

# ENERGY TRANSITION POLICIES

in the Netherlands | Dr. R.W. van den Brink

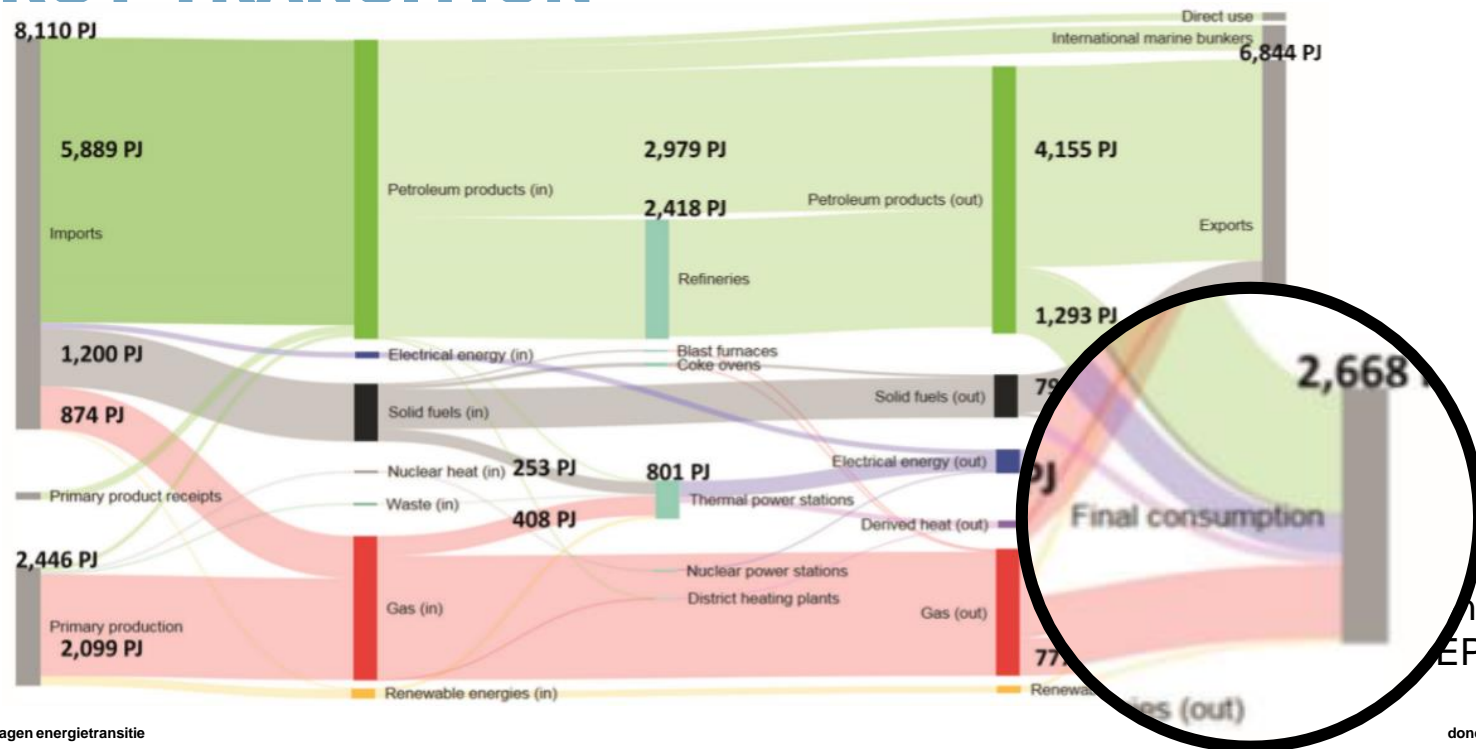
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- › Netherlands energy system
- › Dutch climate agreement
- › Electricity market modeling of flexibility measures
- › Policy needs



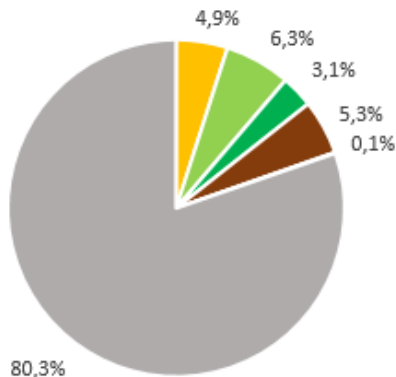
# DE DUTCH ENERGY SYSTEM JUST BEFORE THE ENERGY TRANSITION





# THE NETHERLANDS ARE LAGGING BEHIND...

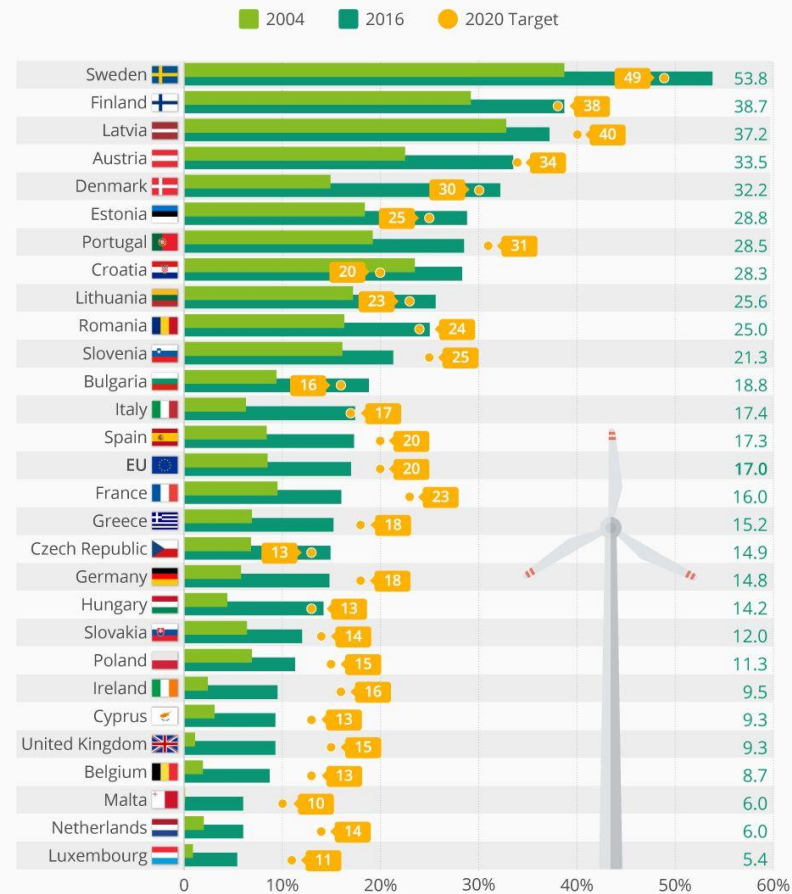
In september 2019 was 20,3% van alle elektriciteit hernieuwbaar



Bron: Energieopwek.nl

## Who's Winning Europe's Renewable Energy Race?

Share of energy from renewable sources and 2020 target\* (in %)



# NETHERLANDS: CLIMATE AGREEMENT

- › Goal: 49% CO<sub>2</sub> reduction in 2030
- › Climate law: 95% CO<sub>2</sub> reduction in 2050
- › Electricity:
  - › Offshore wind: 49 TWh (11,5 GW) in 2030
  - › Public TSO builds offshore electricity transportation infrastructure
  - › Feed in tariff (SDE+ subsidy) until 2025

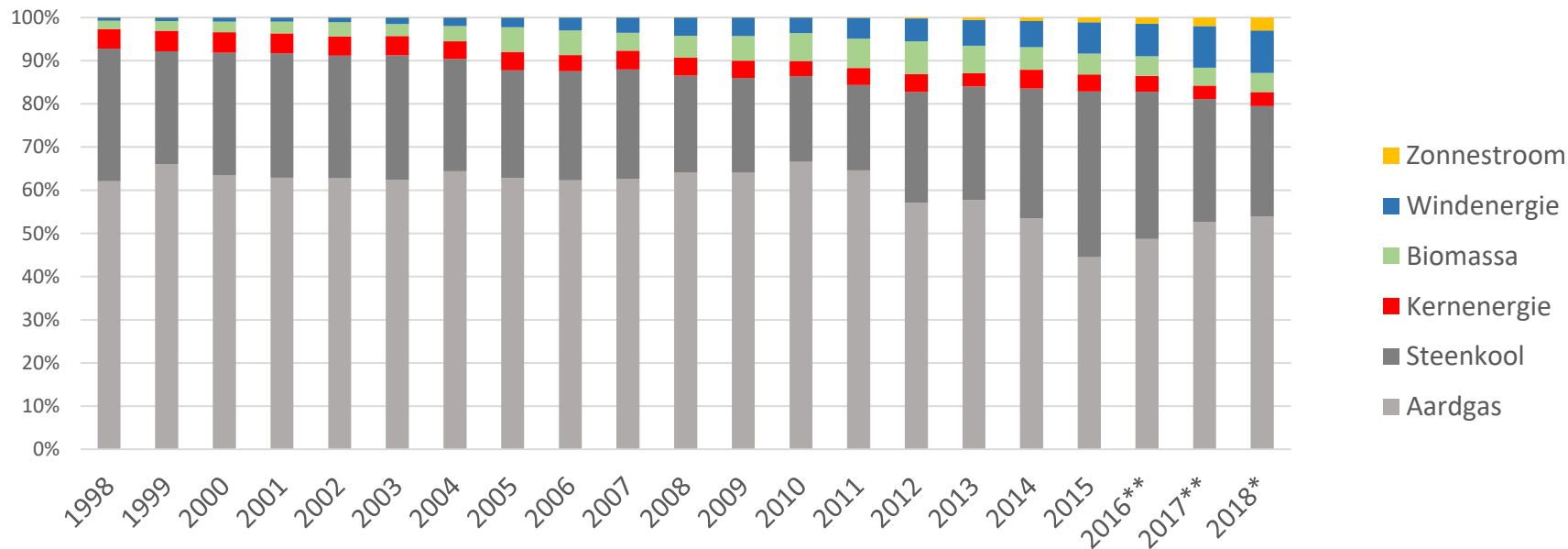


# NETHERLANDS: CLIMATE AGREEMENT (2)

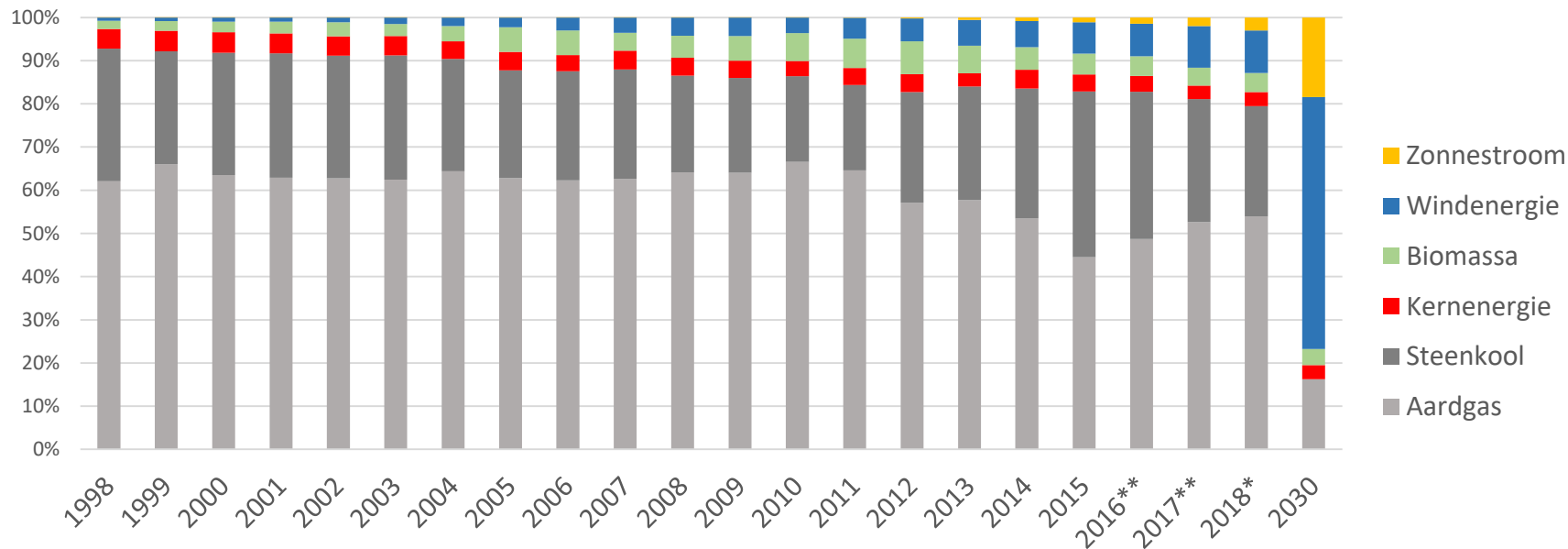
- › Onshore Solar + Wind: 35 TWh
  - › Feed in tariff until 2025
  - › Regional Energy Strategies
  - › Citizen participation
  
- › Net capacity to connect solar farms and wind turbines is an issue
  
- › Flexibility becomes important after 2030
  - › 17 – 24 TWh capacity needed (on a total of 125 TWh electricity production)
  - › ‘Technology neutral’ policy instruments are under investigation



# POWER PRODUCTION IN THE NETHERLANDS

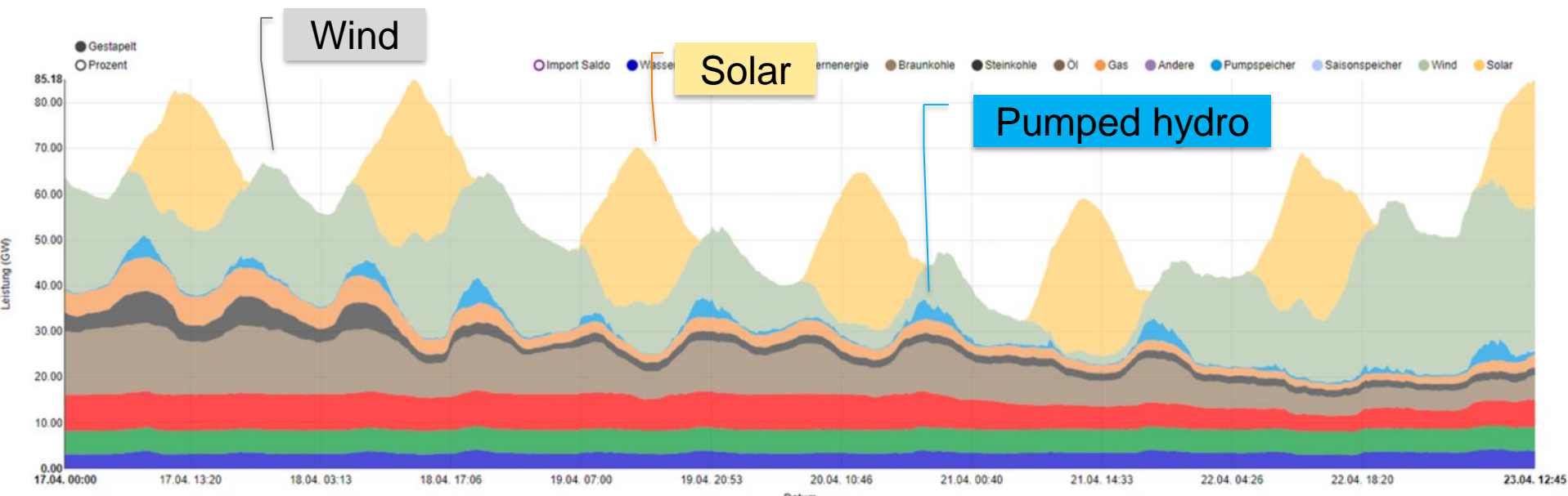


# POWER PRODUCTION IN THE NETHERLANDS



# FLEXIBILITY

# GERMANY AT EASTERN 2019



# GERMANY AT EASTERN 2019

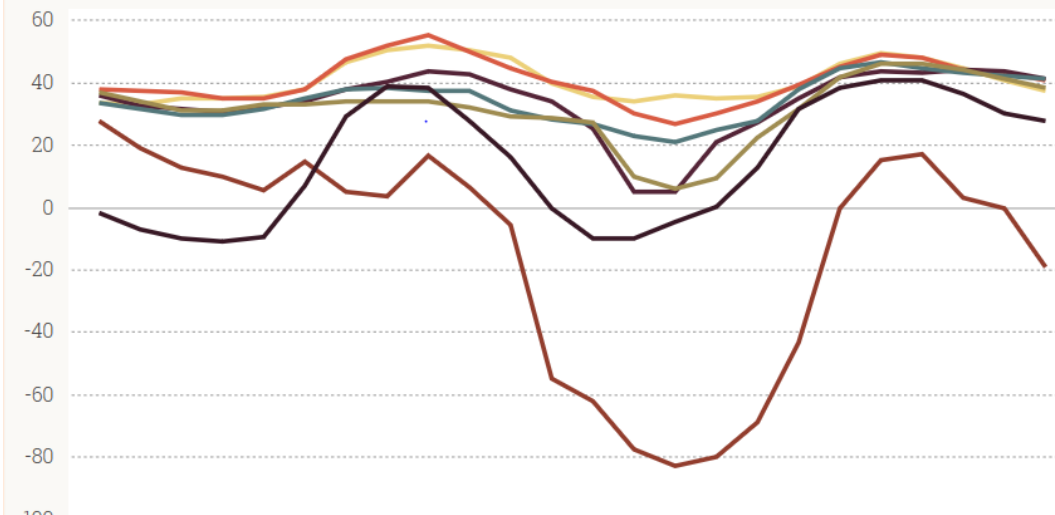
- › 40% renewable electricity production
- › 22 april 2019: high production, low demand

## Elektriciteitsprijs op Duitse spotmarkt

Dagvoortuitprijs per uur

17 april 18 april 19 april 20 april 21 april 22 april 23 april

€ per MWh



# THE NEED FOR FLEXIBILITY

- › **Variability** of power generation from solar and wind;
- › **Uncertainty** of solar and wind output generation;
- › **New demand profiles:** EV's, heating of built environment, electrification of industry
- › **Congestion** (*overloading*) of the power grid



# FLEXIBILITY SUPPLY OPTIONS

- › Flexible power generation (coal, gas, hydrogen)
  - › Solar and wind curtailment
  - › Demand response
  - › Energy (electricity) storage
  - › Cross-border power trade
- } Conversion

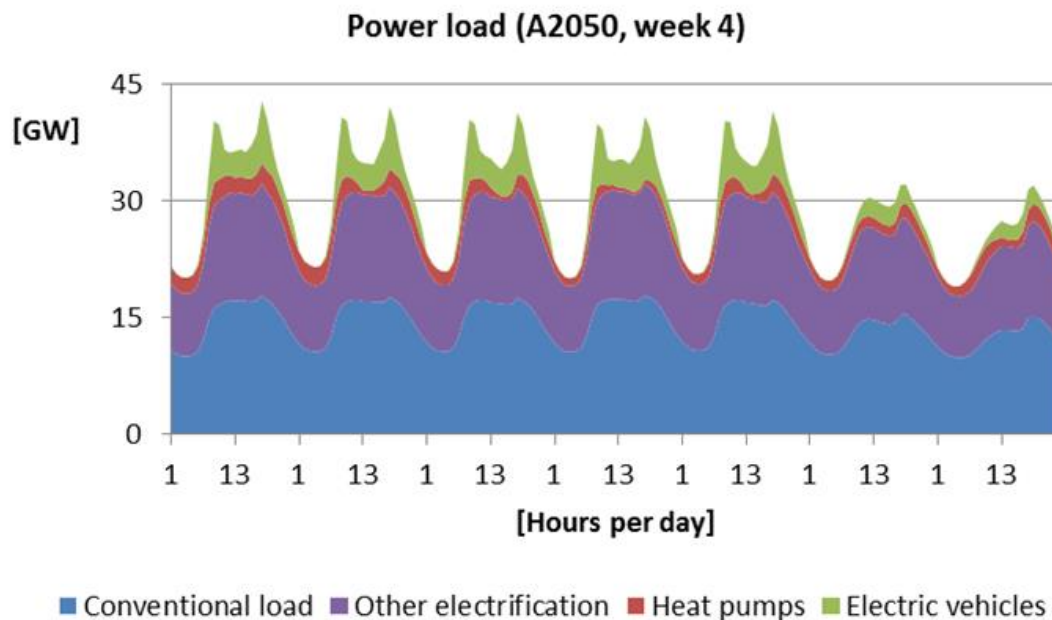


# ELECTRICITY MARKET MODELING

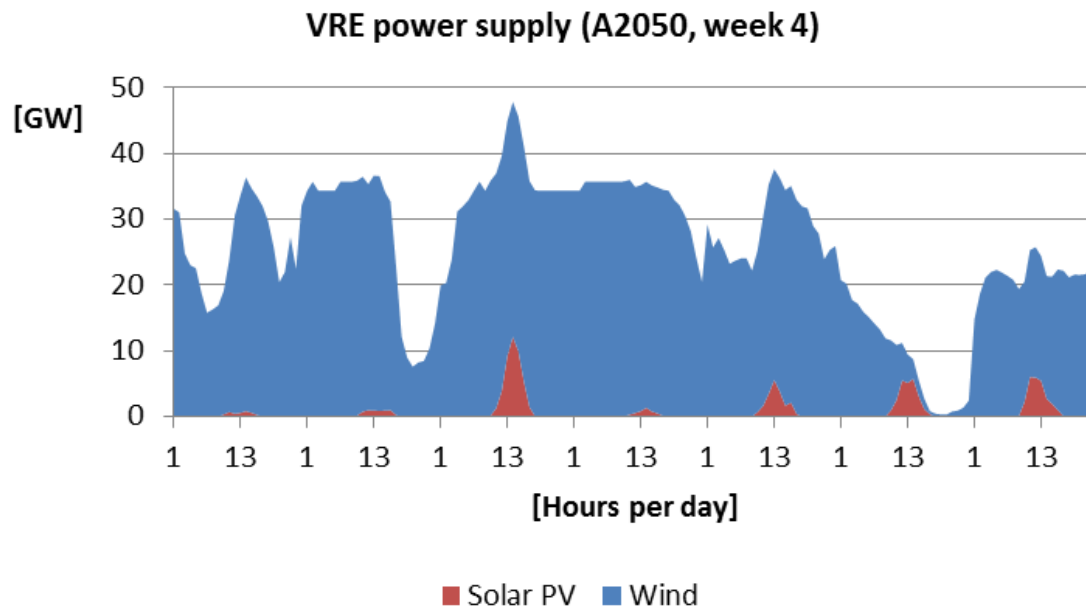
- › The COMPETES model
- › EU28+ electricity market model (optimisation)
  - › Includes interconnection/trade links across EU28+ countries
  - › Runs on an hourly basis



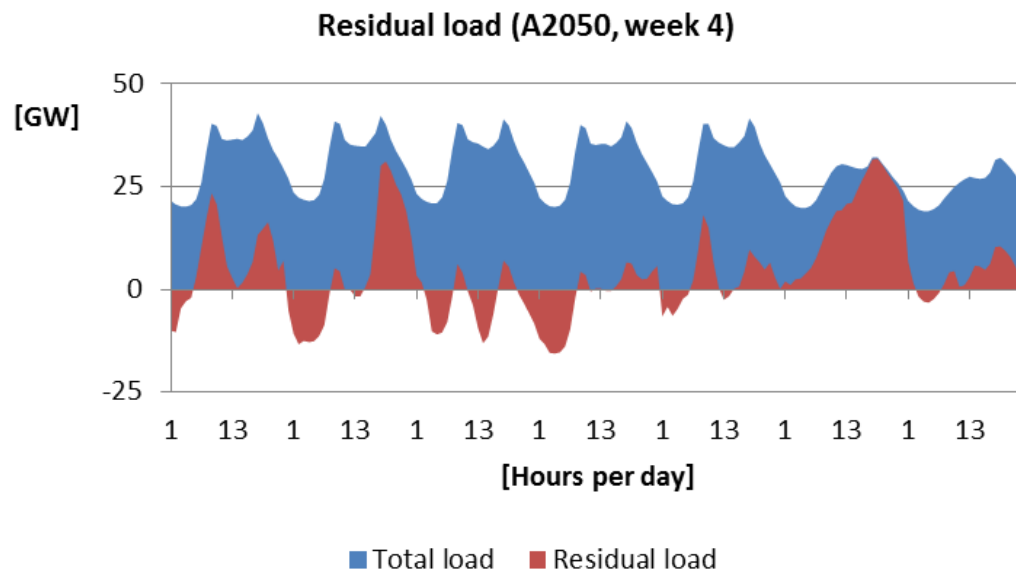
# HOURLY PROFILE OF TOTAL POWER LOAD, NATIONAL LEVEL, A2050



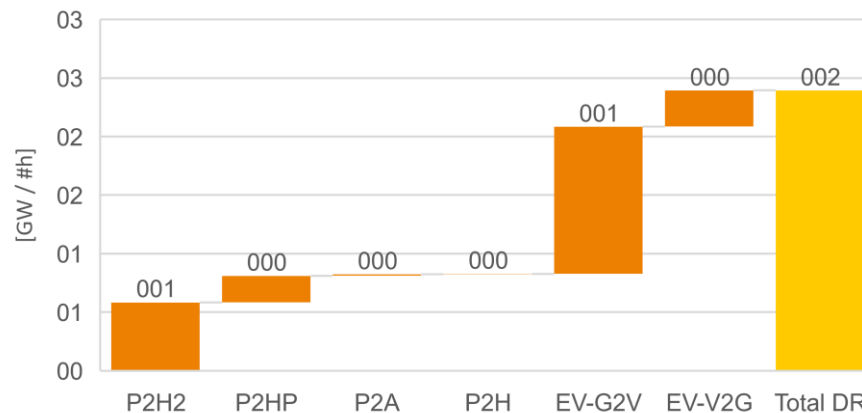
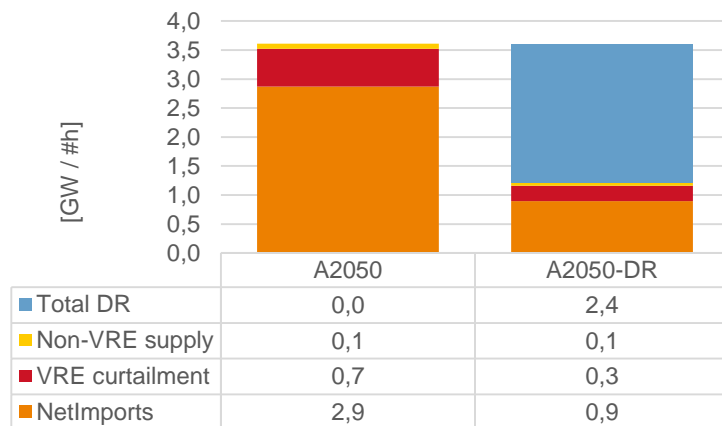
# HOURLY PROFILE OF VRE POWER SUPPLY, NATIONAL LEVEL, A2050



# HOURLY PROFILE OF RESIDUAL POWER LOAD, NATIONAL LEVEL, A2050

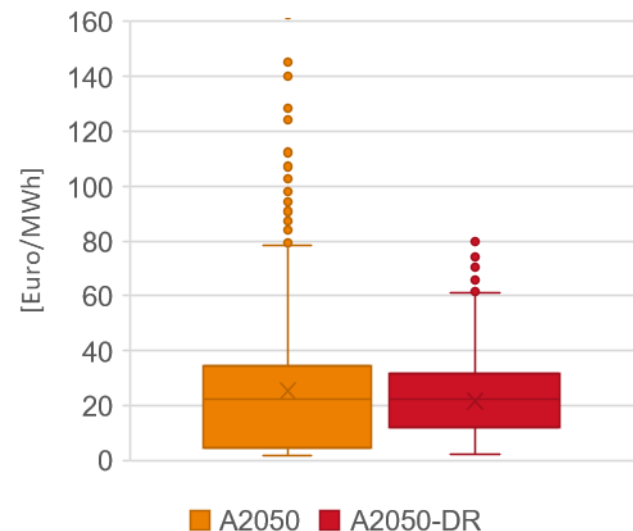
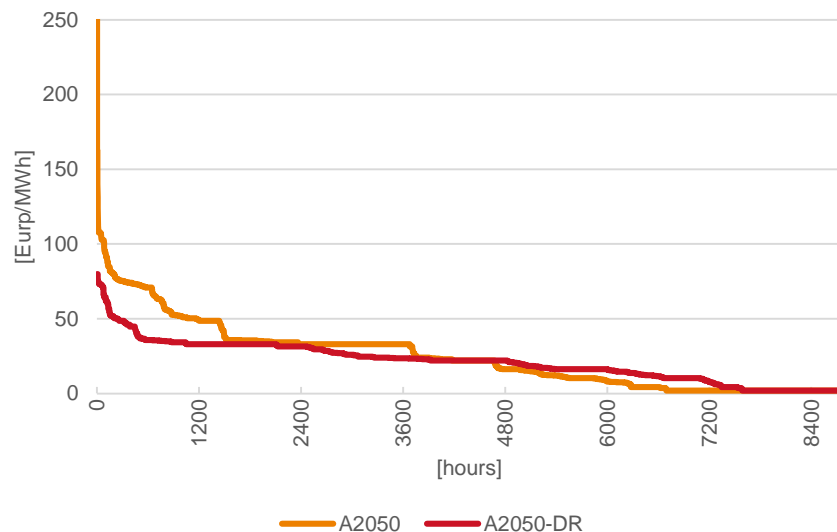


# SUPPLY OF UP FLEXIBILITY



# DEMAND RESPONSE RESHAPING PRICE DURATION CURVES

Duration curves of electricity prices



# ECONOMICALLY MOST OPTIMAL FLEXIBILITY MEASURES

- › **Demand response** has a large potential to meet future flexibility needs; notably EV's and industry
- › **Cross-border trade** becomes major flexibility option in future years but its size depends on available interconnection capacity
- › **Curtailement of VRE power generation** becomes a major flexibility option beyond 2030 depending to the availability of alternative options (trade, demand response).
- › **CO<sub>2</sub>-lean flexible power generation** gas-fired units remain important as back-up capacity
- › **Electricity storage** plays generally a limited role in meeting future flexibility needs of the power system but in specific cases it may be more significant

# DEMAND FOR ELECTRICITY STORAGE

- › Demand response and interconnection are uncertain
  - › EV's
  - › Industry
- › Local energy systems
- › Electricity storage for days
- › Seasonal storage / Dunkelflaute



# POLICY NEEDS

- › Innovation policy:
  - › Technical challenges
  - › Societal issues
  - › Cost reduction
- › Market regulation for back-up capacity
- › Discontinue double taxation
- › Feed-in tariffs for stored electricity



# CONCLUSIONS

- › Energy transition in the Netherlands
  - › Strong growth of variable renewable energy sources
  - › Growth of electric mobility,
  - › Expected growth of electric heating and industrial processes
- › Flexibility
  - › Demand response is economically most optimal solution
  - › Need for storage in certain markets
  - › Policy intervention is necessary



A nighttime photograph of a city street. On the left is a multi-story brick building with many lit windows. On the right is a modern building with a curved facade and large glass windows, also lit up. In the foreground, a curved pedestrian bridge or walkway with a metal railing runs across the frame. Long, horizontal light trails in green and yellow are visible, suggesting motion from a train or car. The overall scene is illuminated by city lights.

› **BEDANKT VOOR UW AANDACHT**

Voor meer inspiratie:  
**TNO.NL/TNO-INSIGHTS**

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