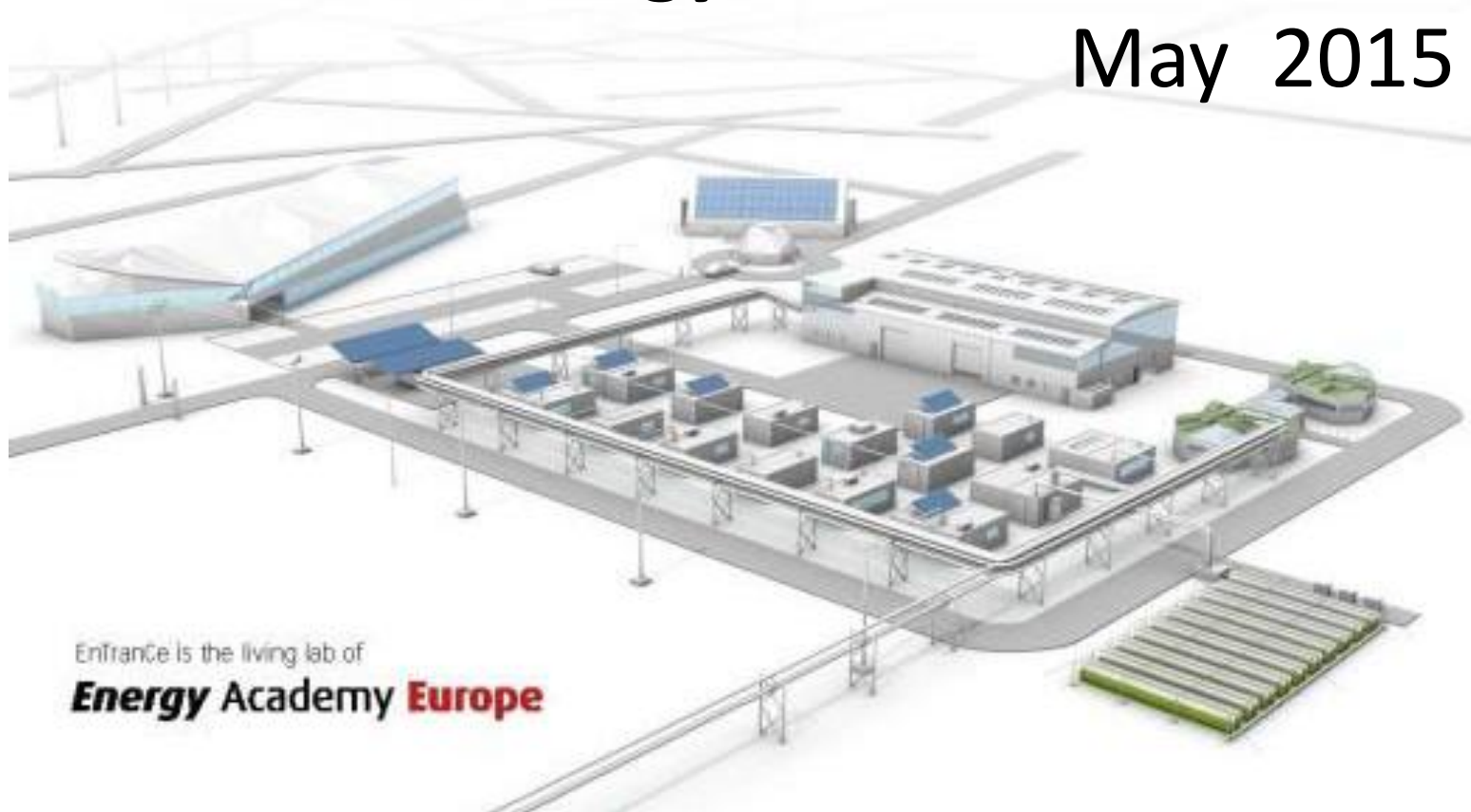


# Renewable Energy in The Netherlands

## May 2015



EnTranCe is the living lab of  
**Energy Academy Europe**

**Dr. Martien Visser**

Professor Energy Transition & Network Integration

Hanze University of Applied Sciences Groningen

Partner of the Energy Academy Europe

E-mail: [b.m.visser@pl.hanze.nl](mailto:b.m.visser@pl.hanze.nl)

This analyses contains information of various sources and own analyses, including various estimates.

Readers are encouraged to add, to improve the quality of the information provided.

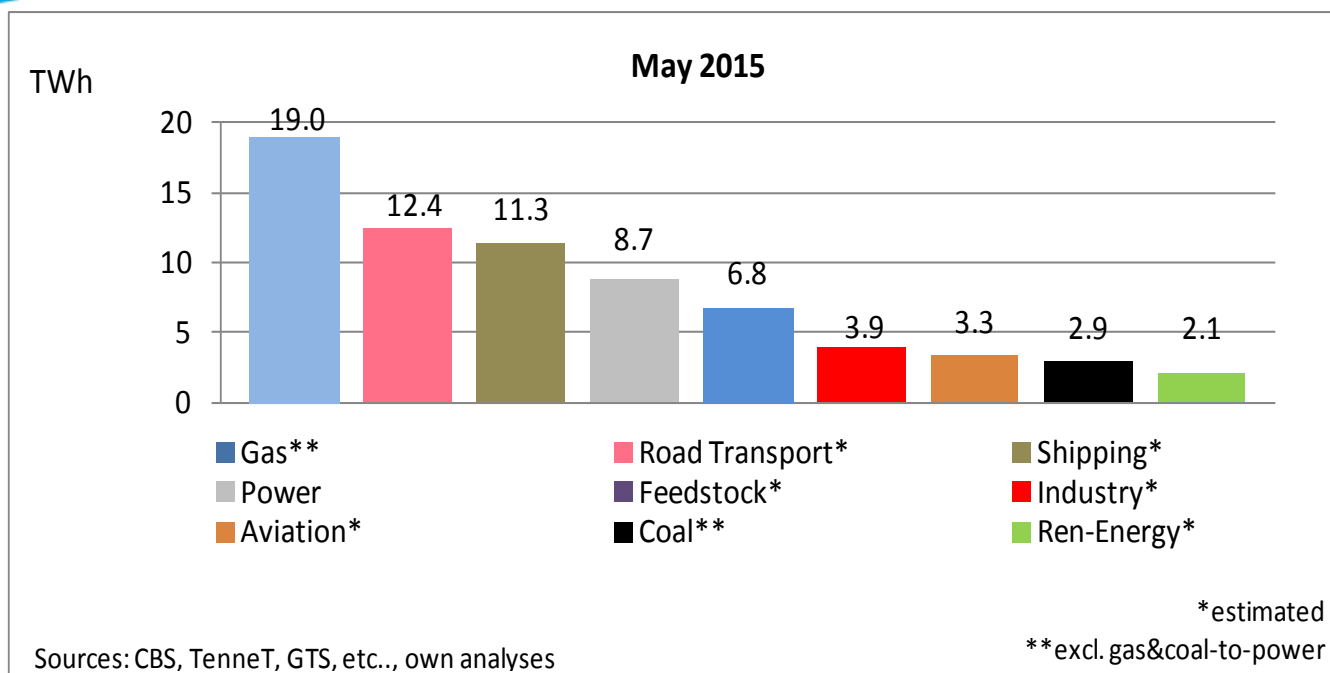
May 2015

## In a Nutshell

- Electricity production by Solar PV reached a record level of 0.14 TWh
- Installed wind capacity passed the 3000 MW threshold
- Average utilization of wind capacity was 27% and for solar-PV 15%
- Net power imports increased substantially and were at the level of last year
- Coal was again the main source of Dutch power and contributed for 80% of the CO<sub>2</sub> emissions from the Dutch power sector.
- The Netherlands became, for the first time in its history, a net gas importer
- Dutch CO<sub>2</sub> emissions were on par with May 2014
- The fraction renewable energy was 5.0%, compared to 4.8% in May 2014

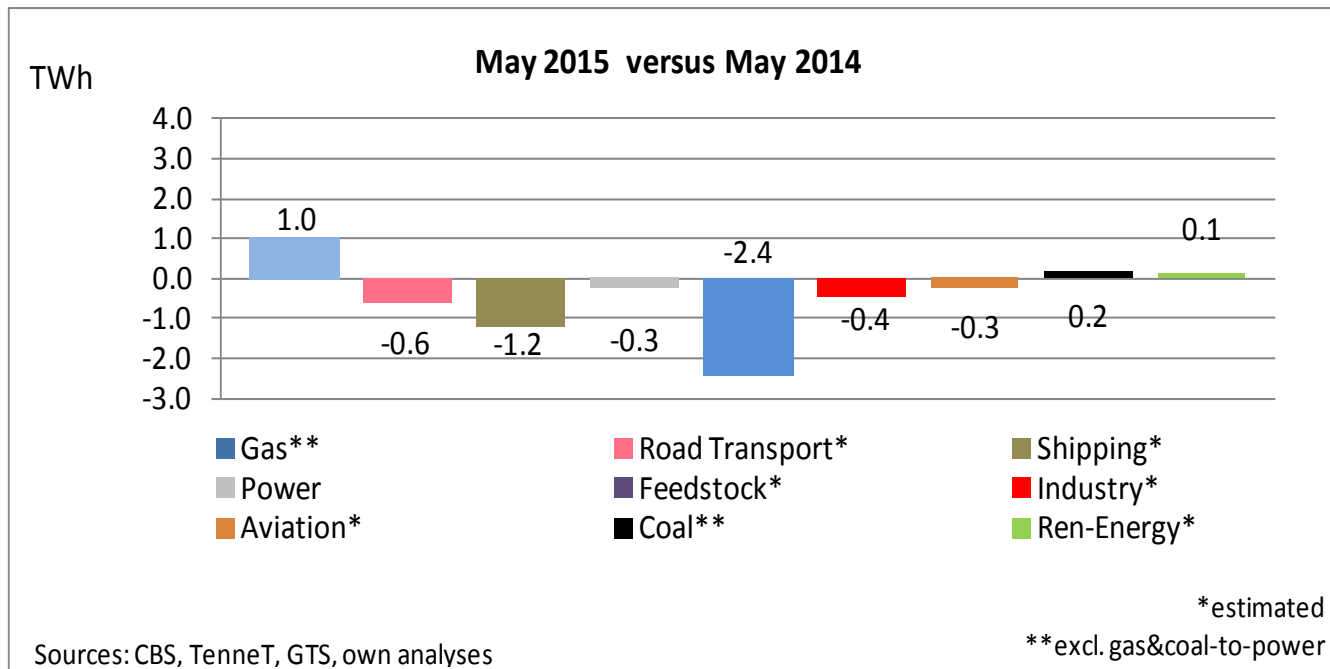
- May 2015 data
- Monthly profiles
- Monthly data
- Hourly data
- Miscellaneous

# SELECTED ENERGY DATA FROM MAY 2015

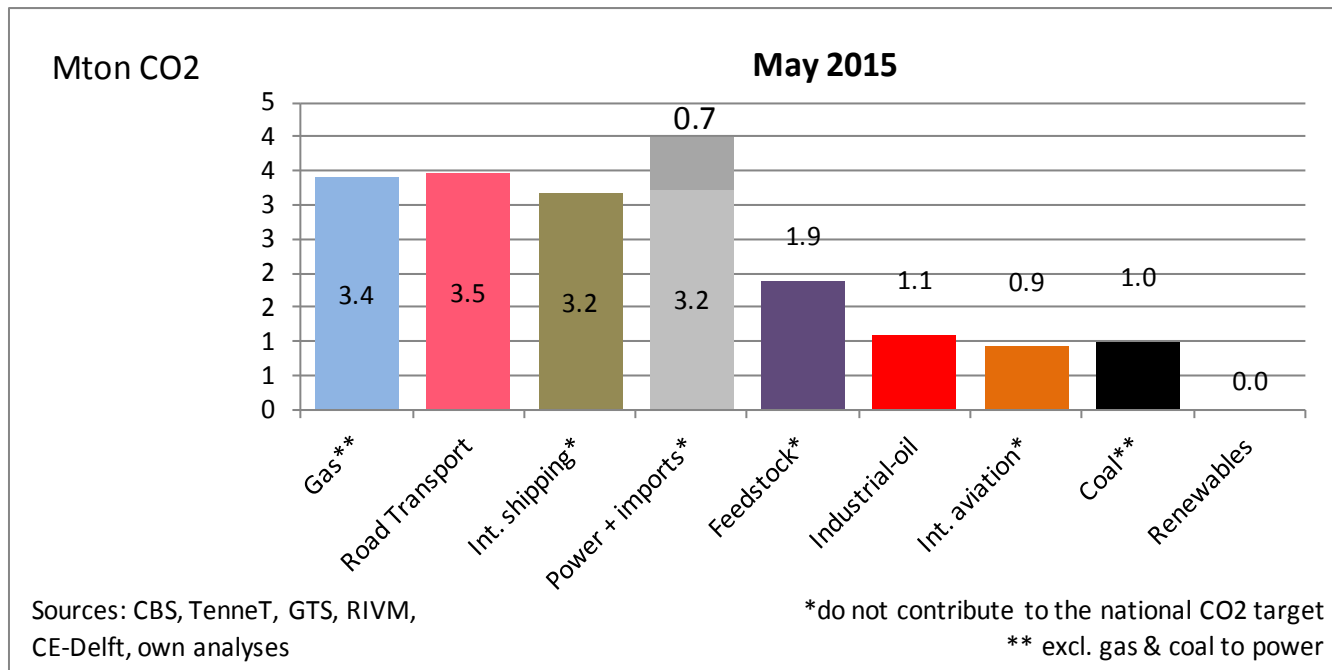


Energy is used for many different purposes. In May 2015, the most important applications were heating/gas (19 TWh) and Transport (27 TWh). Renewables are given by comparison.

# Final Energy Demand May 2015



In May 2015, gas consumption was higher than last year, mainly due to lower temperatures. Energy used for transport, bunkering (shipping) and in particular feedstock is estimated to be lower than previous year.

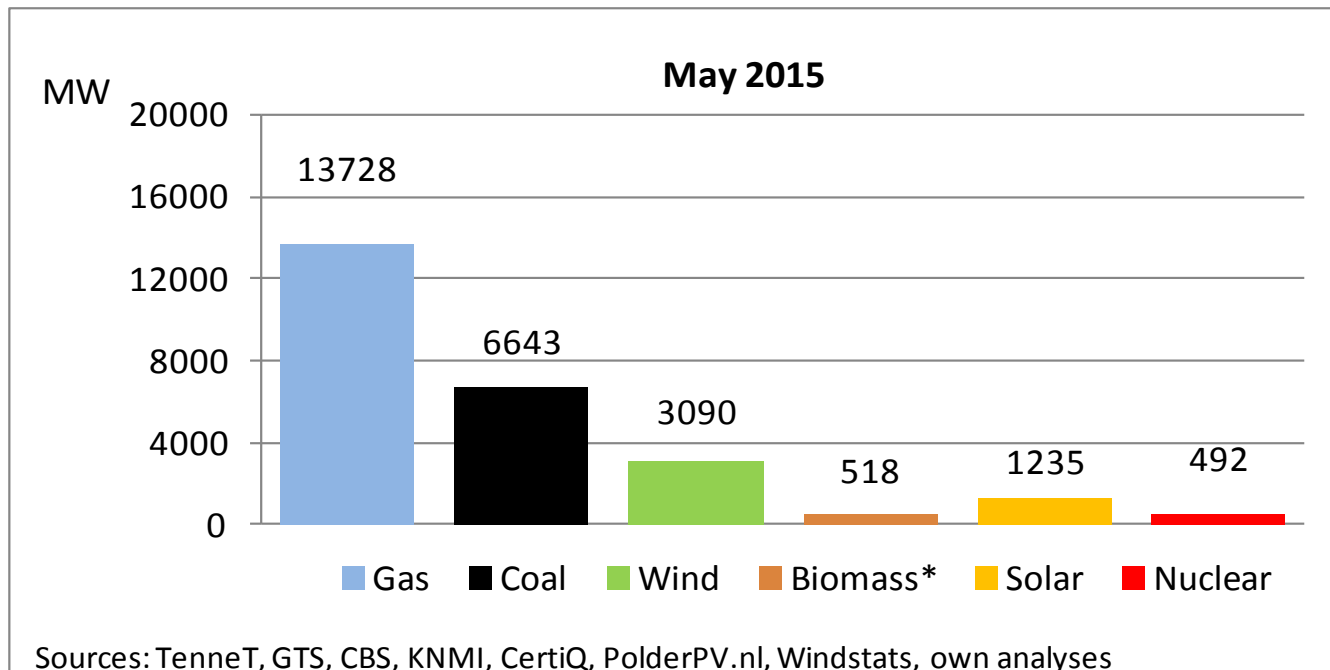


The national CO2 emissions for May 2015, excluding power imports, feedstock and international shipping & aviation, have been estimated at 12.1 Mton. This was exactly the same as in May 2014.

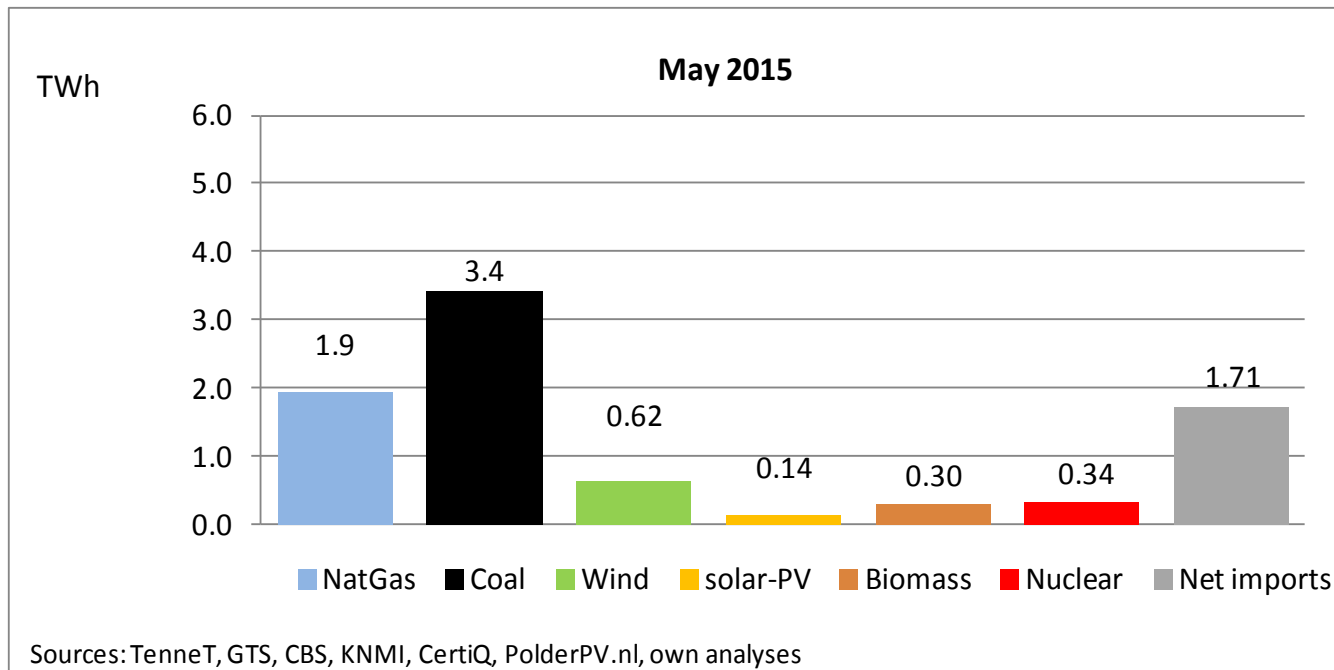
Main contributions came from road transport, gas and power.



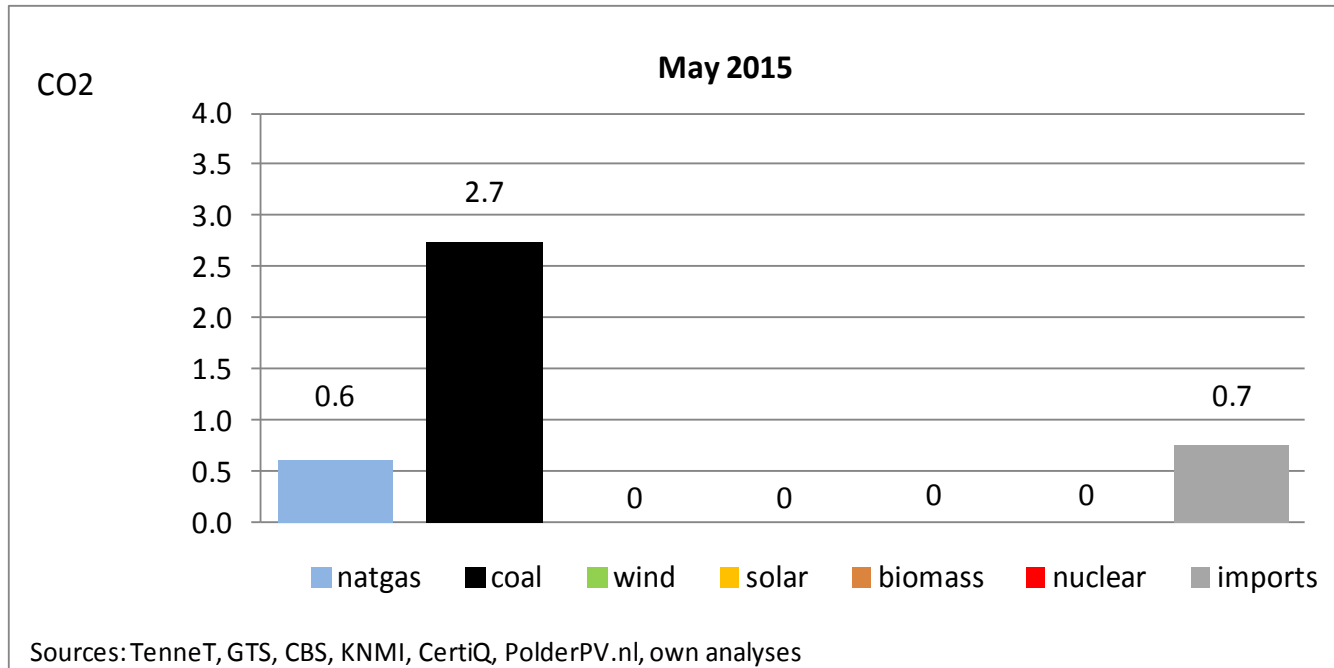
# Power Generation Capacity May 2015



In May 2015, the available capacity in wind power has passed 3000 MW



In May 2015, power consumption was 8.7 TWh, 3% lower than in May 2015 2014. Power imports and exports were similar than last year. The usage of coal for power generation increased by 37% y-o-y. In May, the average contribution from renewables to the power system was 11.9%, compared to 10.6% in May 2014.

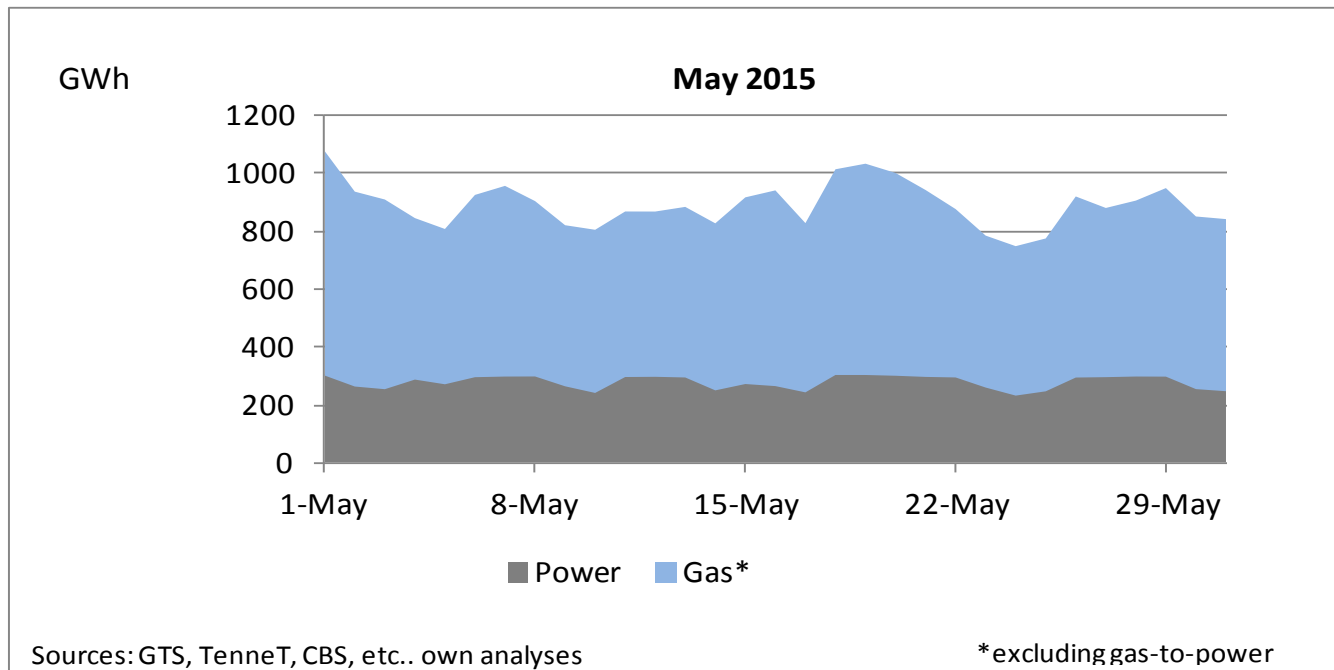


The CO2 emissions from imports are given for comparison, as these emissions do not contribute to the National Dutch CO2 emission level. In May 2015, 80% of the CO2 emissions from the power sector came from coal-fired power stations.

# SELECTED MONTHLY PROFILES

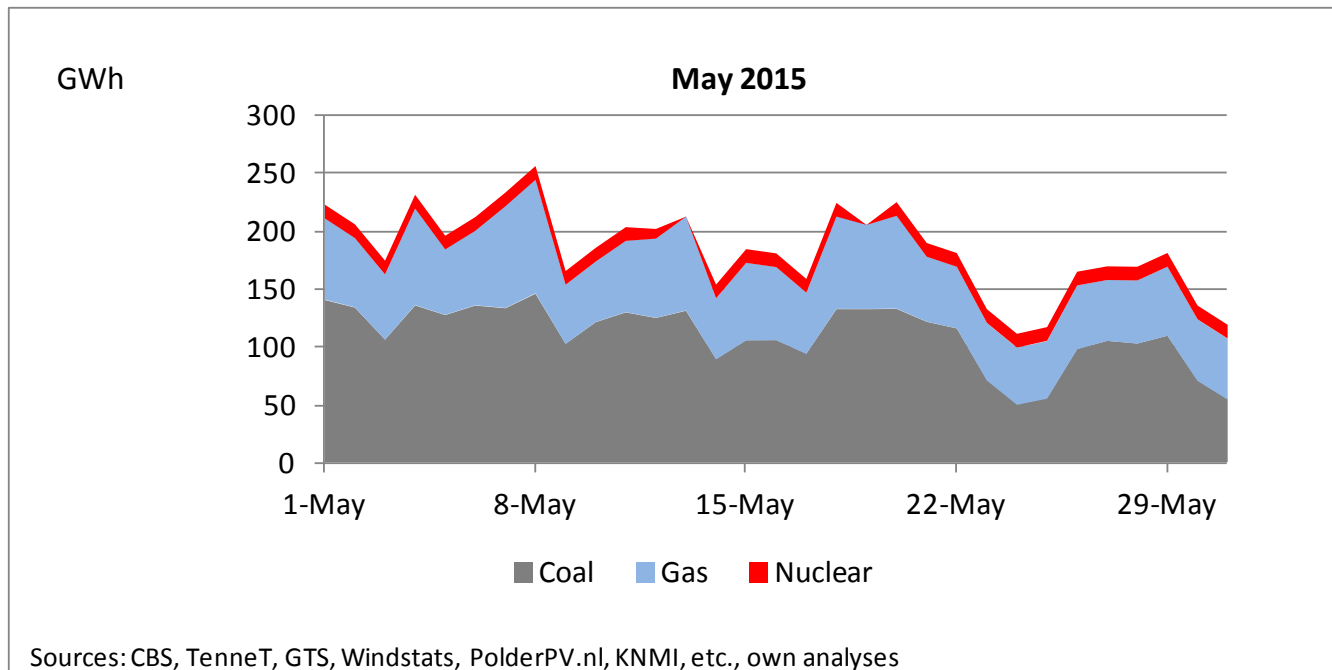
(using daily data)

# Gas and Power Demand May 2015



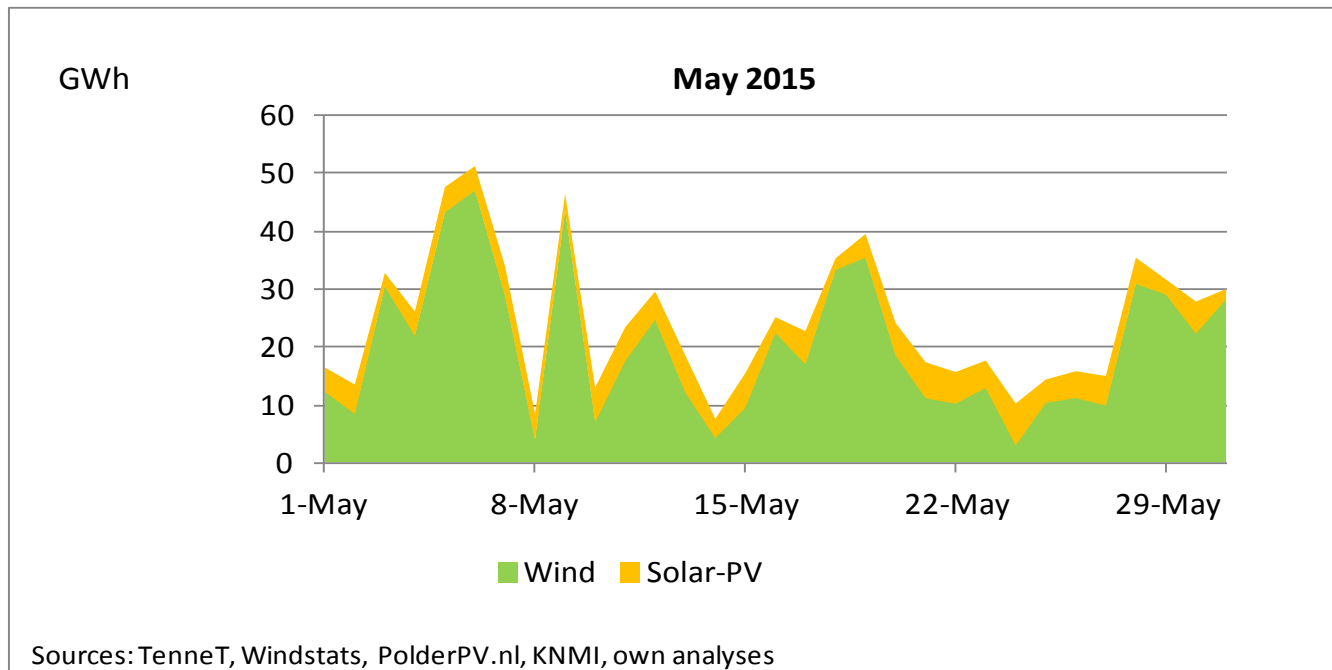
Daily power demand shows a week-weekend pattern. Daily gas demand (excluding gas demand for power) is mainly used for the heating market and affected by ambient temperature.

# Conventional Power Production May 2015



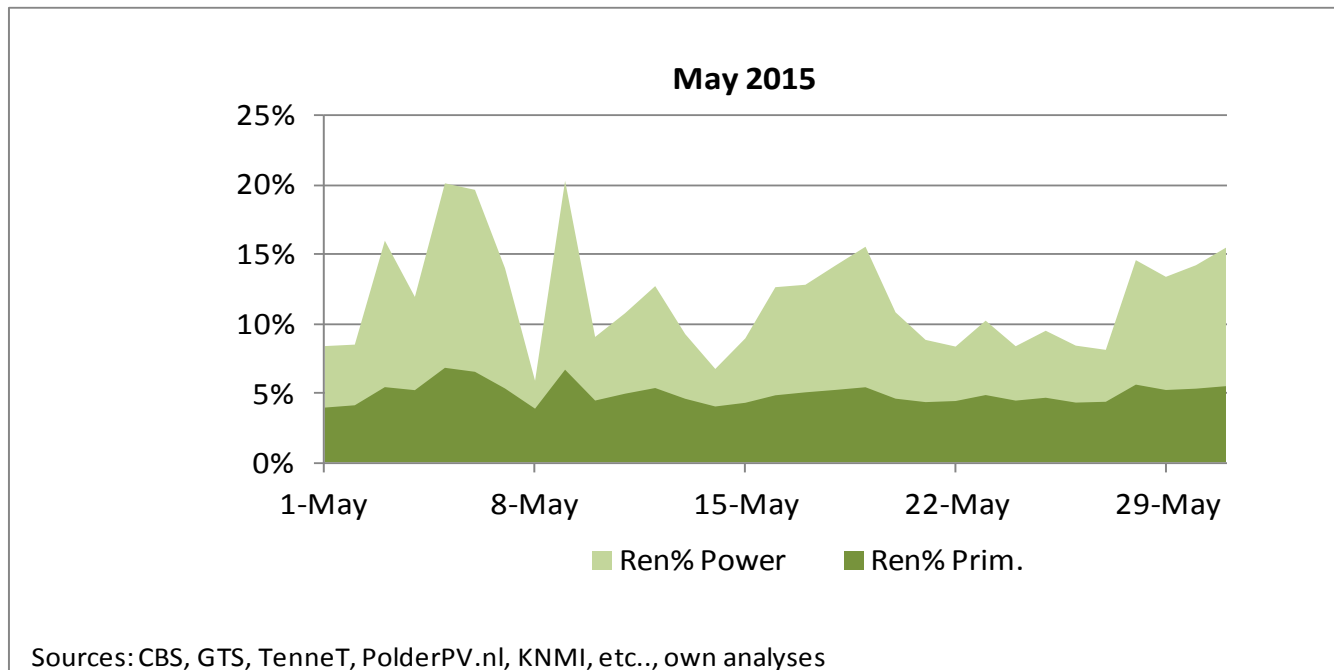
The picture clearly shows that nowadays, power in the Netherlands is primarily produced using coal.

# Wind and Solar Power Production May 2015



Both wind and solar power proved to be very volatile in May.  
1 GWh is sufficient to provide power for a year to 300 households

# Contribution of Renewable Energy May 2015

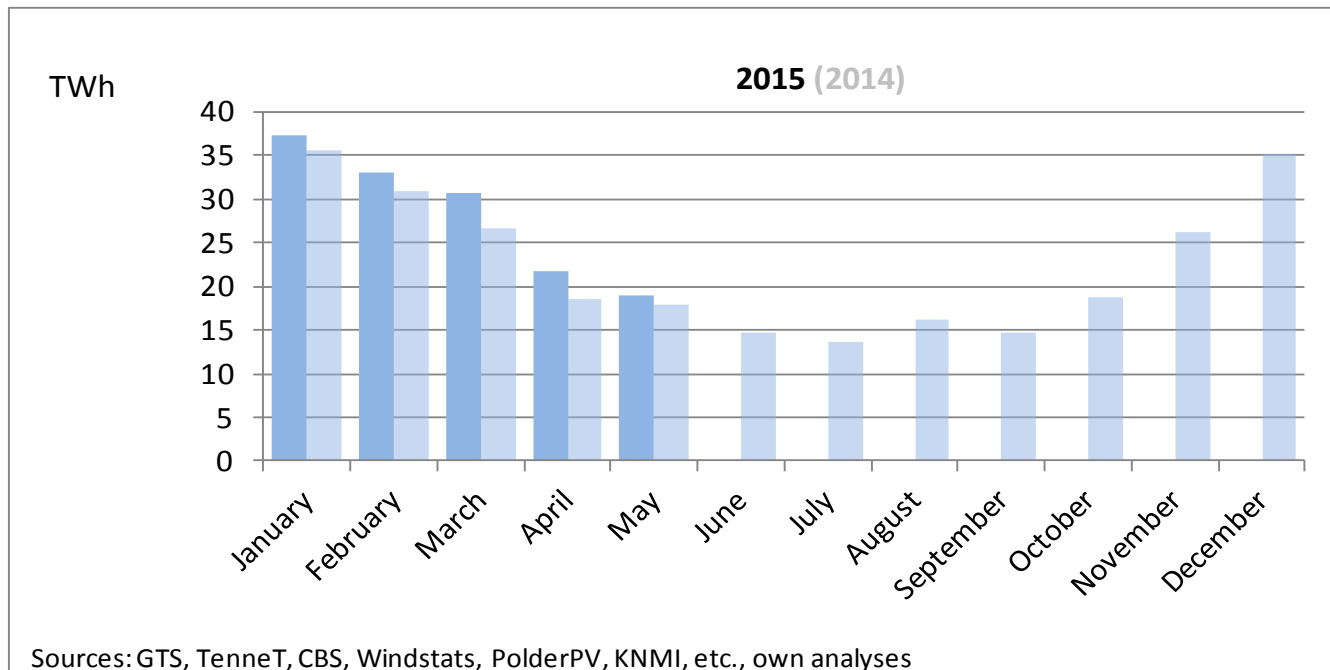


Renewable energy peaked to 7% on May 5<sup>th</sup>, while the fraction of renewable power peaked to 20% that day. These high values have been caused by high wind speeds in combination with a public Holiday in The Netherlands (liberation day).



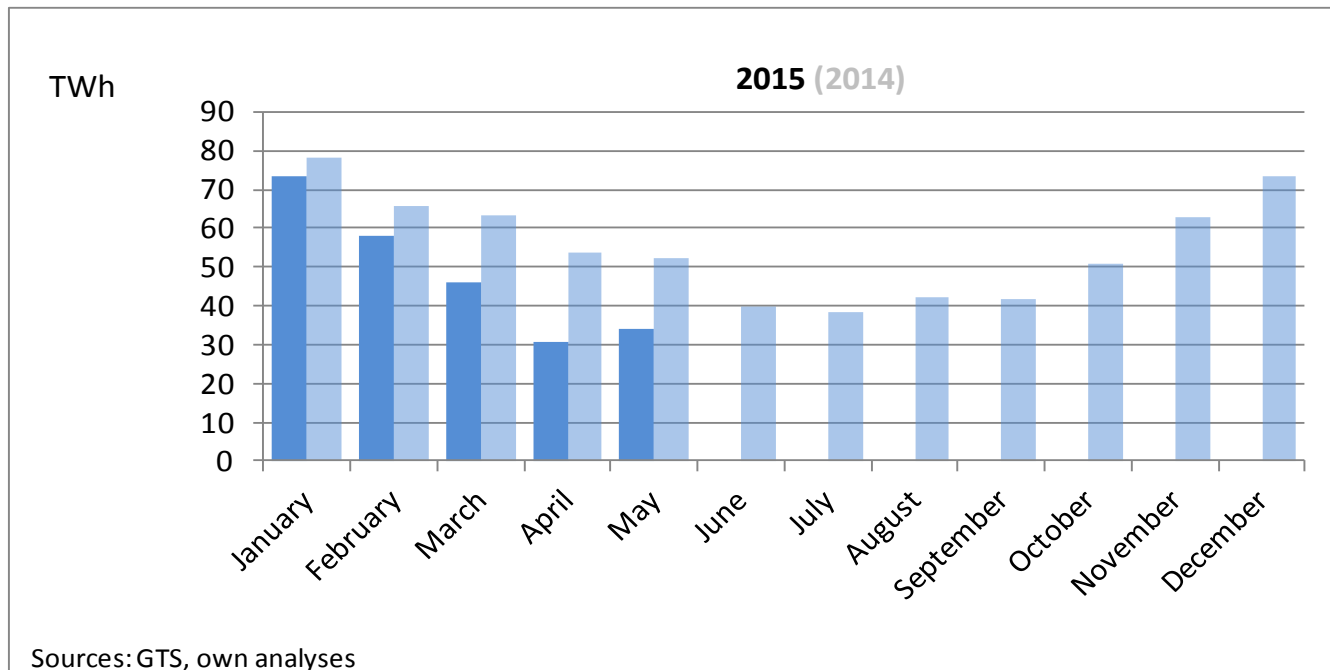
# SELECTED MONTHLY ENERGY DATA

# Gas Demand 2015 (and 2014)



For the fifth consecutive month, gas demand (excluding gas demand for power production) was higher than in the same month in 2014, due to lower temperatures in 2015 compared to 2014

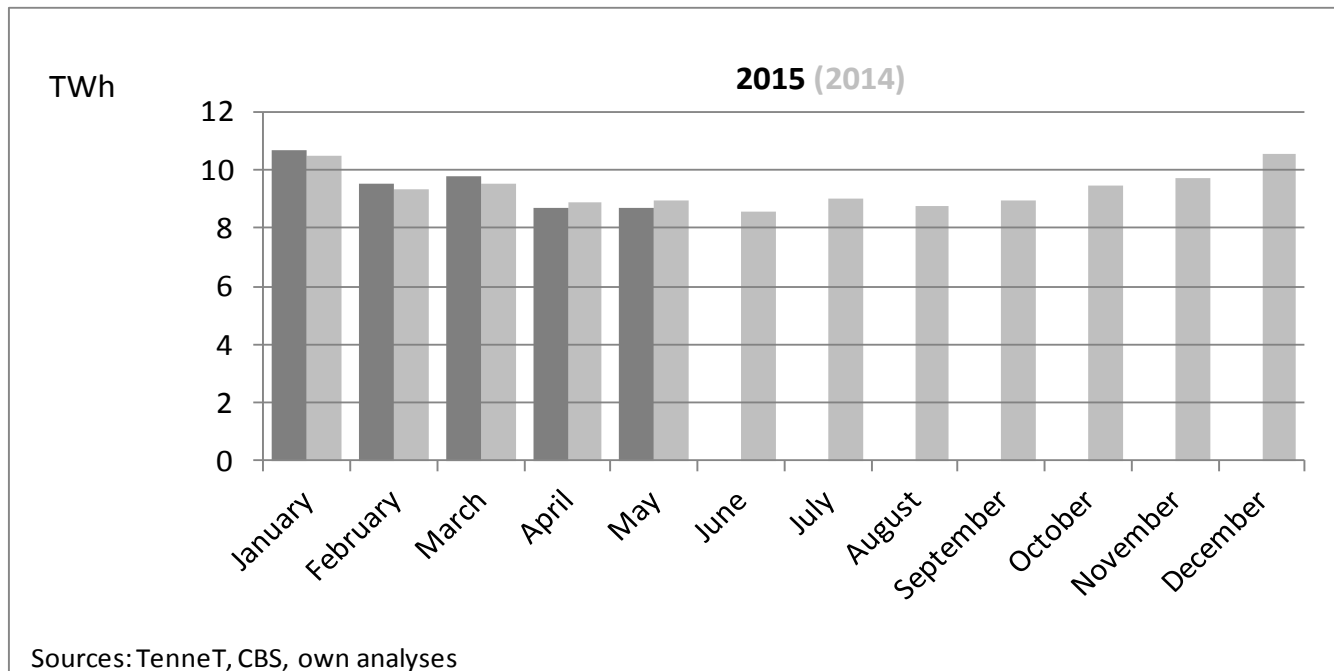
# Gas Production 2015 (and 2014)



Due to lower production from the Groningen gas field and declining gas production from the North Sea, Dutch gas production in 2015 is considerable lower than in 2014.

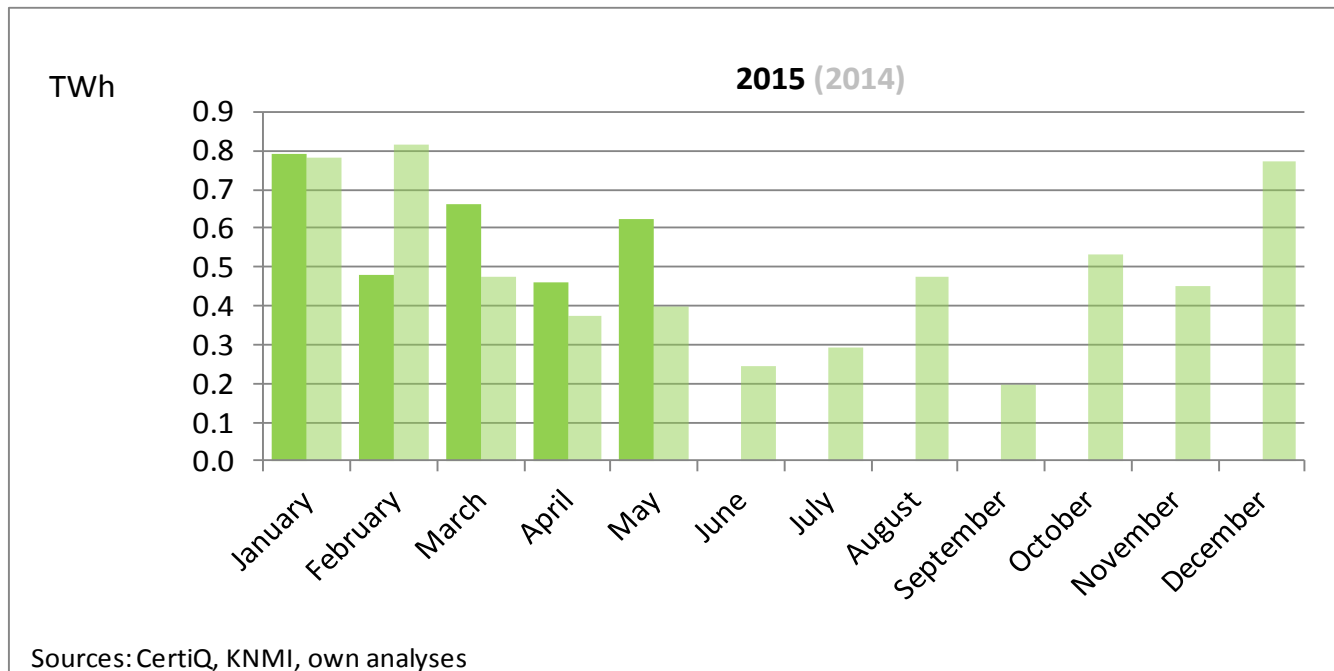
10 TWh gas is sufficient to supply heat to all houses in Amsterdam for two years

# Power Demand 2015 (and 2014)



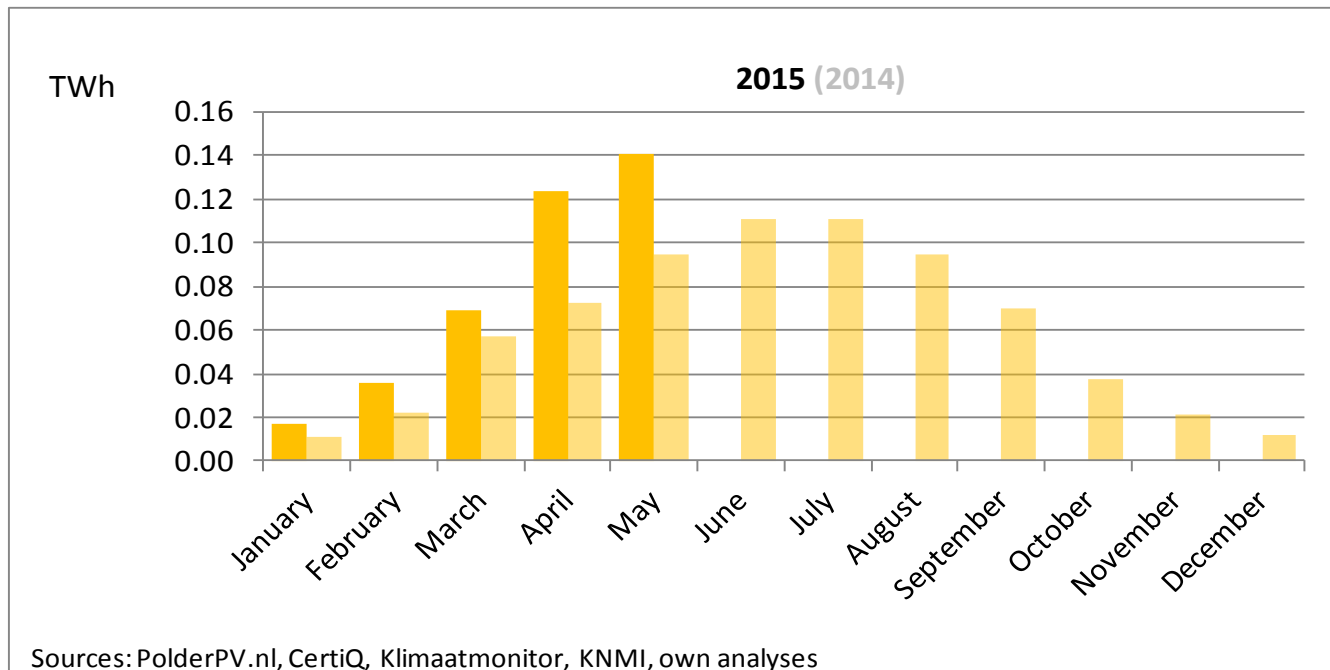
After three consecutive months with power demand growth, demand fell for the second consecutive month in May (-3%).

# Wind Production 2015 (and 2014)



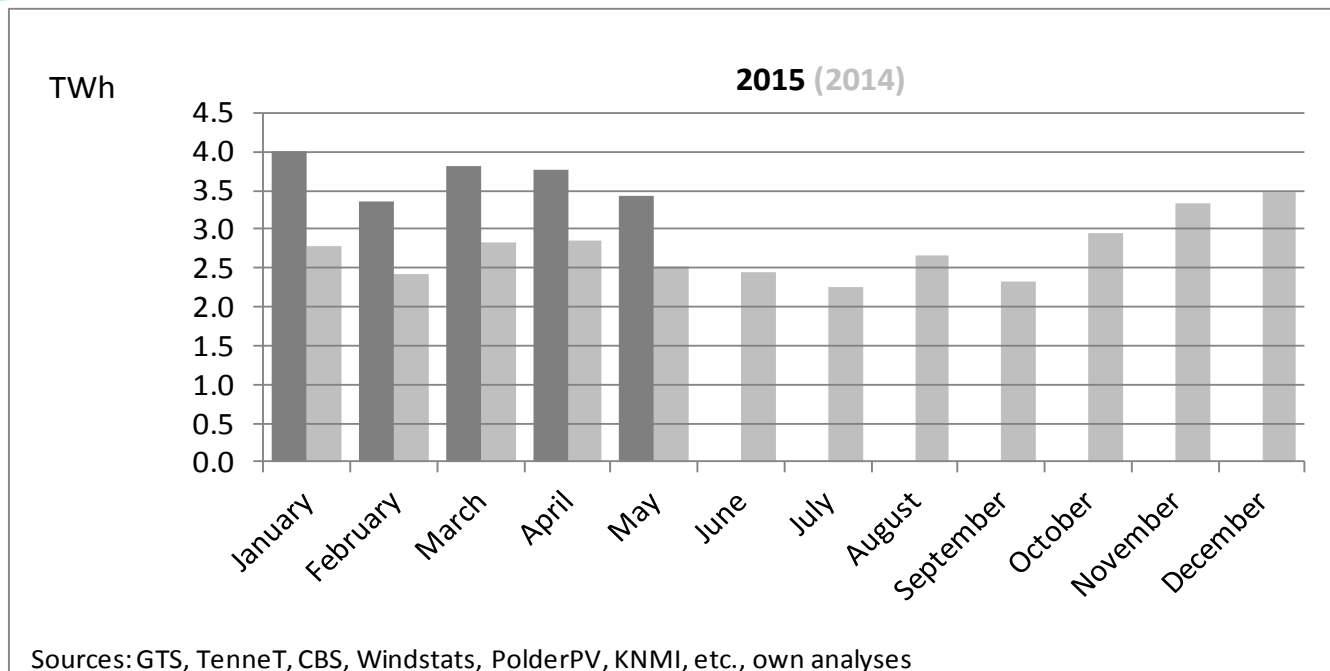
Monthly, wind power production is volatile y-o-y. Wind production in May 2015 was 57% higher than in May 2014, due to increased wind capacity and more wind availability. In May 2015, wind capacity passed the 3000 MW threshold.

# Solar PV Production 2015 (and 2014)



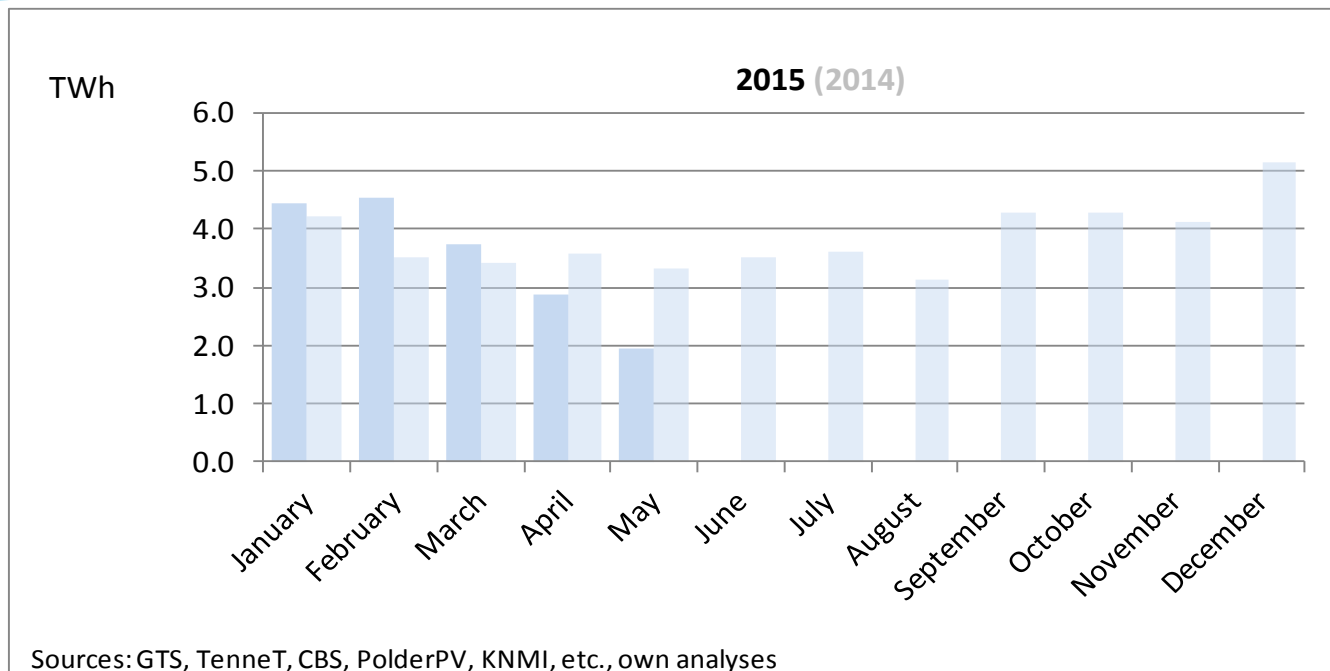
In May 2015, electricity production by Solar PV in The Netherlands reached a new record level of 141 GWh (0.14 TWh). This was 49% higher than in May 2014, mainly due to increased Solar PV capacity.

# Coal-to-Power 2015 (and 2014)



For the fifth consecutive month, coal utilization for power generation increased significantly.

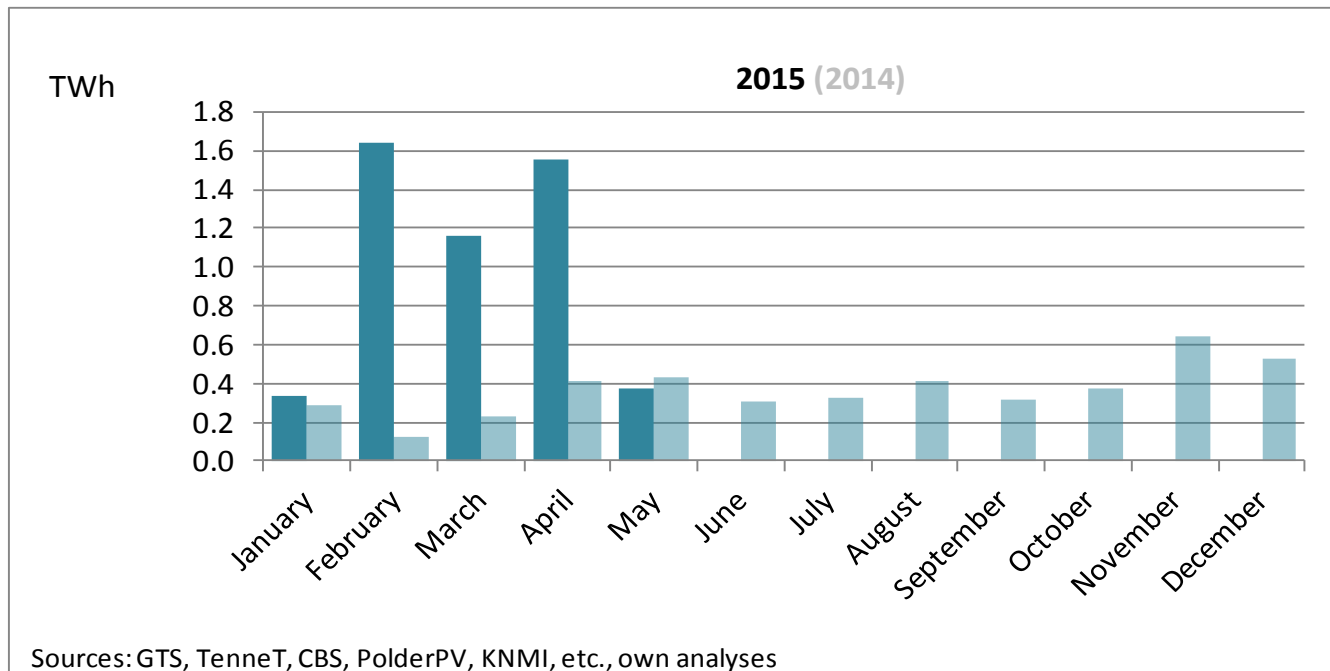
# Gas to Power 2015 (and 2014)



In May 2015, power production by gas-fired power stations and cogeneration was significantly lower than in May 2014.

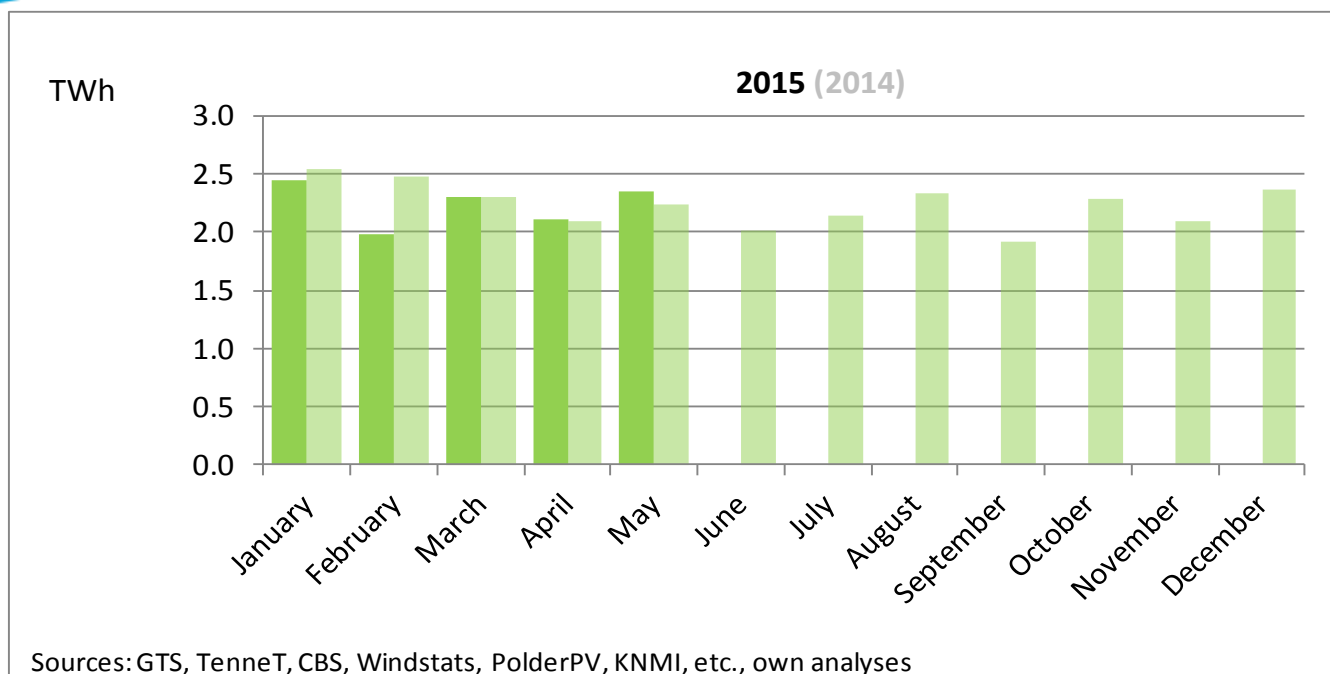


# LNG imports 2015 (and 2014)



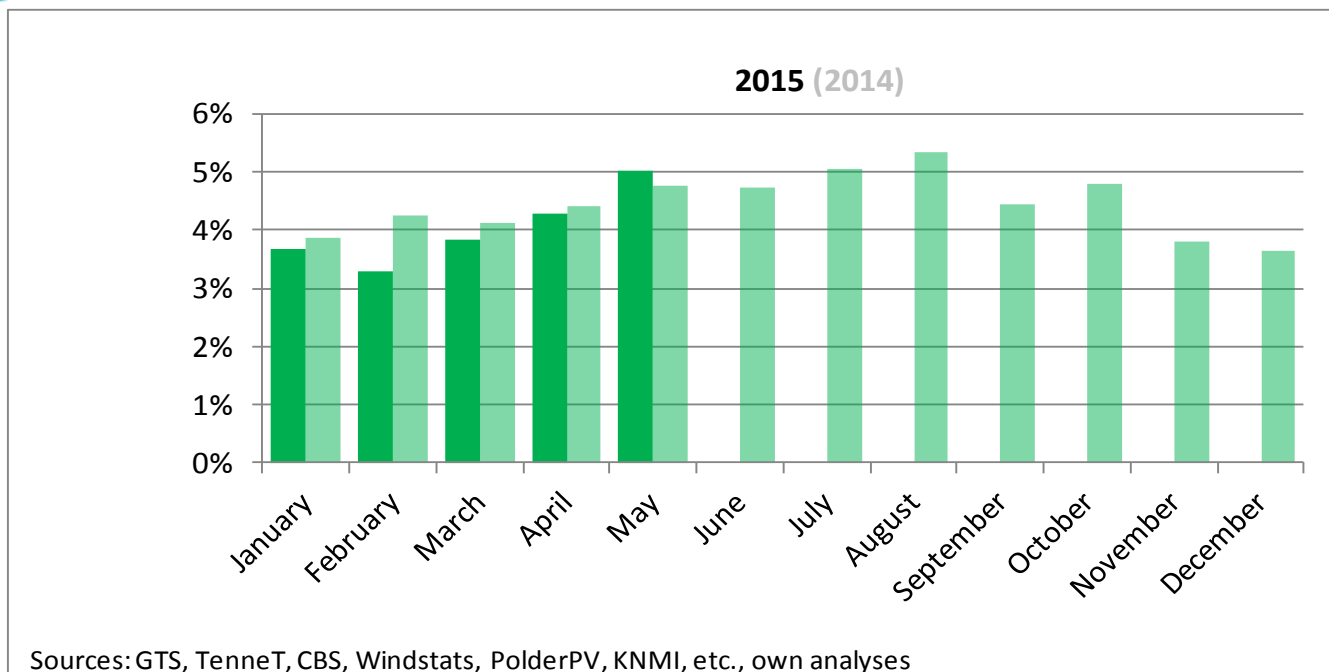
In May 2015, after three months with considerable imports from the Gate terminal, gas flows were at a relatively low level (again).

# Renewable Energy All Sources 2015 (and 2014)



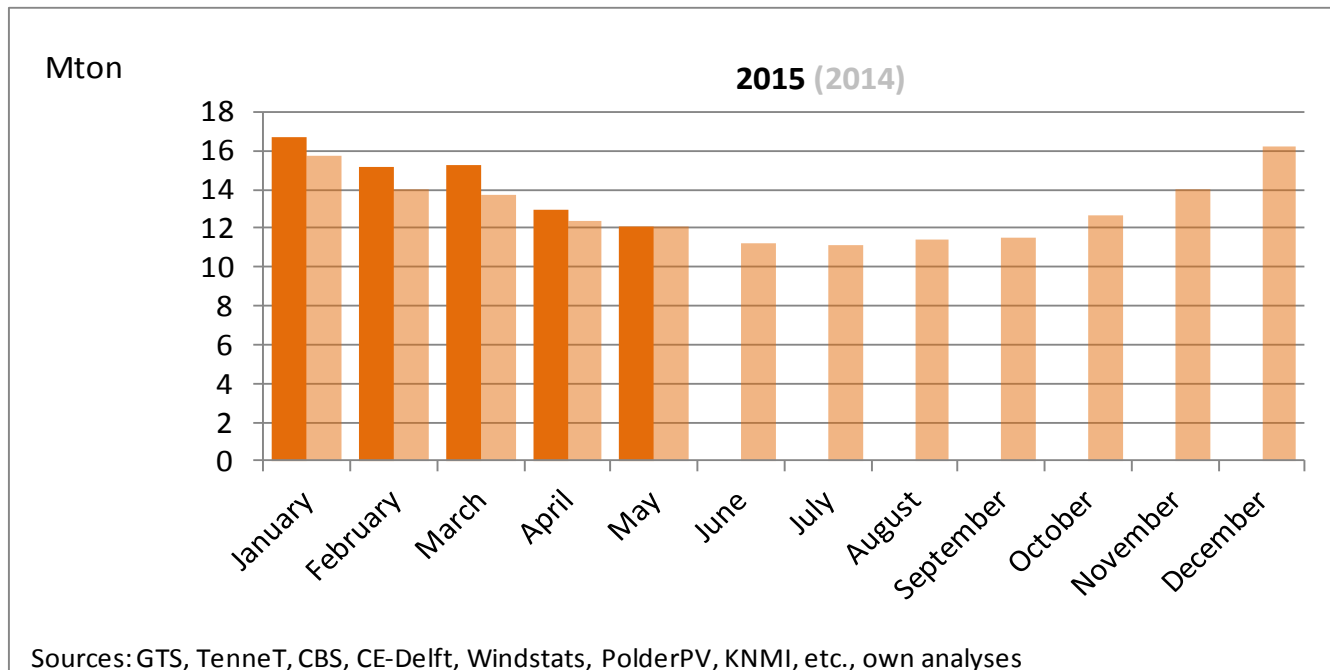
May 2015, the total renewable energy production in The Netherlands increased slightly compared to May 2014. Higher contributions from wind and sun have been compensated by lower contributions from biomass.

# Renewable Energy Percentage 2015 (and 2014)



In May 2015, the percentage of renewable energy for The Netherlands, as fraction of total energy demand (EU definition), has been estimated at 5.0%, slightly higher than in May 2014.

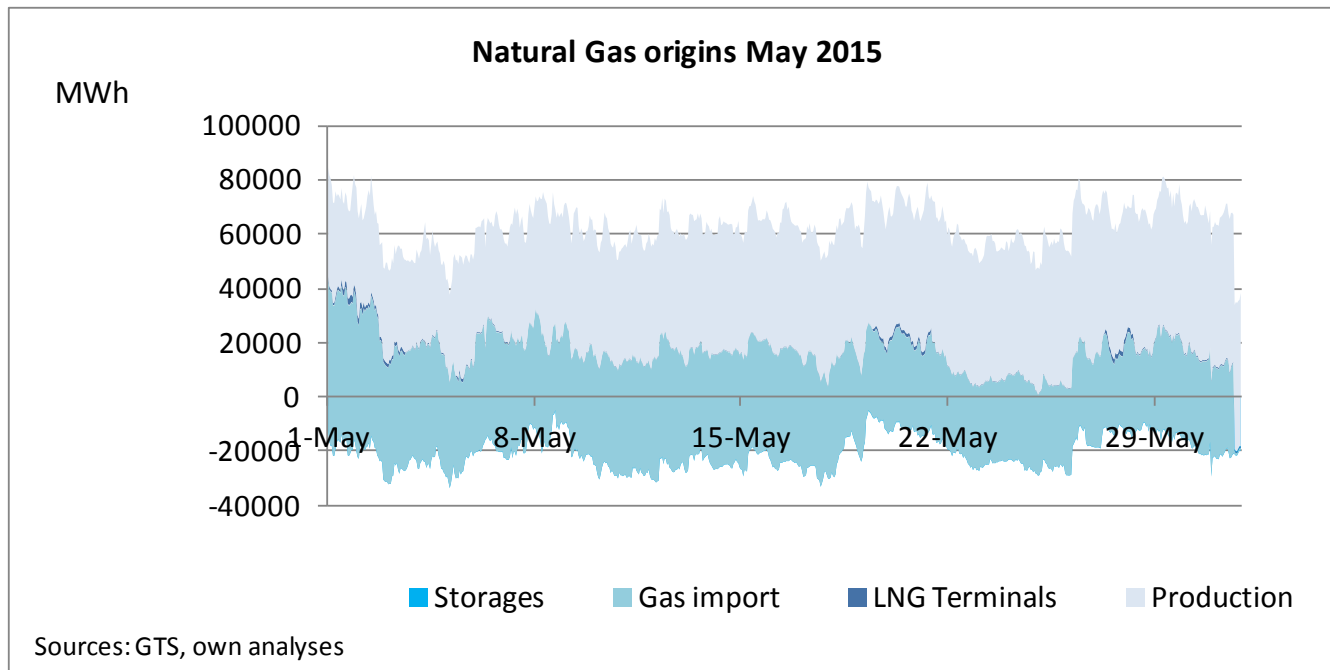
# CO2 Emissions 2015 (and 2014)



In May 2015, Dutch national CO2 emissions were at the same level as in May 2014, after four months of increasing values. One of the reasons is that power imports, which do not contribute to the national CO2 emissions, were much higher in May than in the previous months.

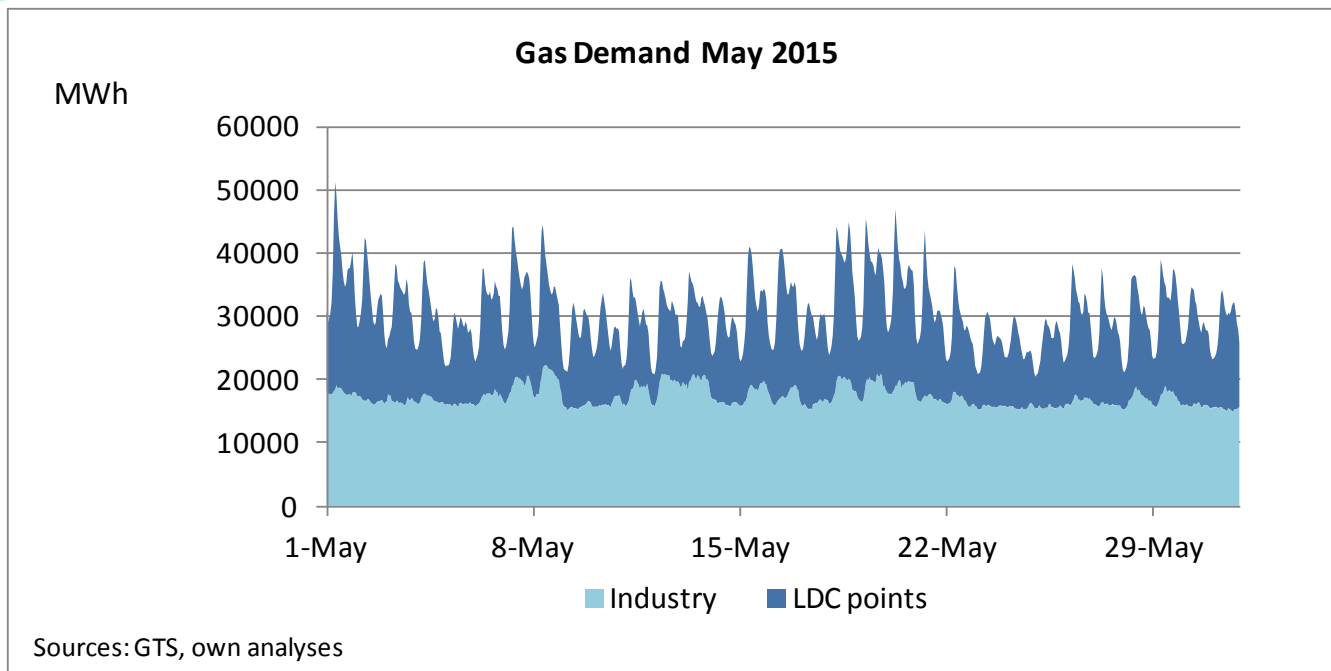
# SELECTED HOURLY ENERGY DATA

# Gas Supply May 2015



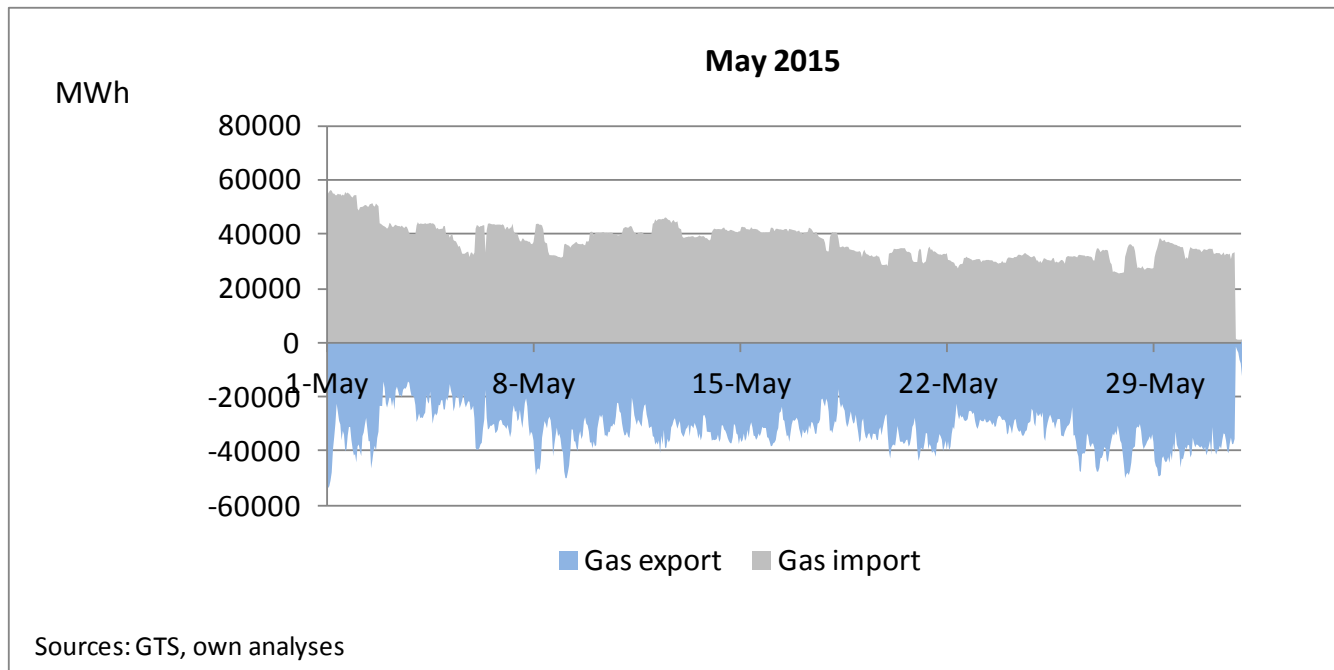
In May 2015, substantial gas volumes were used to fill gas storages, depicted as negative values in the figure. Maximum gas supplies (import + production) reached about 100.000 MW.

# Gas Demand Including Gas-to-Power May 2015



On May 1<sup>st</sup>, gas demand in The Netherlands peaked to 50.000 MW.

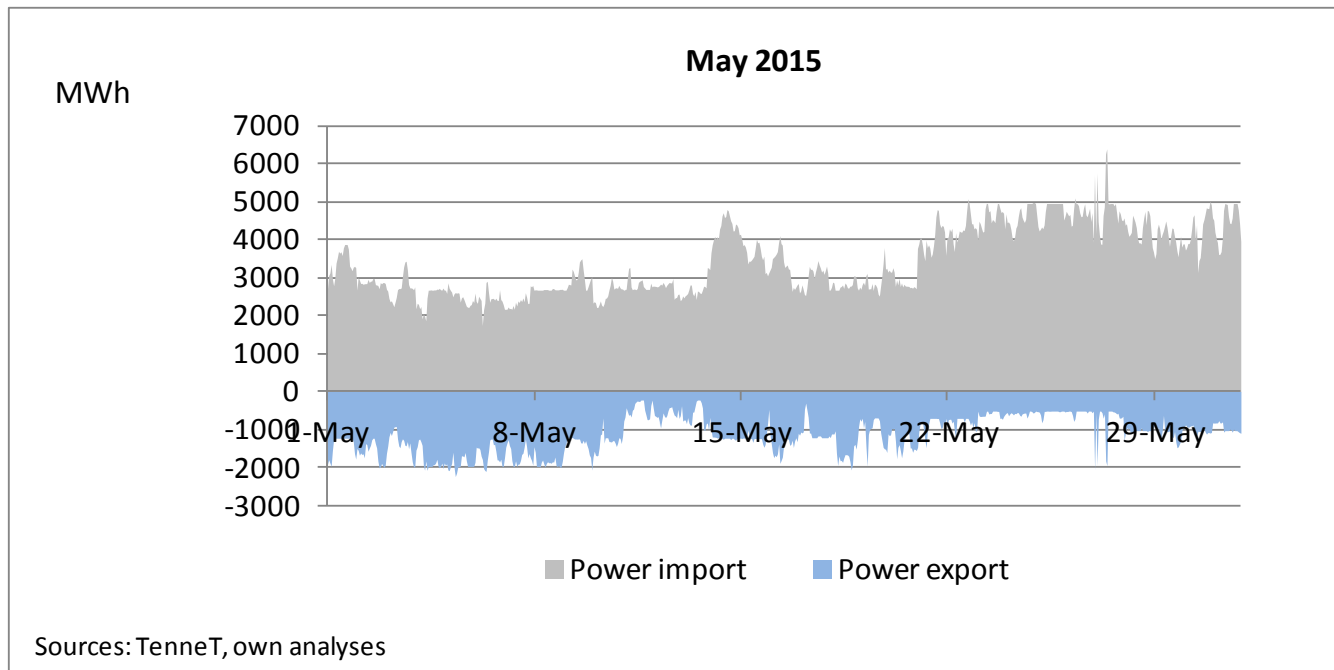
# Gas Imports & Exports May 2015



In May 2015, gas imports were higher than gas exports. Thus, probably for the first time in its history, The Netherlands became a gas importing country for a month.

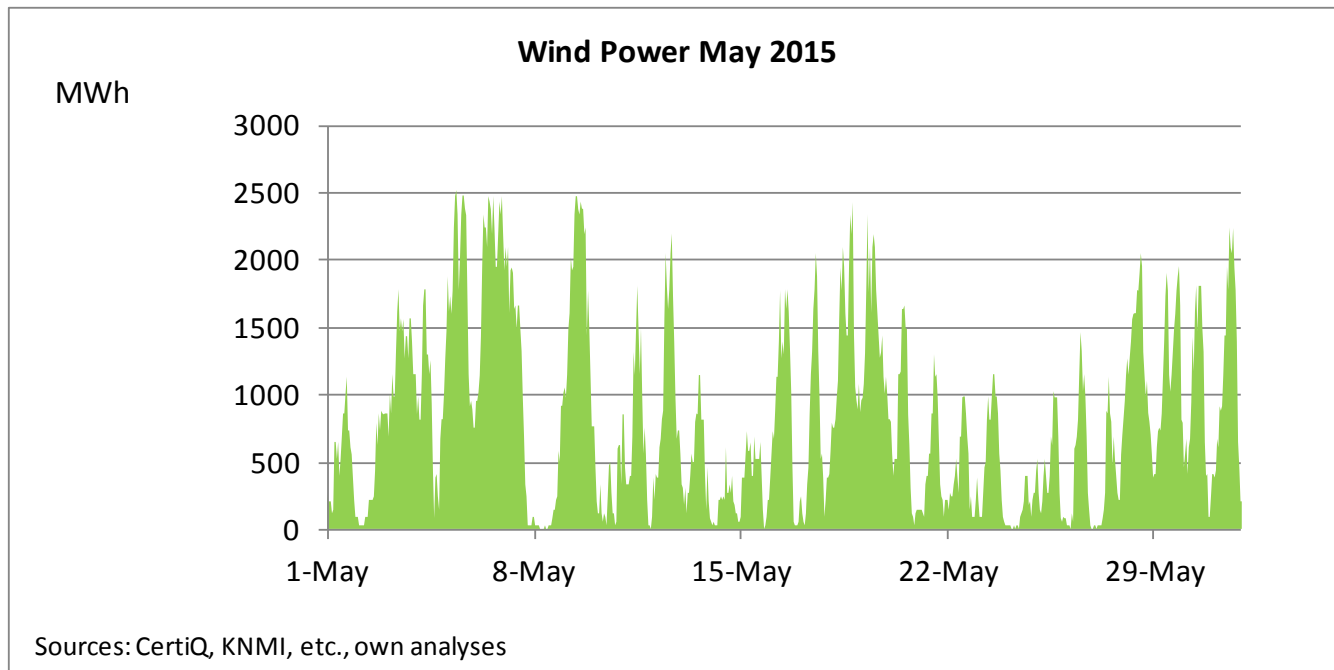


# Power Imports & Exports May 2015



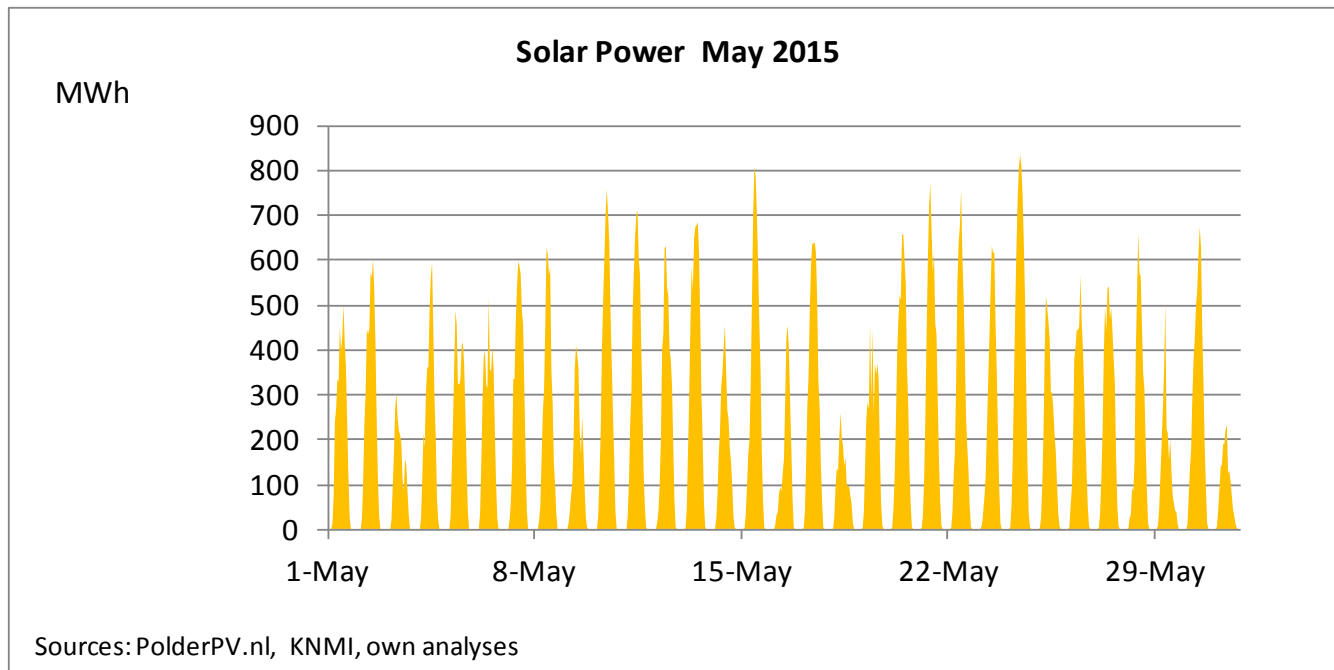
In May 2015, little power exports were recorded while power imports soared compared to previous months.

# Wind Power May 2015



May 2015 was characterized by a highly volatile wind pattern. The utilization rate of the available wind capacity was 27%.

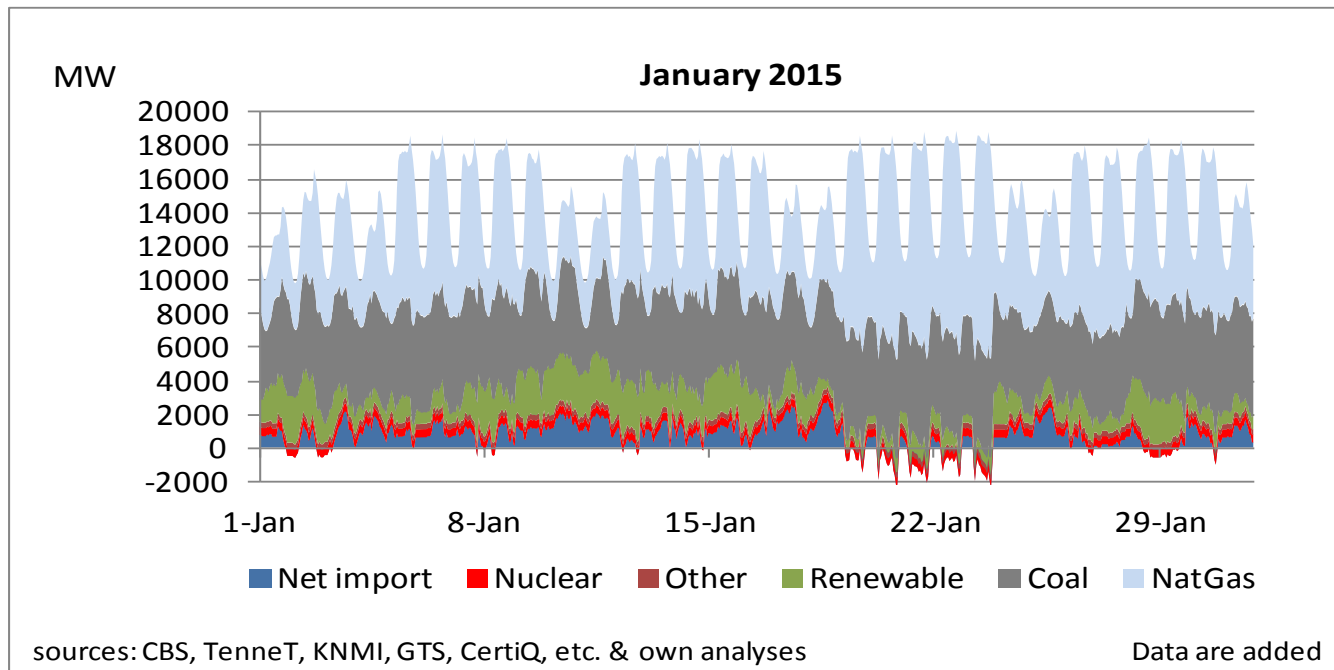
# Solar PV Power May 2015



In May Solar-PV reached a new Dutch record level of 141 GWh. Solar-PV peaked to more than 800 MW, up from its previous record of 700 MW in April. In May, the average utilization rate of the solar PV installed was 15%.

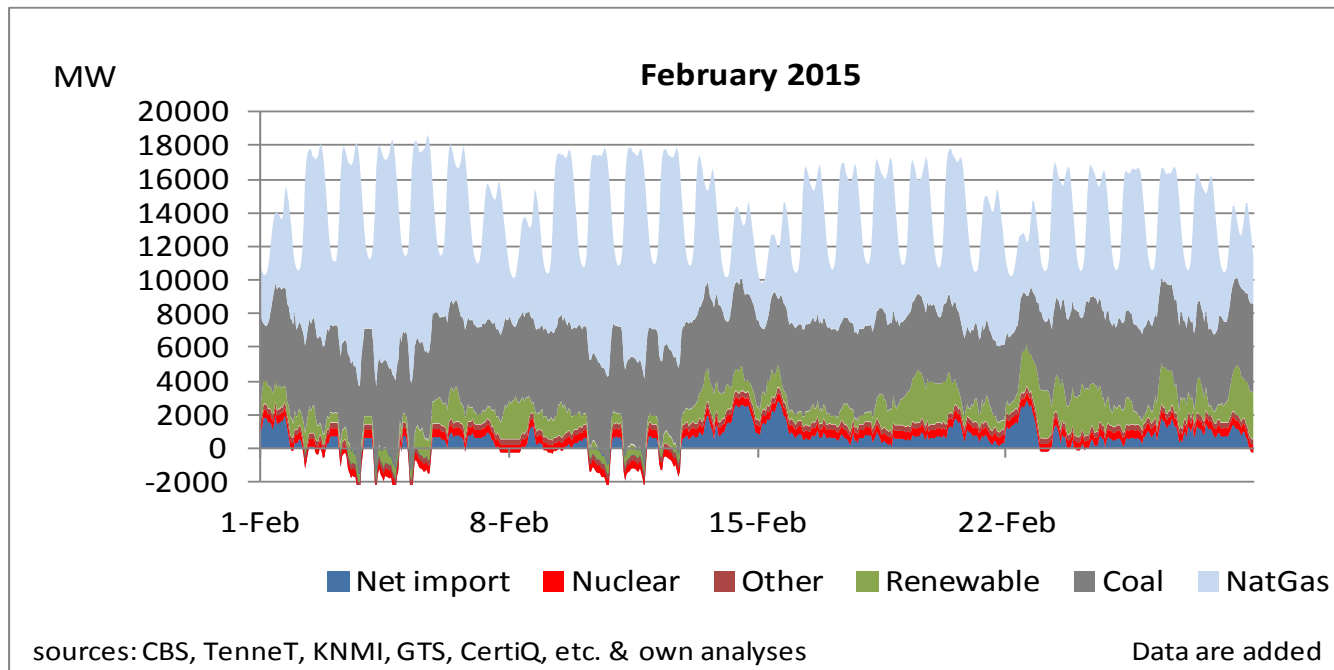
The following set of slides presents for each month in 2015 the hourly contributions of various energy sources to total power consumption in The Netherlands.

# Power Generation January 2015



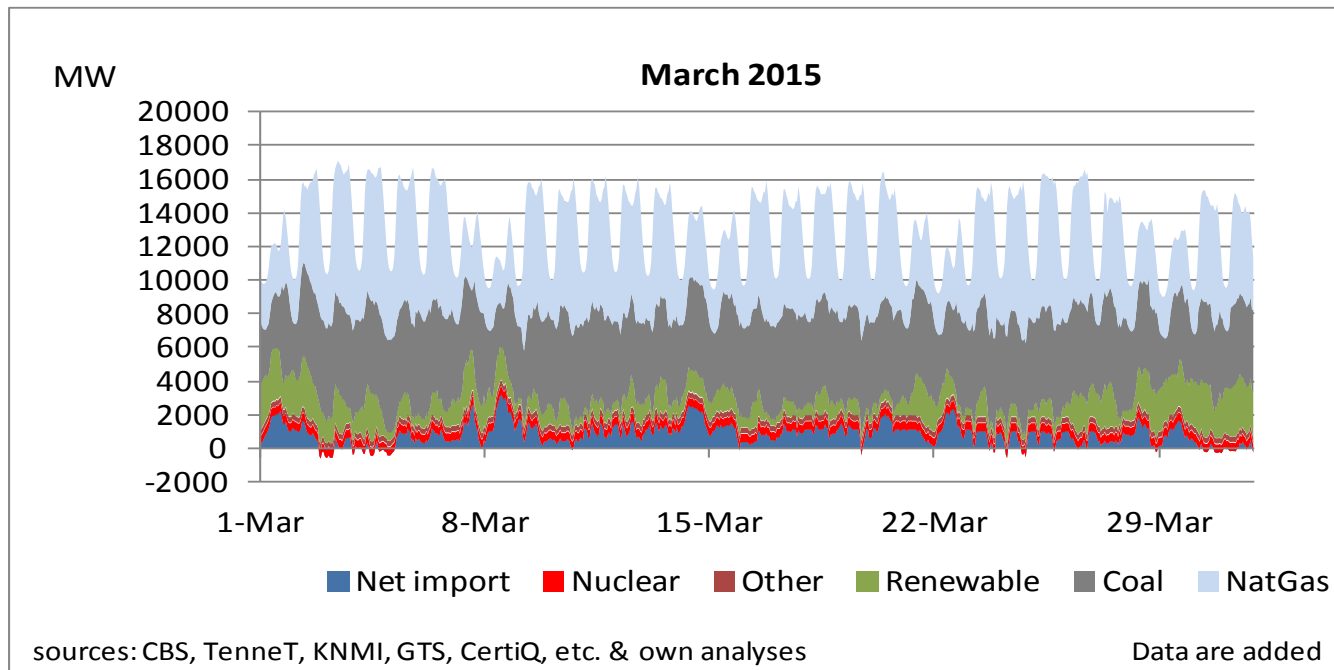
In the week of 20-24 January, power generation peaked, due to the net exports that occurred. The majority of the additional power generation has been generated by gas-fired installations.

# Power Generation February 2015



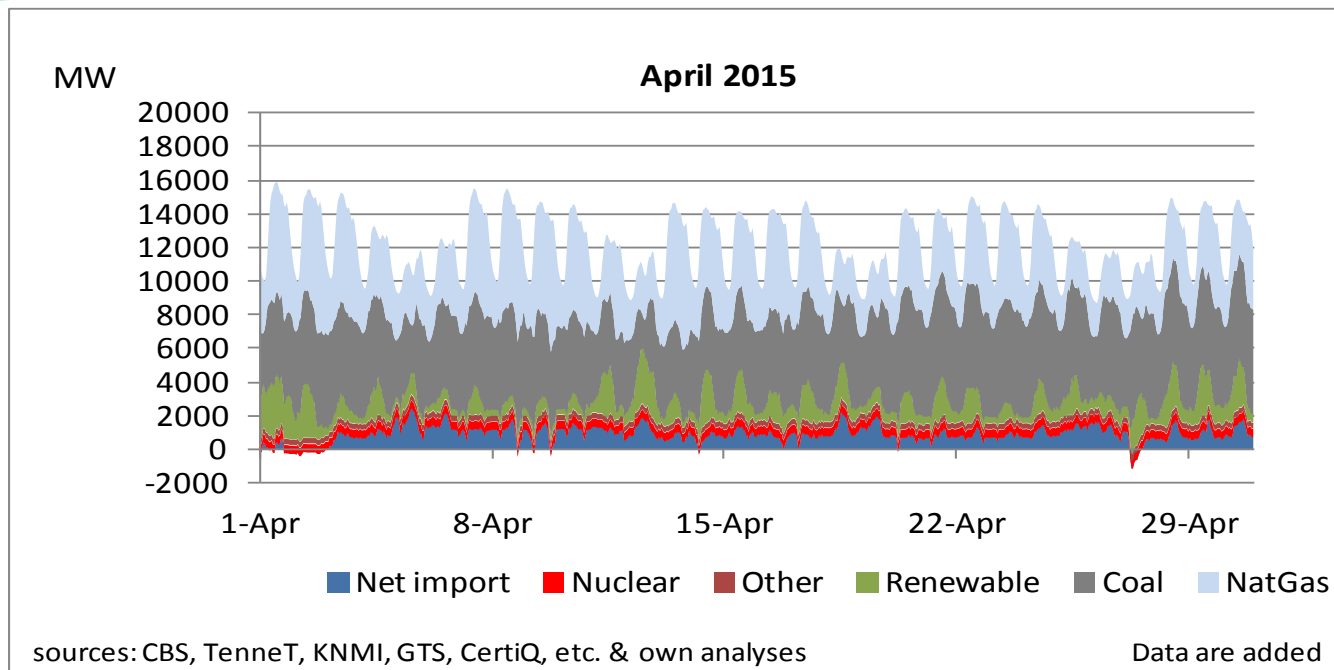
Like in January, low wind availability coincided with net exports of power.

# Power Generation March 2015



Relatively low imports of power occurred in March. On several Saturdays, some net exports were recorded.

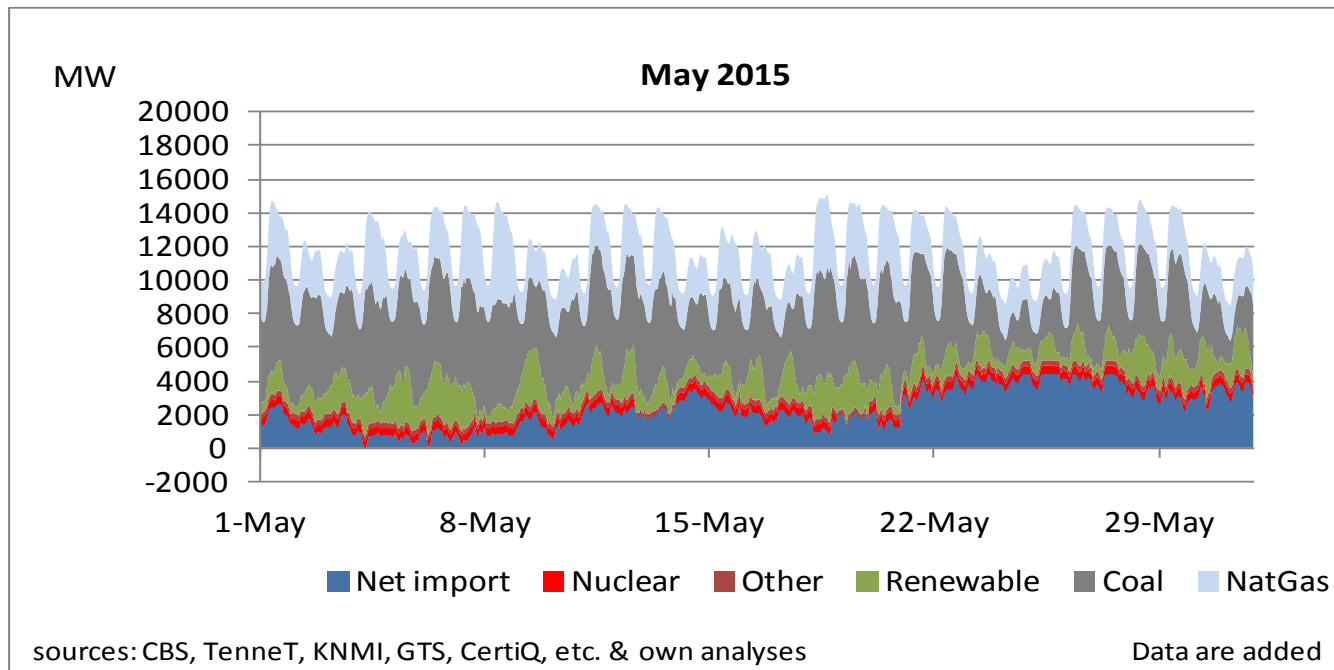
# Power Generation April 2015



Relatively low imports of power occurred in April. On several occasions, mainly on Saturdays, net exports were recorded. April showed several days with high coal-fired generation, while gas-fired generation was low.



# Power Generation May 2015



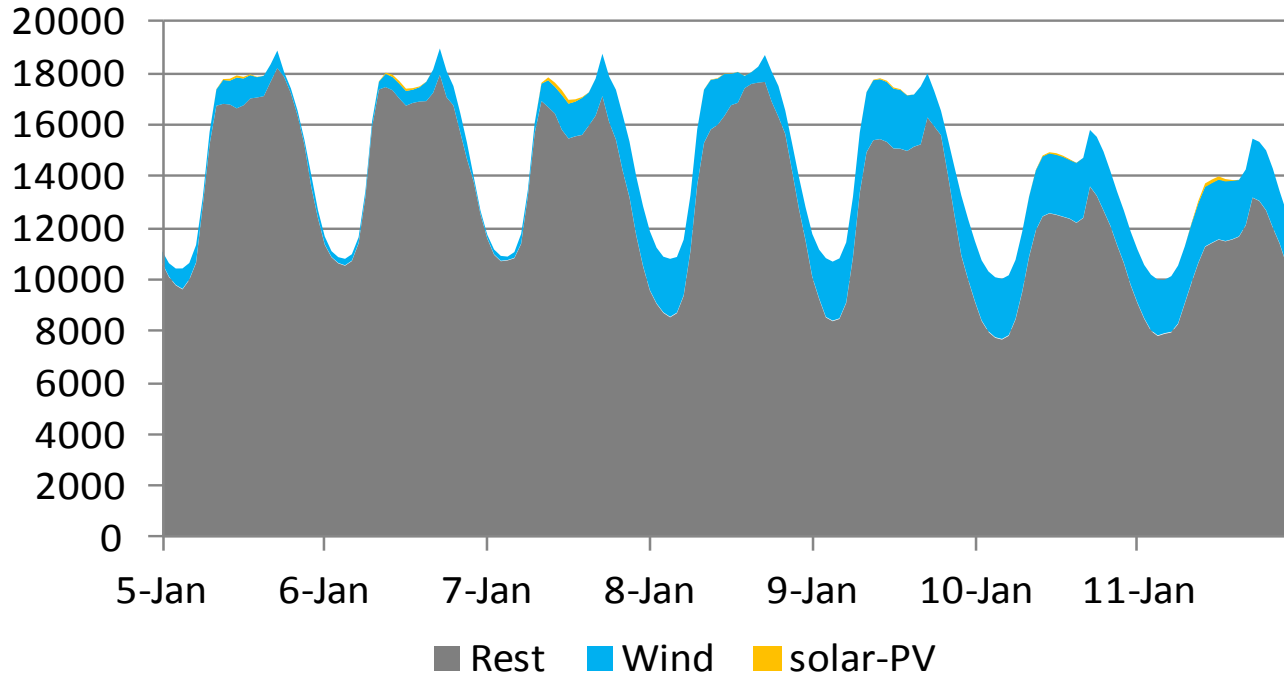
In May, high net imports and high coal utilization squeezed gas-fired power generation.

The following set of slides presents for each week in 2015 the hourly contributions of wind and solar-PV to the total power consumption in The Netherlands.

# Hourly Solar-PV and Wind Generation 2015

MWh

2015

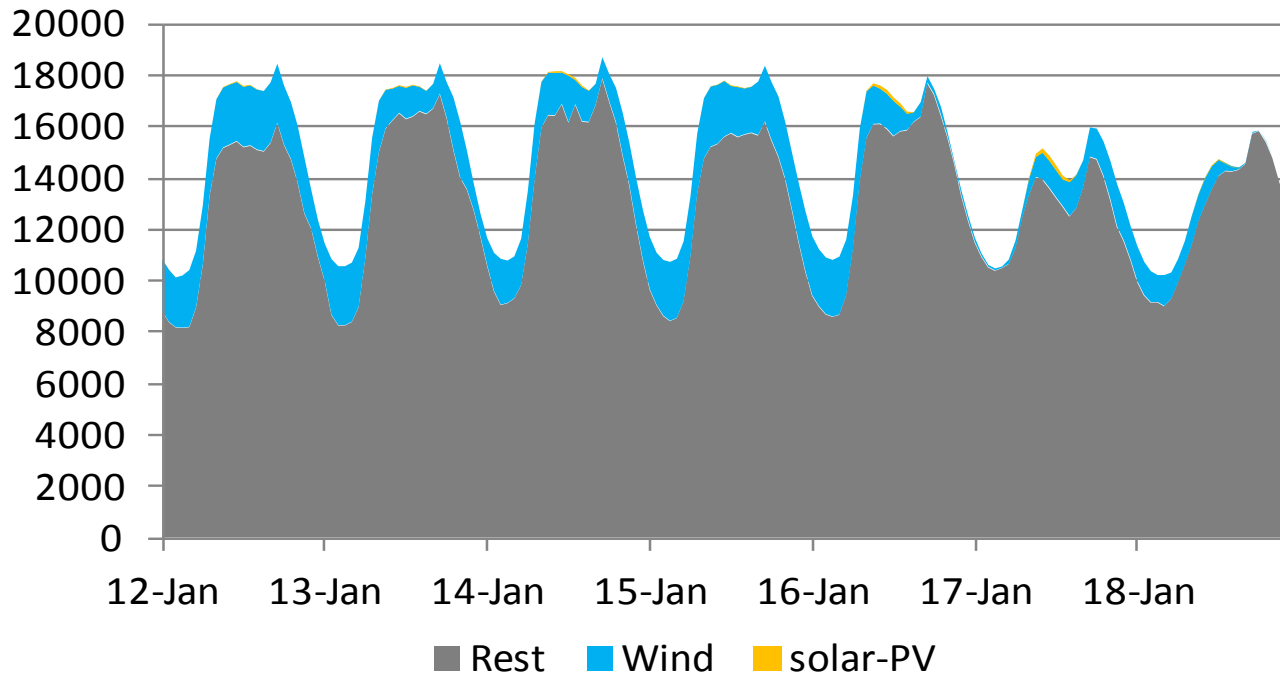


Sources: TenneT, CertiQ,, PolderPV.nl, KNMI, etc., own analyses

# Hourly Solar-PV and Wind Generation 2015

MWh

2015

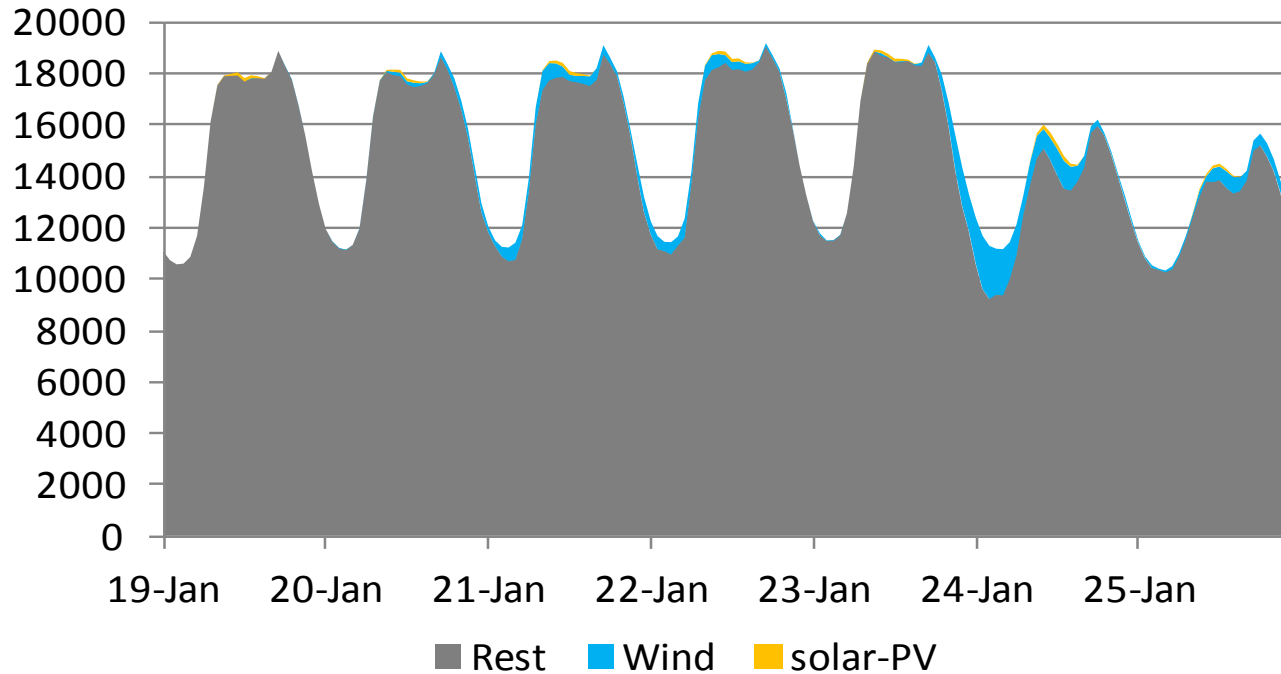


Sources: TenneT, CertiQ, PolderPV.nl, KNMI, etc., own analyses

# Hourly Solar-PV and Wind Generation 2015

MWh

2015

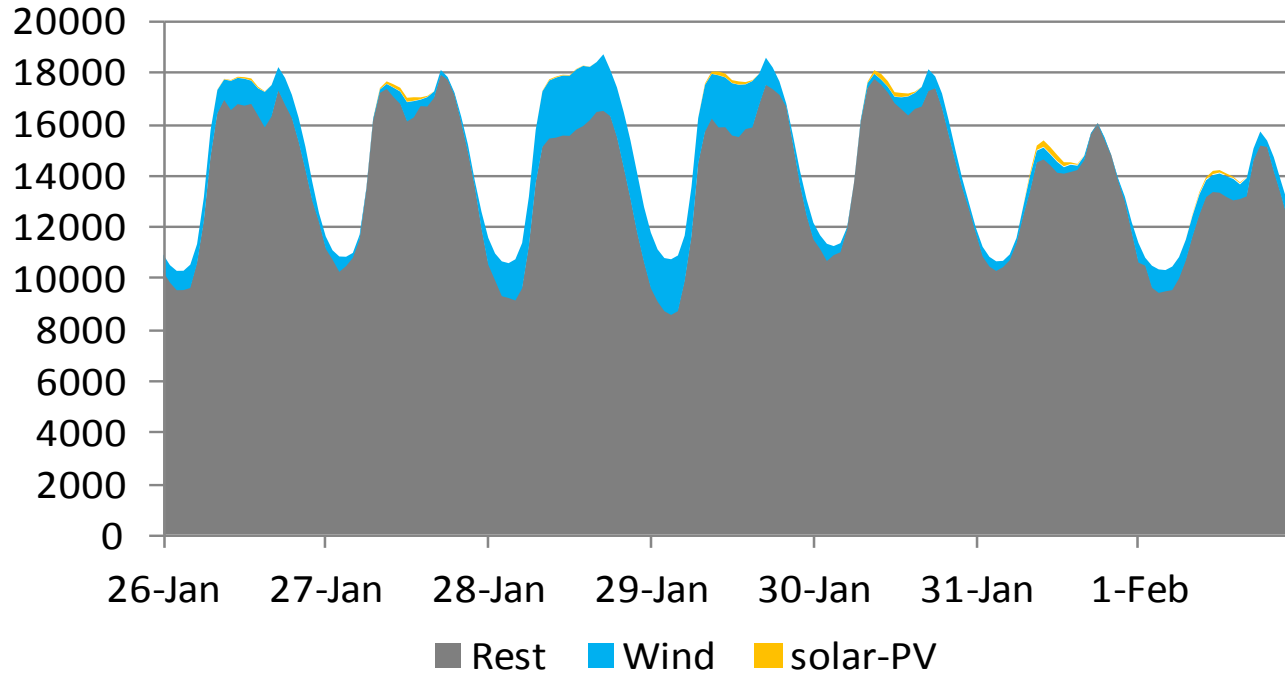


Sources: TenneT, CertiQ, PolderPV.nl, KNMI, etc., own analyses

# Hourly Solar-PV and Wind Generation 2015

MWh

2015

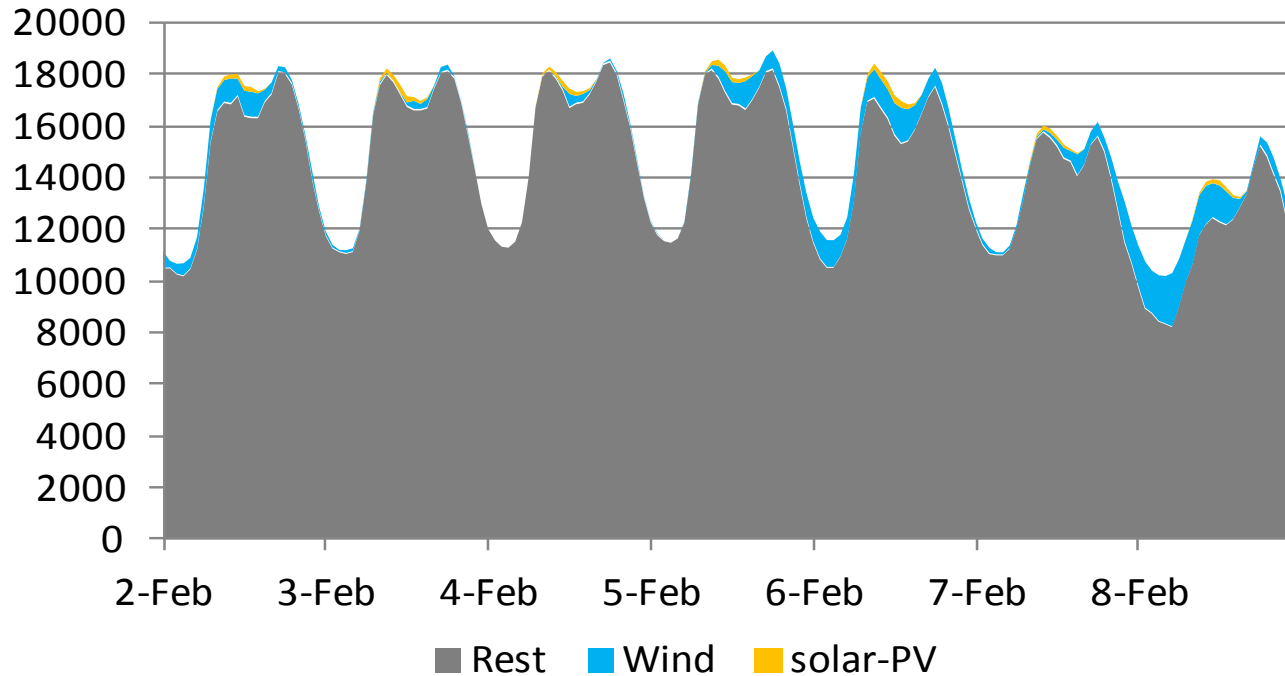


Sources: TenneT, CertiQ, PolderPV.nl, KNMI, etc., own analyses

# Hourly Solar-PV and Wind Generation 2015

MWh

2015

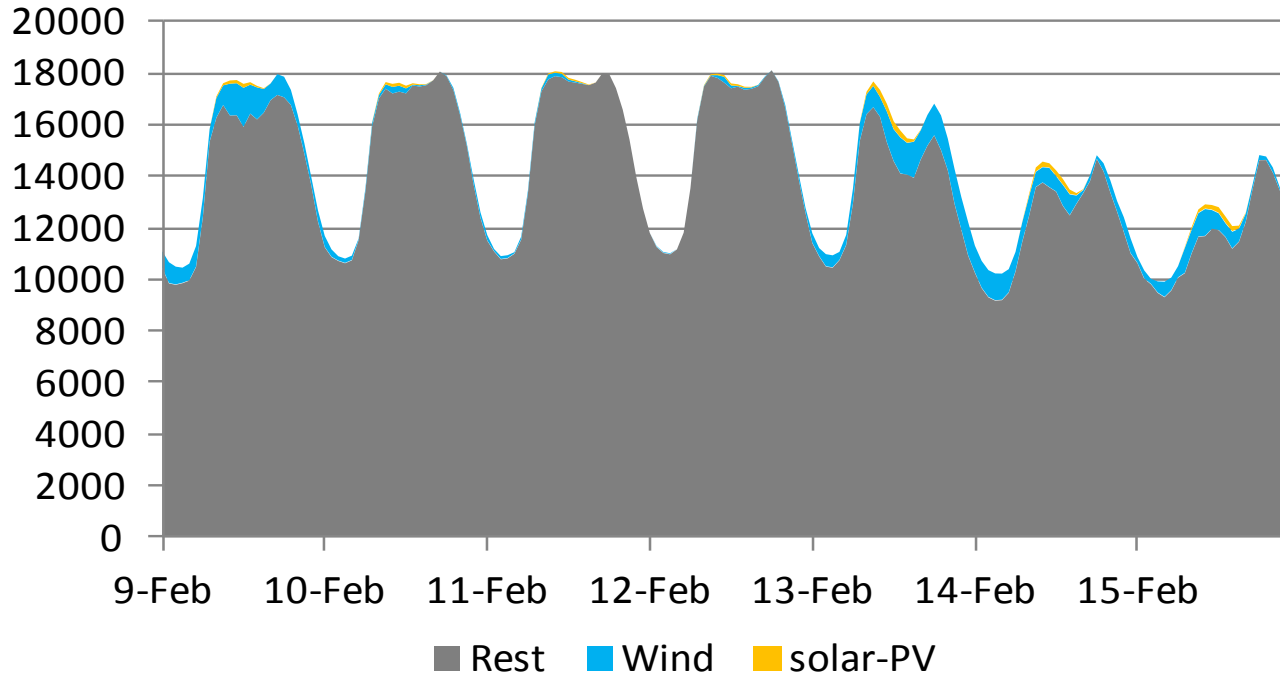


Sources: TenneT, CertiQ, KNMI, PolderPV.nl, etc., own analyses

# Hourly Solar-PV and Wind Generation 2015

MWh

2015



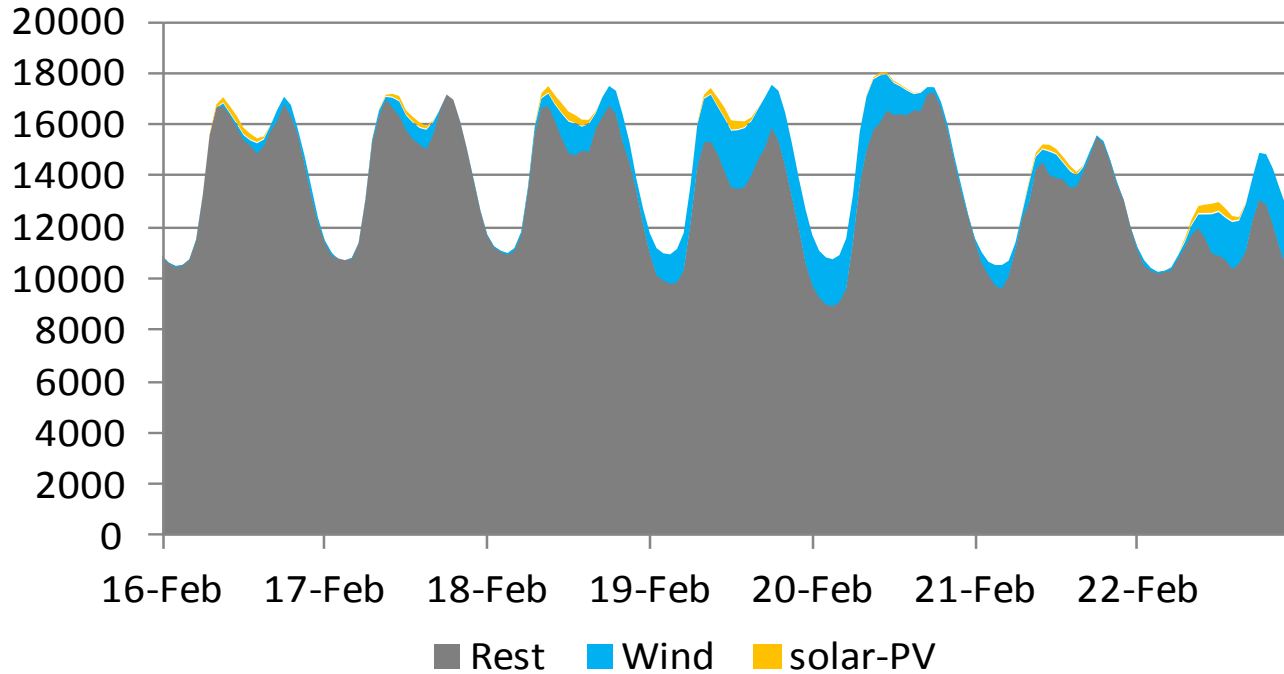
Sources: TenneT, CertiQ, KNMI, PolderPV.nl, etc., own analyses



# Hourly Solar-PV and Wind Generation 2015

MWh

2015

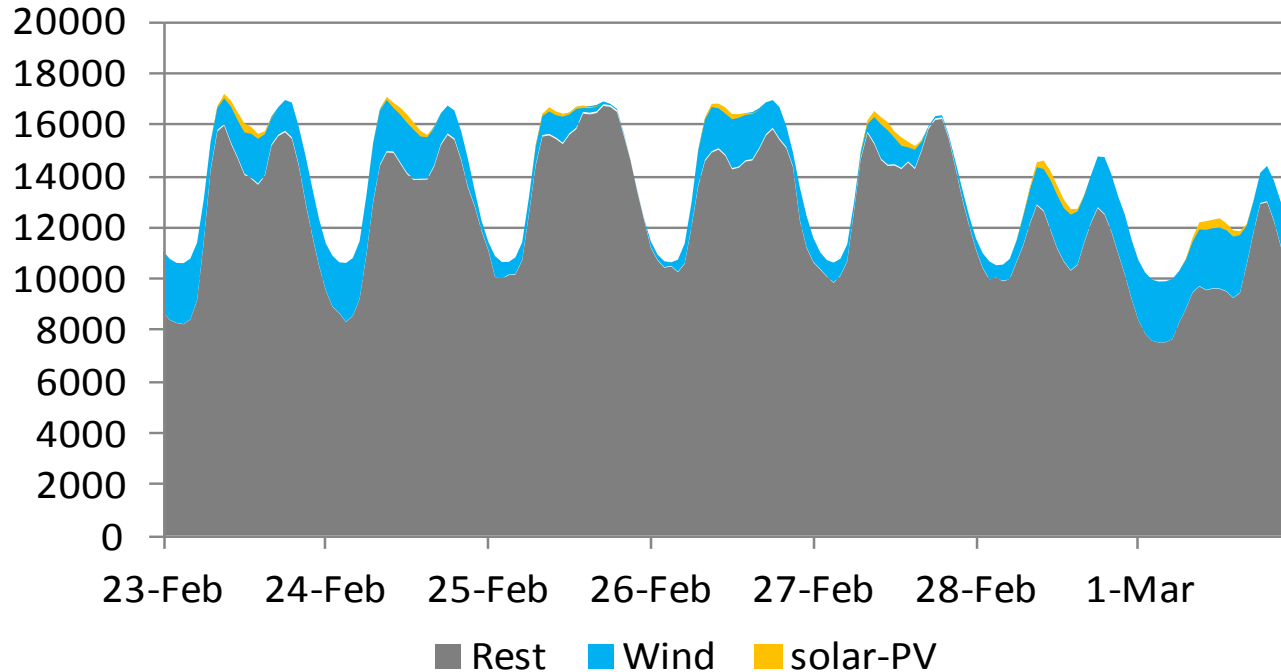


Sources: TenneT, CertiQ, PolderPV.nl, KNMI, etc., own analyses

# Hourly Solar-PV and Wind Generation 2015

MWh

2015

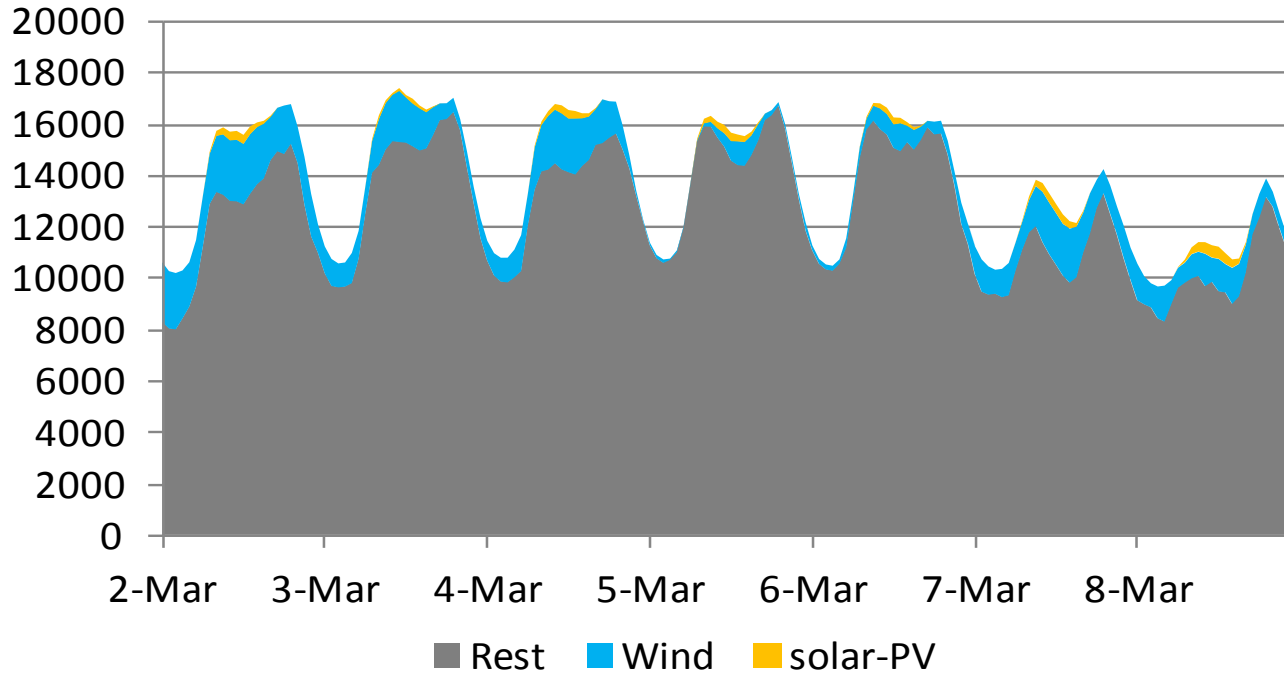


Sources: TenneT, CertiQ, PolderPV.nl, KNMI, etc., own analyses

# Hourly Solar-PV and Wind Generation 2015

MWh

2015

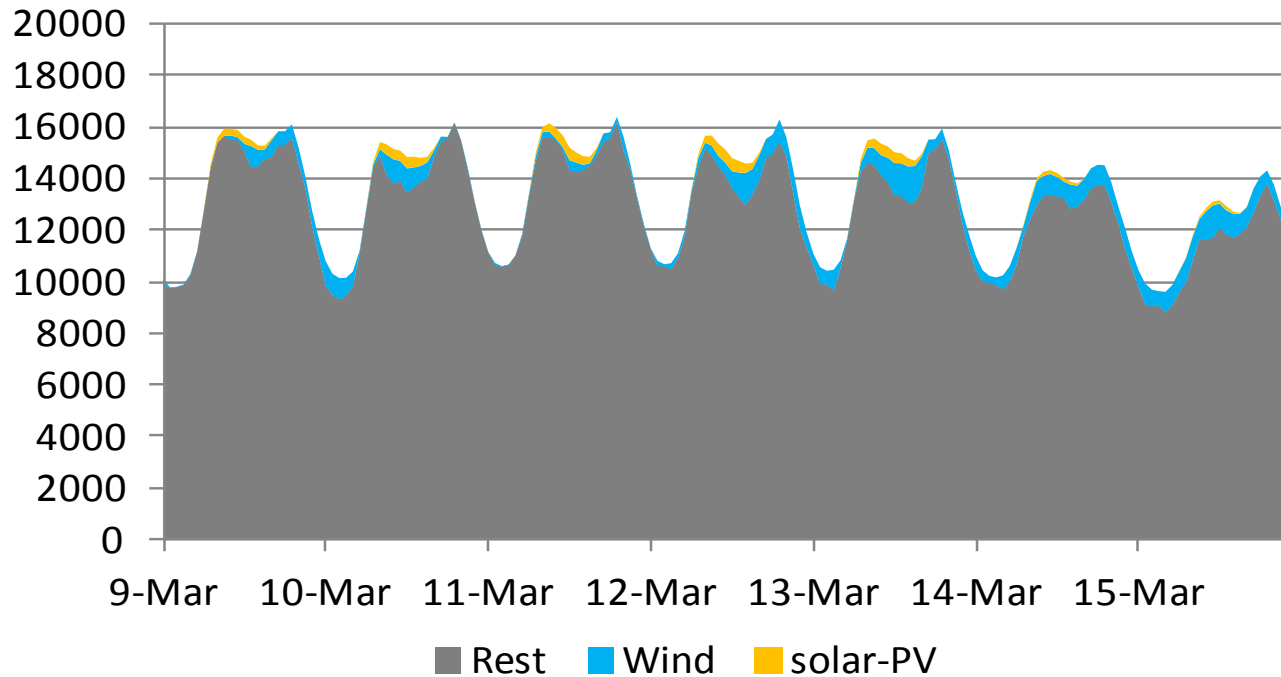


Sources: TenneT, CertiQ, Windstats, Klimaatmonitor, PolderPV.nl, KNMI, own analyses

# Hourly Solar-PV and Wind Generation 2015

MWh

2015

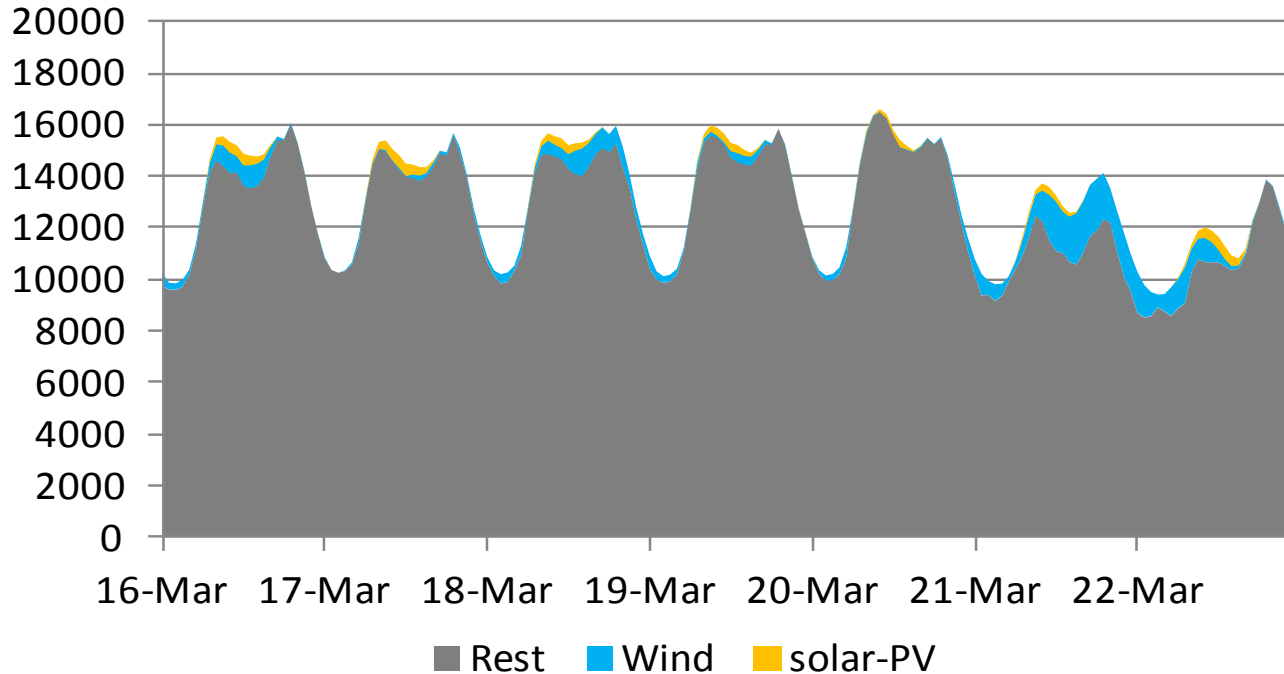


Sources: TenneT, CertiQ, Windstats, Klimaatmonitor, PolderPV.nl, KNMI, own analyses

# Hourly Solar-PV and Wind Generation 2015

MWh

2015

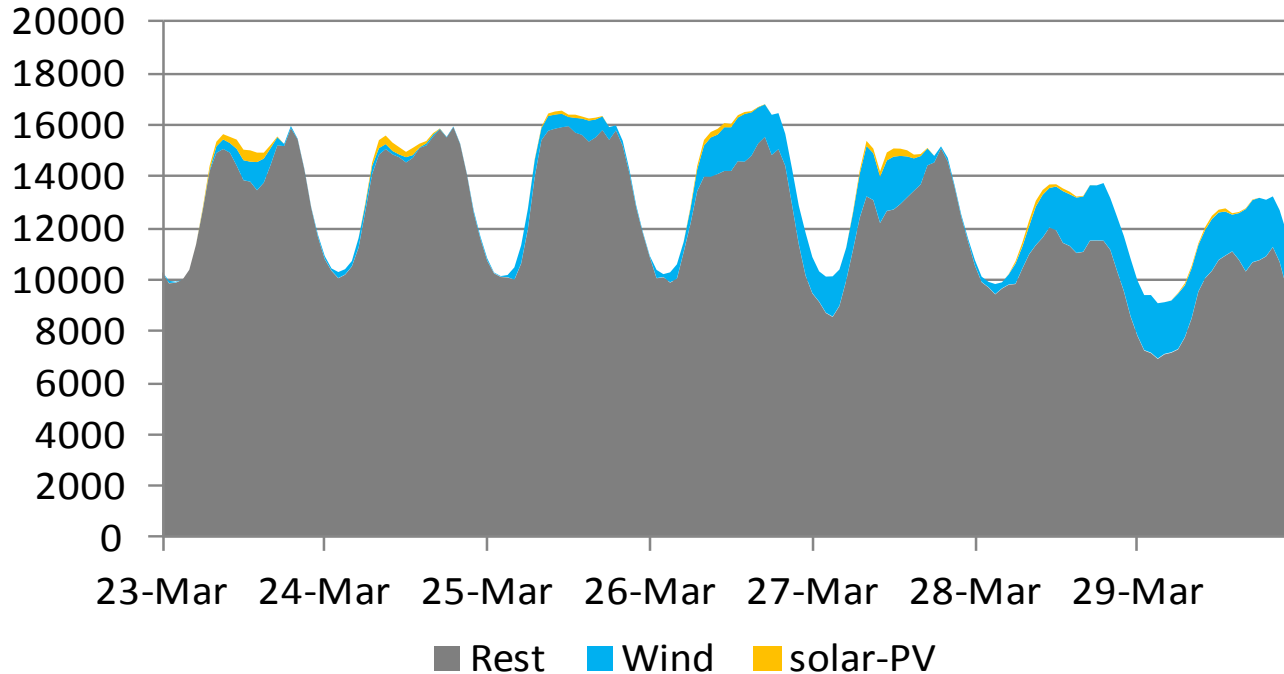


Sources: TenneT, CertiQ, Windstats, Klimaatmonitor, PolderPV.nl, KNMI, own analyses

# Hourly Solar-PV and Wind Generation 2015

MWh

2015

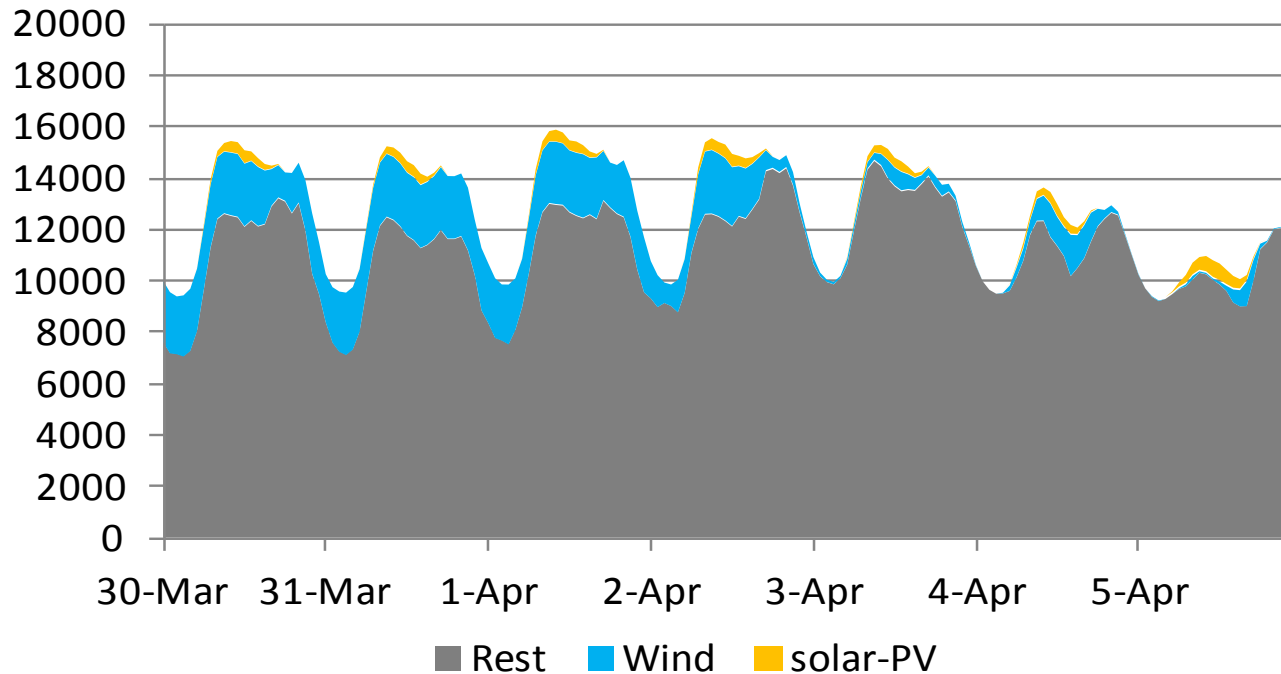


Sources: TenneT, CertiQ, Windstats, Klimaatmonitor, PolderPV.nl, KNMI, own analyses

# Hourly Solar-PV and Wind Generation 2015

MWh

2015

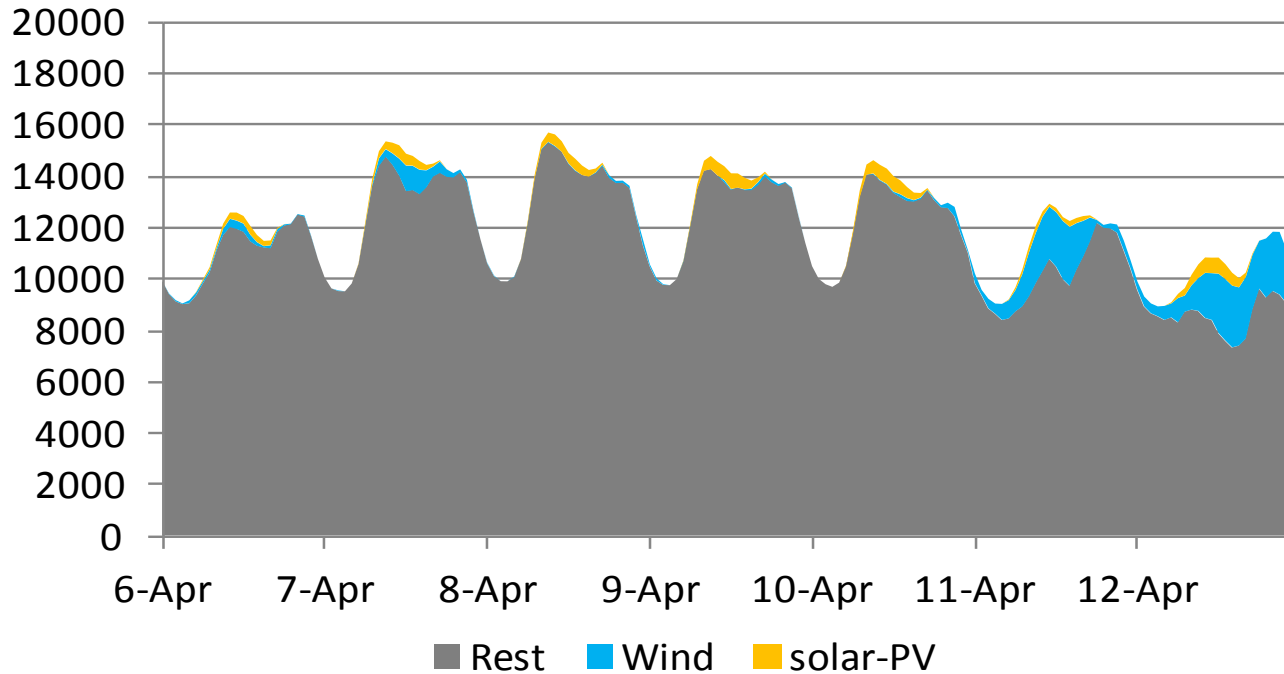


Sources: TenneT, CertiQ, Windstats, Klimaatmonitor, PolderPV.nl, KNMI, own analyses

# Hourly Solar-PV and Wind Generation 2015

MWh

2015



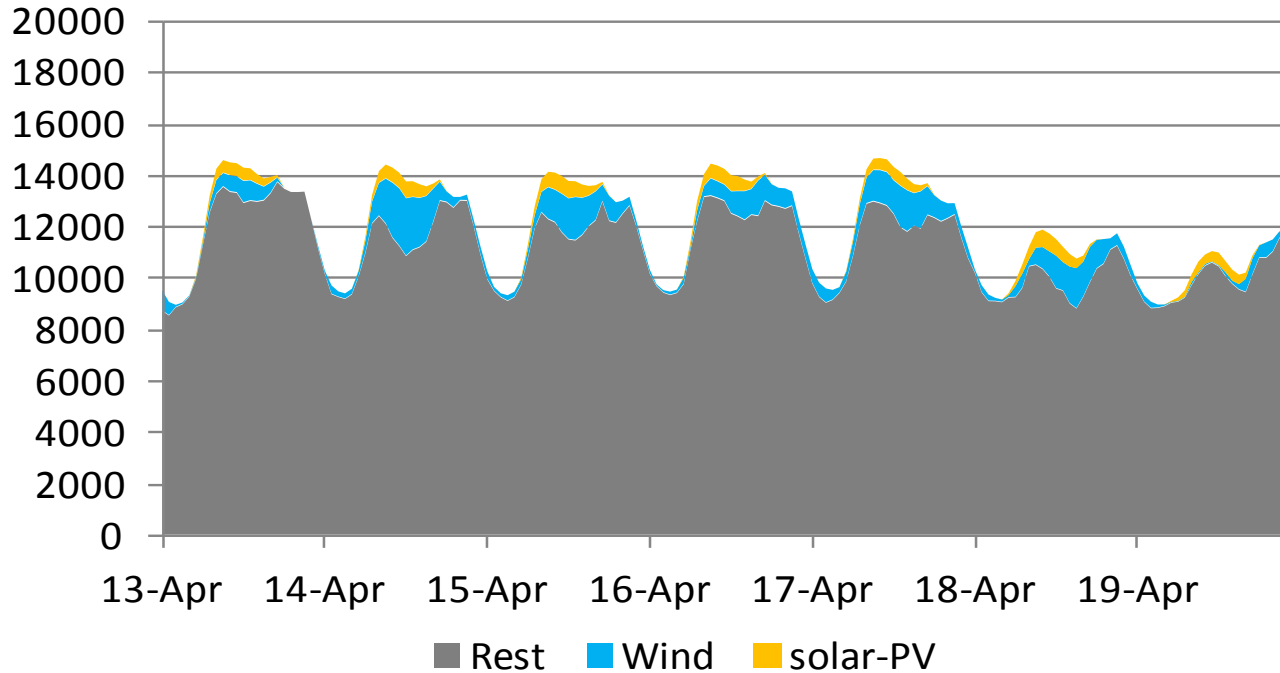
Sources: TenneT, CertiQ, Windstats, Klimaatmonitor, PolderPV.nl, KNMI, own analyses



# Hourly Solar-PV and Wind Generation 2015

MWh

2015

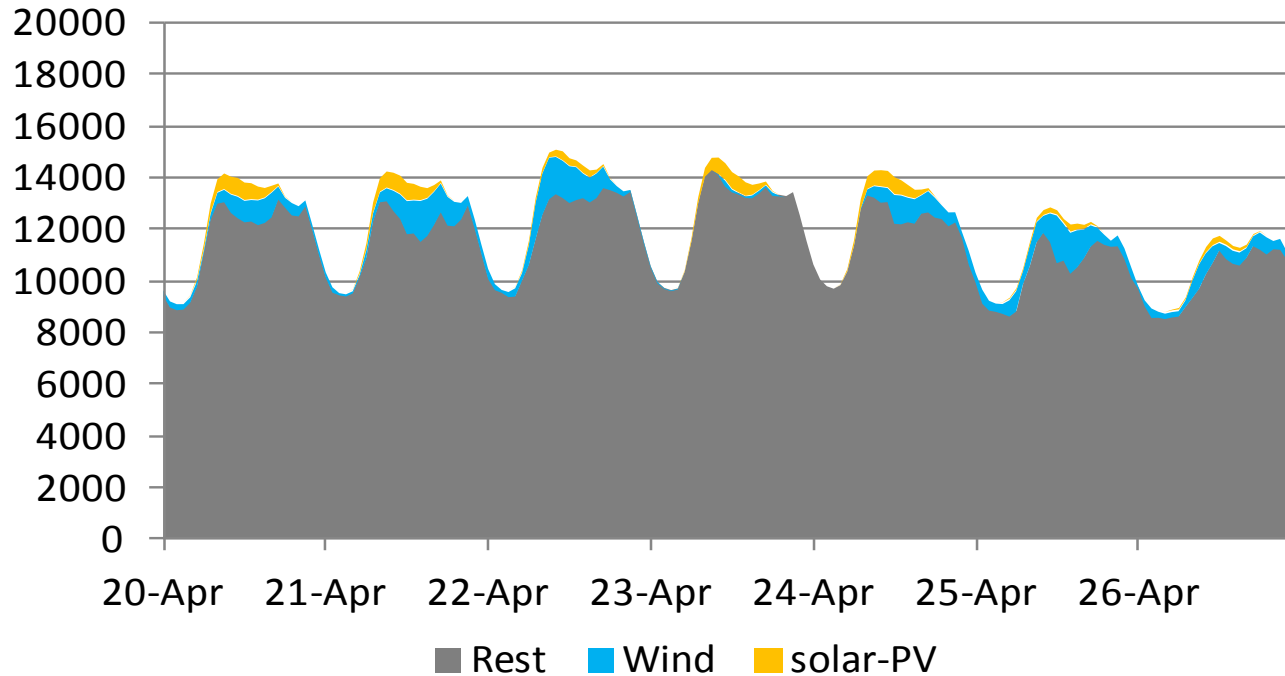


Sources: TenneT, CertiQ, Windstats, Klimaatmonitor, PolderPV.nl, KNMI, own analyses

# Hourly Solar-PV and Wind Generation 2015

MWh

2015

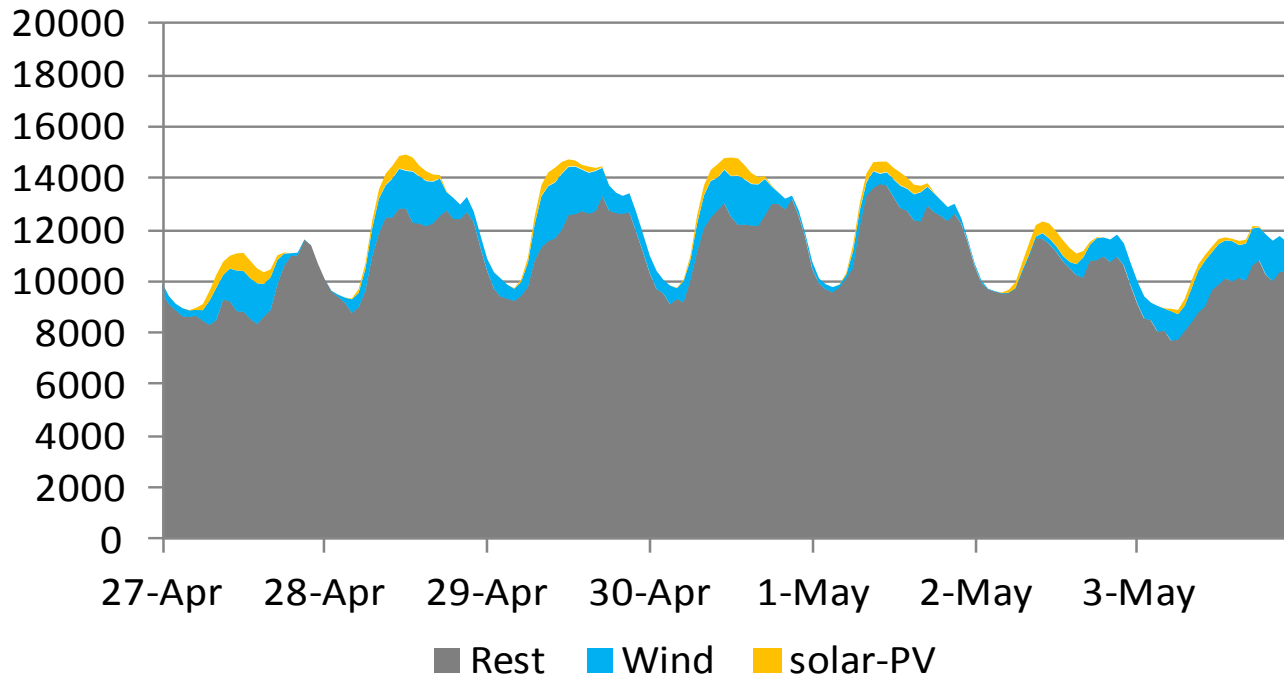


Sources: TenneT, CertiQ, Windstats, Klimaatmonitor, PolderPV.nl, KNMI, own analyses

# Hourly Solar-PV and Wind Generation 2015

MWh

2015

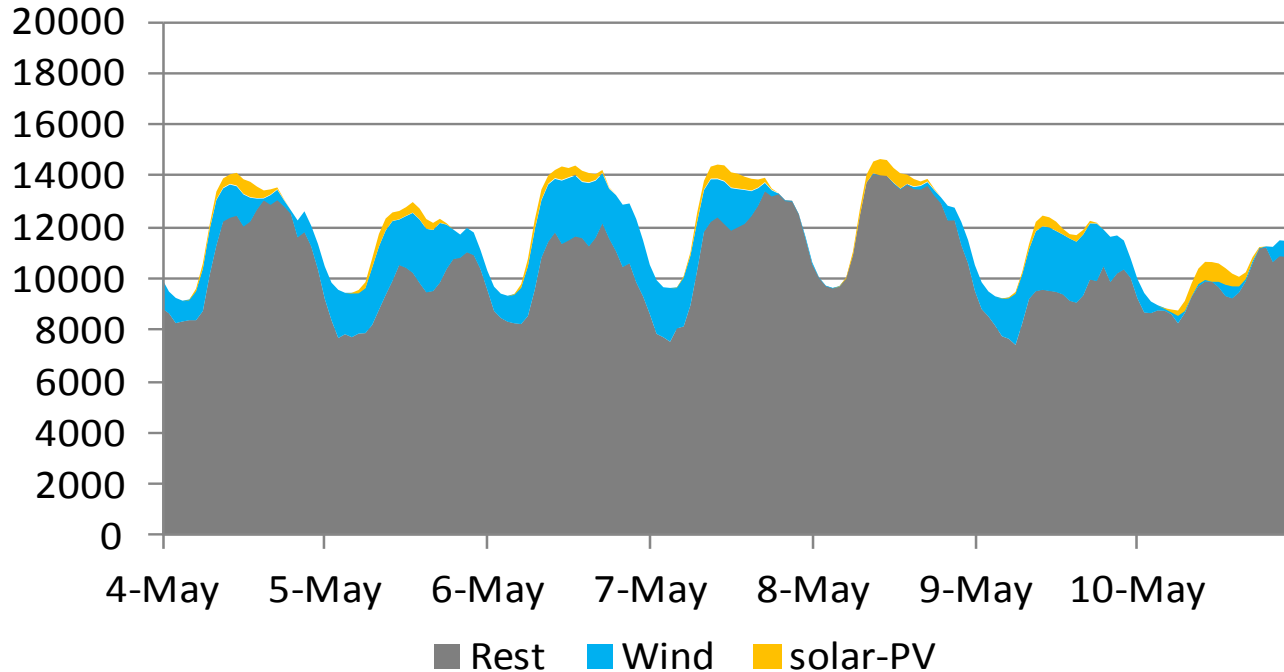


Sources: TenneT, CertiQ, Windstats, Klimaatmonitor, PolderPV.nl, KNMI, own analyses

# Hourly Solar-PV and Wind Generation 2015

MWh

2015

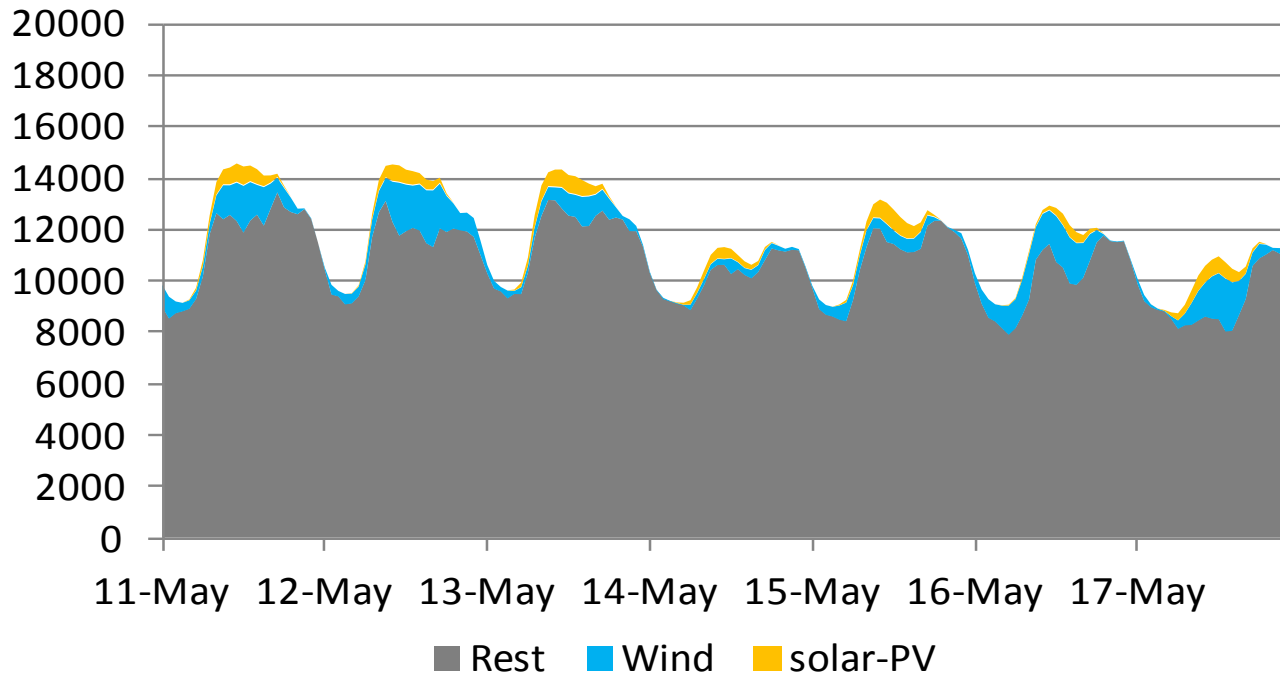


Sources: TenneT, CertiQ, Windstats, Klimaatmonitor, PolderPV.nl, KNMI, own analyses

# Hourly Solar-PV and Wind Generation 2015

MWh

2015

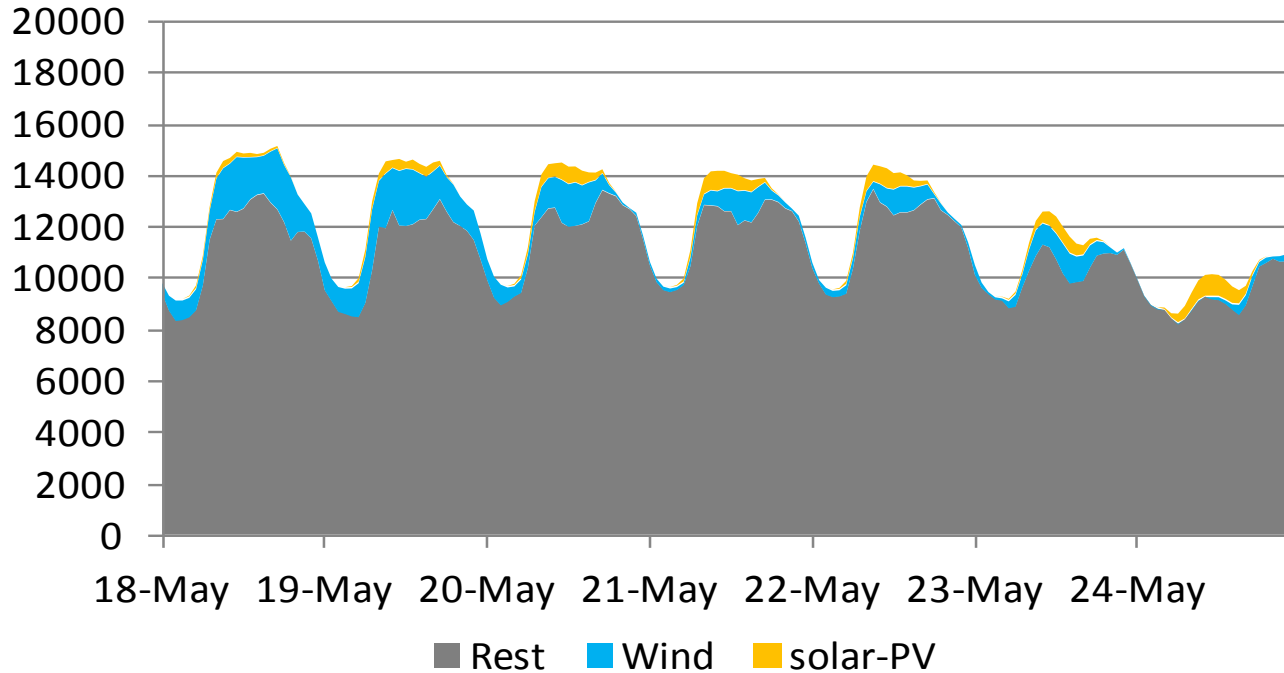


Sources: TenneT, CertiQ, Windstats, Klimaatmonitor, PolderPV.nl, KNMI, own analyses

# Hourly Solar-PV and Wind Generation 2015

MWh

2015

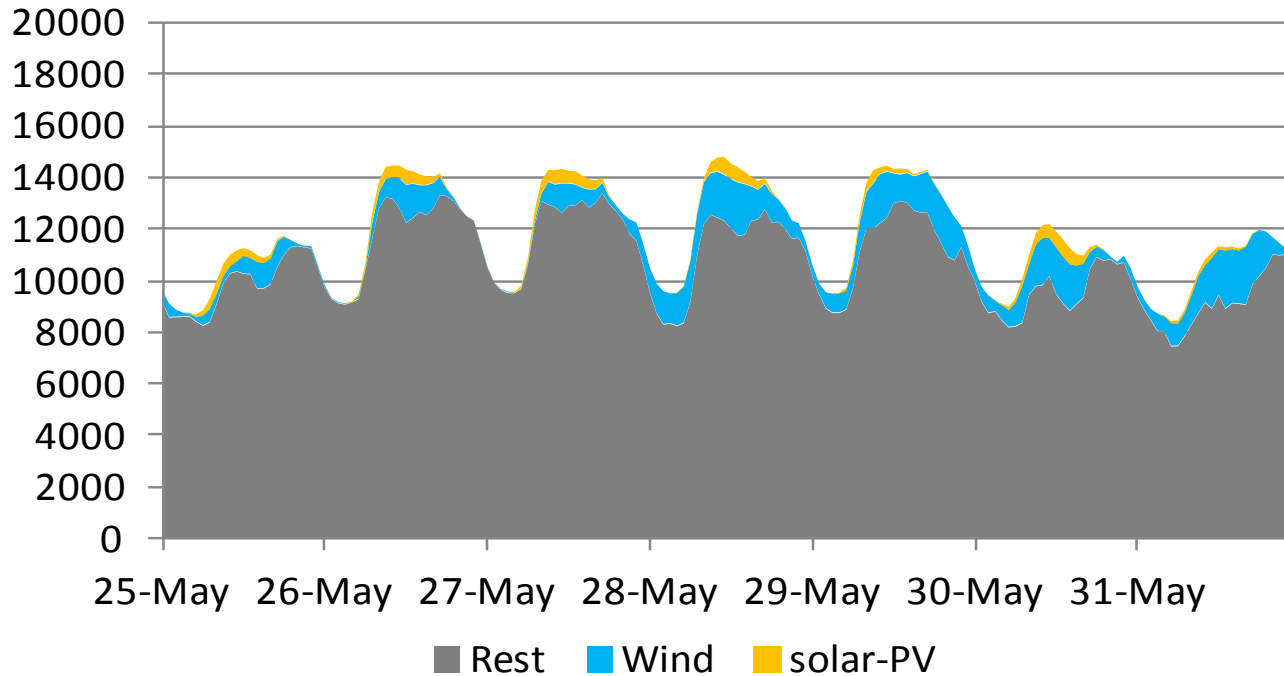


Sources: TenneT, CertiQ, Windstats, Klimaatmonitor, PolderPV.nl, KNMI, own analyses

# Hourly Solar-PV and Wind Generation 2015

MWh

2015

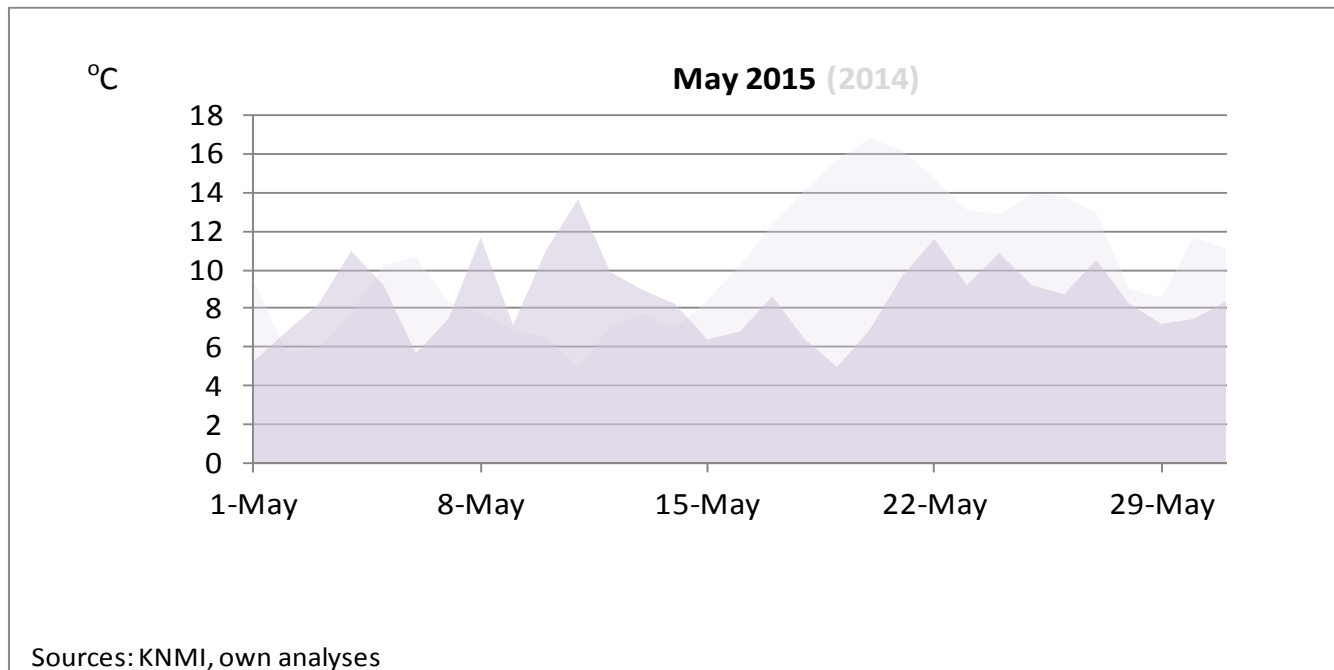


Sources: TenneT, CertiQ, Windstats, Klimaatmonitor, PolderPV.nl, KNMI, own analyses

# MISCELLANEOUS

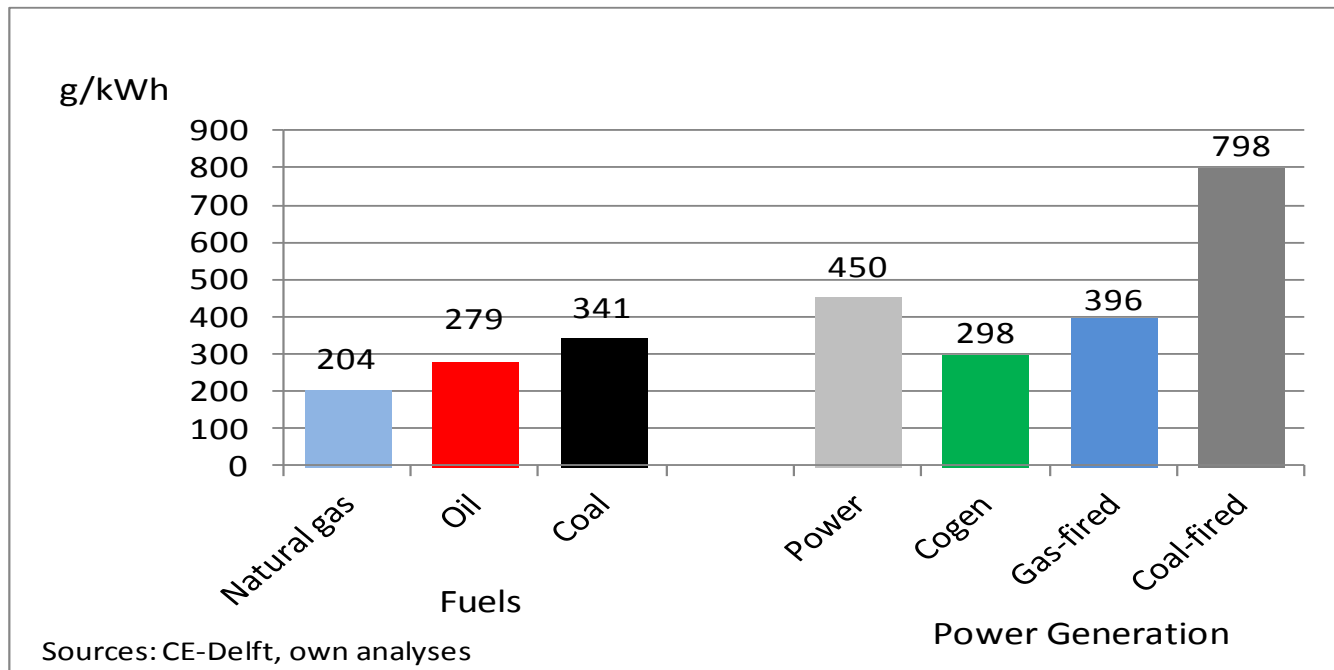


# Effective Temperature 2015



The effective temperature (temperature including wind shield factor). The beginning of May registered colder temperatures than last year. For comparison, effective daily temperatures of May 2014 are presented as well.

# Fuel Specific CO2 Emissions



Characteristic CO2 emissions used in this presentation.

# Epilogue

b.m.visser@pl.hanze.nl

This presentation is based on numerous sources which present data on energy demand and supply in The Netherlands. These data, however, do not cover the entire energy system. Some approximations and scaling factors were thus needed. The author would like to thank students from Hanze University of Applied Science in Groningen and various energy experts in The Netherlands which gave suggestions for improvements of the methods used. Currently, the aggregated results of this work are in good agreement with data supplied by the Dutch National Office of Statistics (CBS). It is believed by the author that the detailed results in this presentation give a fair presentation of the complex reality of the Dutch energy system.

Nevertheless, the author invites readers to comment on the data provided with the objective to further improve this work. After all, good and reliable data are at the heart of any successful policy to make our world more sustainable.