁾ – to review JRC report
 - **Article 31 group** confirmed JRC's overall findings on the protection of humans against radiation, deep geological repositories to handle fuel waste, and nuclear's compliance with various regulatory frameworks established by the EU.
 - The **Scheer** committee found JRC report to be “comprehensive” for nuclear's non-radiological impact. However, “there are several findings where the report is incomplete and requires to be enhanced with further evidence.”

1) expert group on radiation protection and 2) the scientific committee on health, environmental and emerging risks

EU Taxonomy

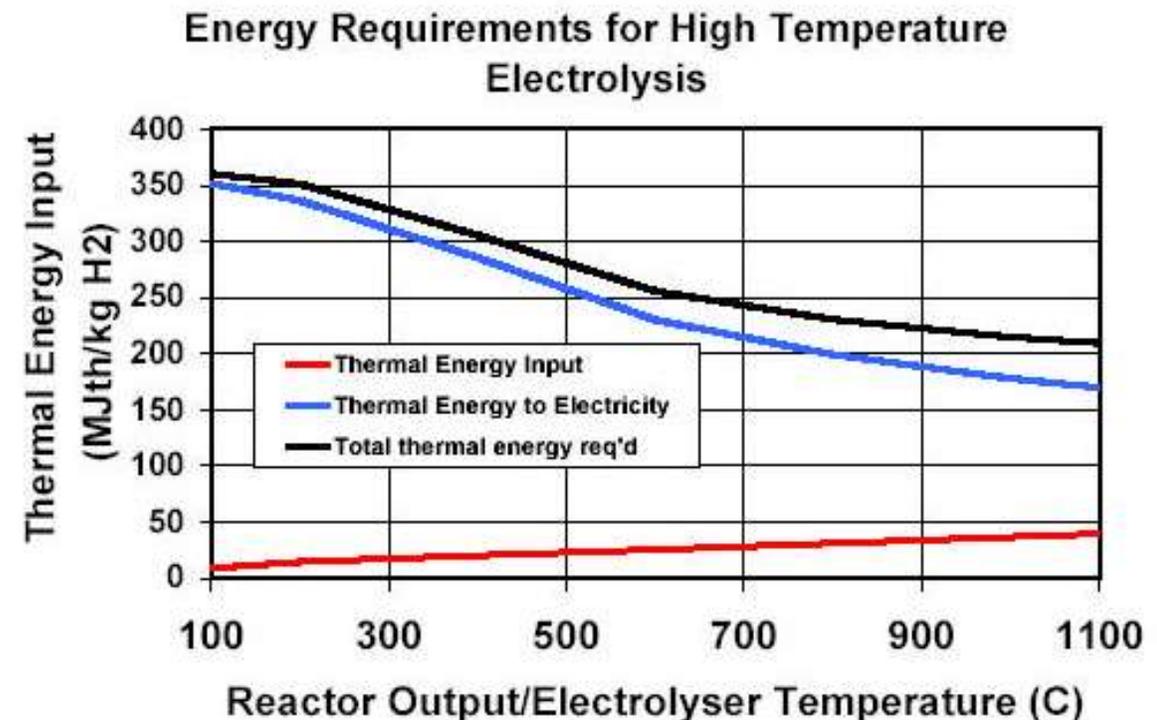
...but has now become political



- Ten EU countries, including France, spoke out in support of nuclear power
 - France announced plan for 6 EPRs to be commissioned before 2035 and major investment in development of Gen IV reactors
- Germany is leading countries opposing nuclear, but needs natural gas to be included in the Taxonomy
 - Germany's new coalition wants to close coal and lignite fueled power plants already by 2030 (was: 2038)
- In the backdrop of soaring energy prices and growing awareness of geopolitical dependencies

High Temperature Electrolysis

- HTE is ideally suited for use with advanced nuclear reactor system
- A portion of the heat from the reactor is used to create steam, while high efficiency electrical conversion cycles take max. advantage of the high- temperature reactor heat source.
- Combination of high-temperature reactor and high-temperature electrolysis will achieve a thermal conversion efficiency of 40 to 50% while avoiding the challenging chemistry and corrosion issues associated with other hydrogen production processes.



Conclusions



- All low carbon sources are needed
 - Create a level playing field
 - Export of CO2 emissions is not the right thing to do
 - Renewables and nuclear for power and hydrogen necessary for rapid decarbonisation and reduced reliance on fossil fuels
- EU taxonomy should include nuclear

"Let's avoid demonising thinking, where anyone who dares question the cost or direction of the energy transition is suspect and anyone who advocates 'green' has the moral right on their side." (Louise Fresco)

**Thank you for
your attention**