

Renewable Energy in The Netherlands

March 2015



EnTranCe is the living lab of
Energy Academy Europe

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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.

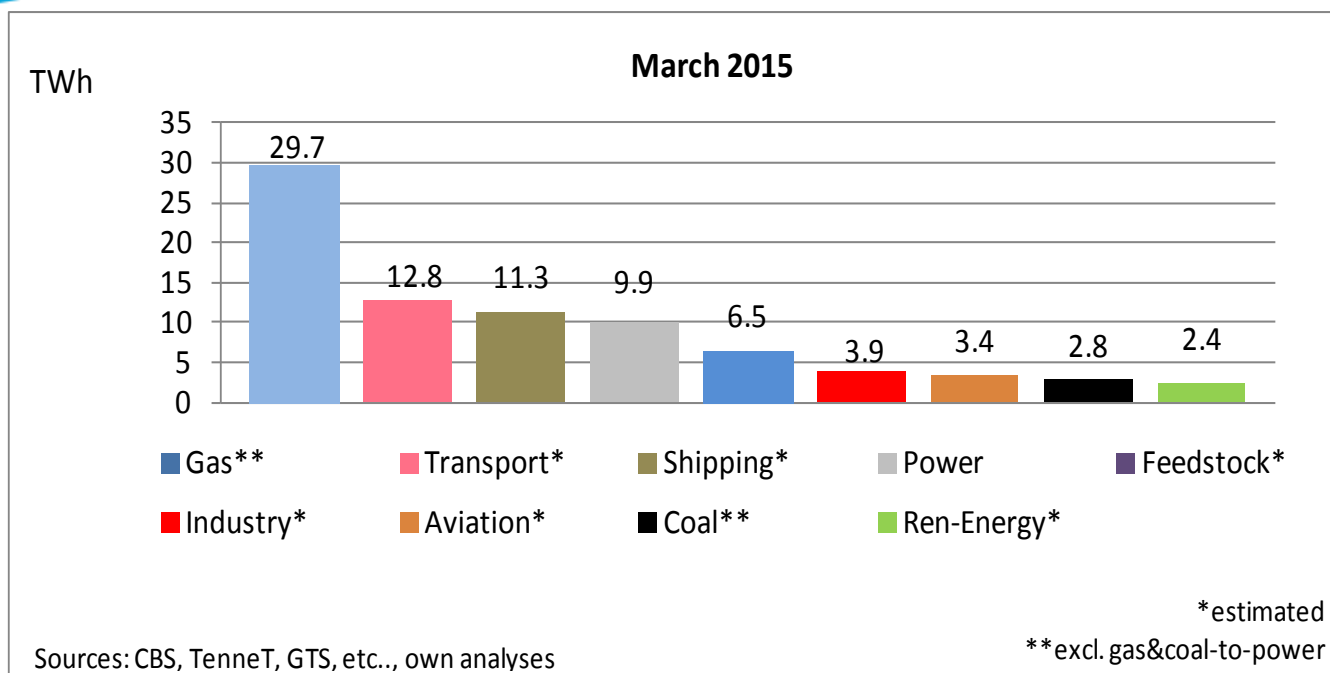
March 2015

In a Nutshell

- Electricity production by Solar Energy was 21% higher than in March 2014
- Electricity production by wind energy was 40% higher than in March 2014
- A capacity of 62 MW of wind and 30 MW of solar PV was added in March 2015
- Power imports into the Netherlands were 65% lower than in previous year
- LNG imports increased by 400% compared to March 2014 (sheet 56)
- Coal fired power generation increased by 20% compared to last year
- In March 2015, CO2 emissions were 8% higher compared to last year
- The fraction renewable energy was 4.0% compared to 4.1% in March 2014
- A solar eclipse occurred on March 20 (sheet 54)
- A partial black-out occurred on March 27 (sheet 55)

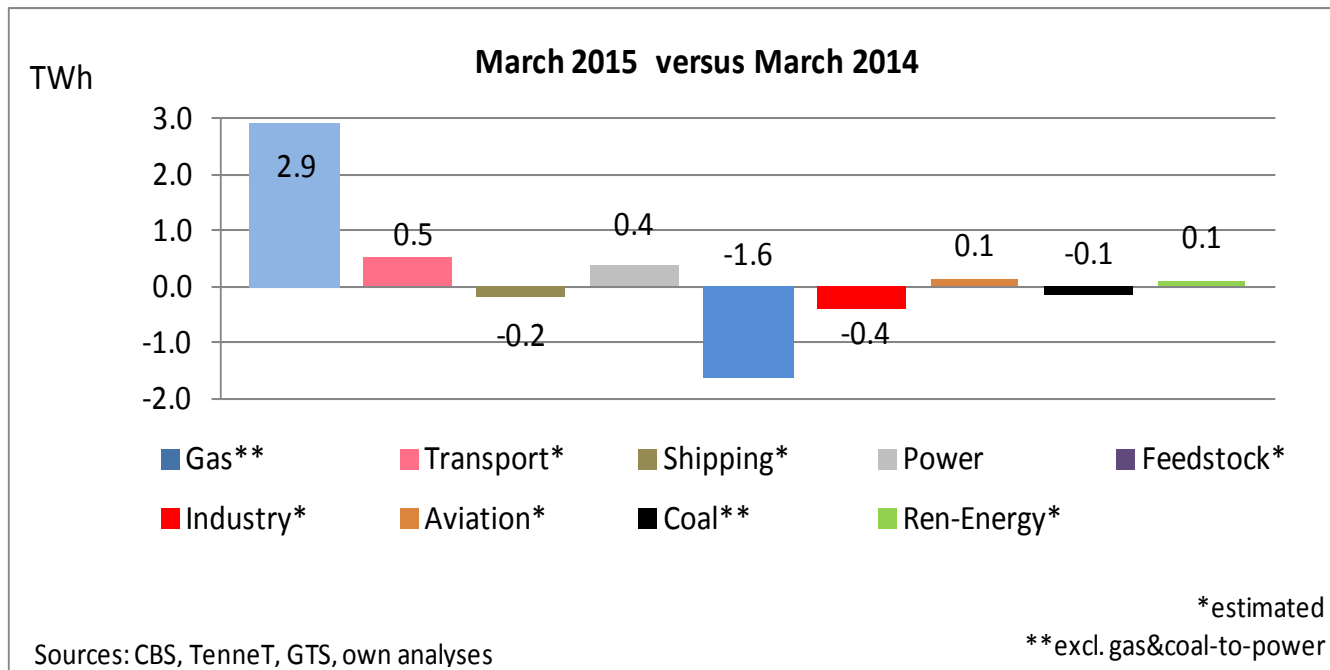
- March 2015 data
- Monthly profiles
- Monthly data
- Hourly data
- Miscellaneous

SELECTED ENERGY DATA FROM MARCH 2015



Energy is used for many different purposes. In March, the most important applications were heating/gas (29.7 TWh) and transport (27.5 TWh). Final energy demand, including sources that do not contribute to national CO2 targets, was about 80 TWh. Renewables are given by comparison.

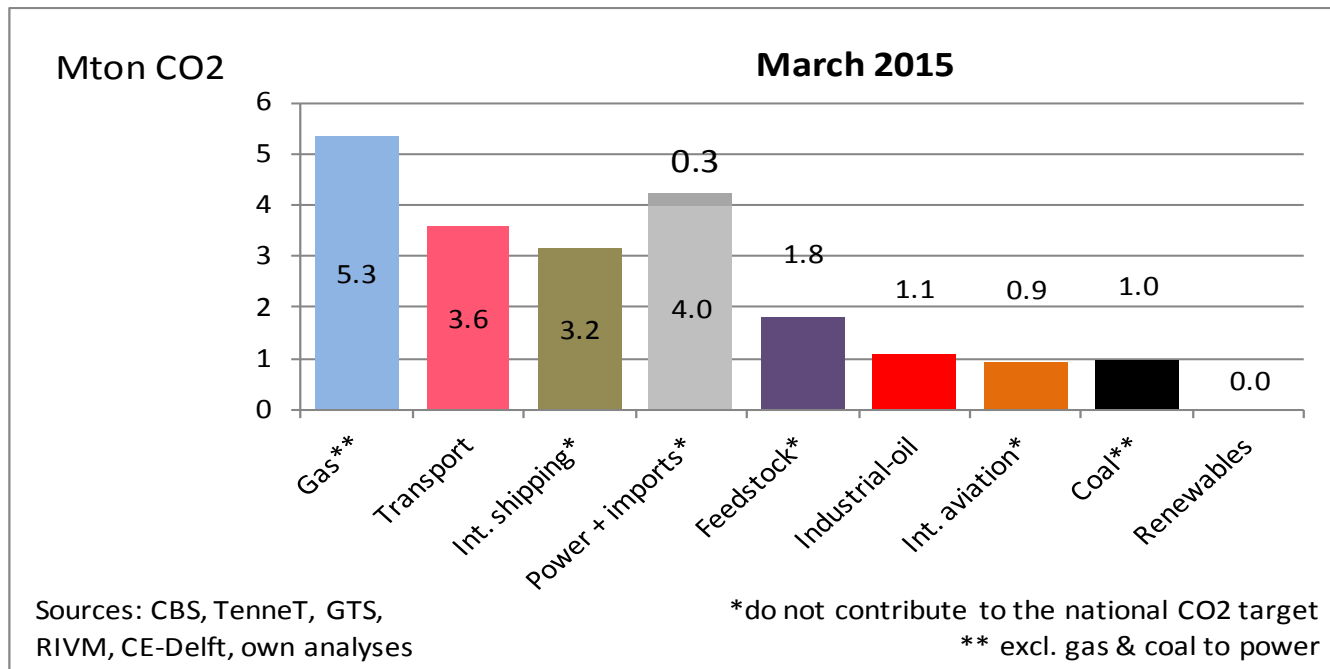
Final Energy Demand March 2015



In March 2015, gas consumption was higher than last year, due to lower winter temperatures. Energy used for bunkering and feedstock is estimated to be lower than previous year.

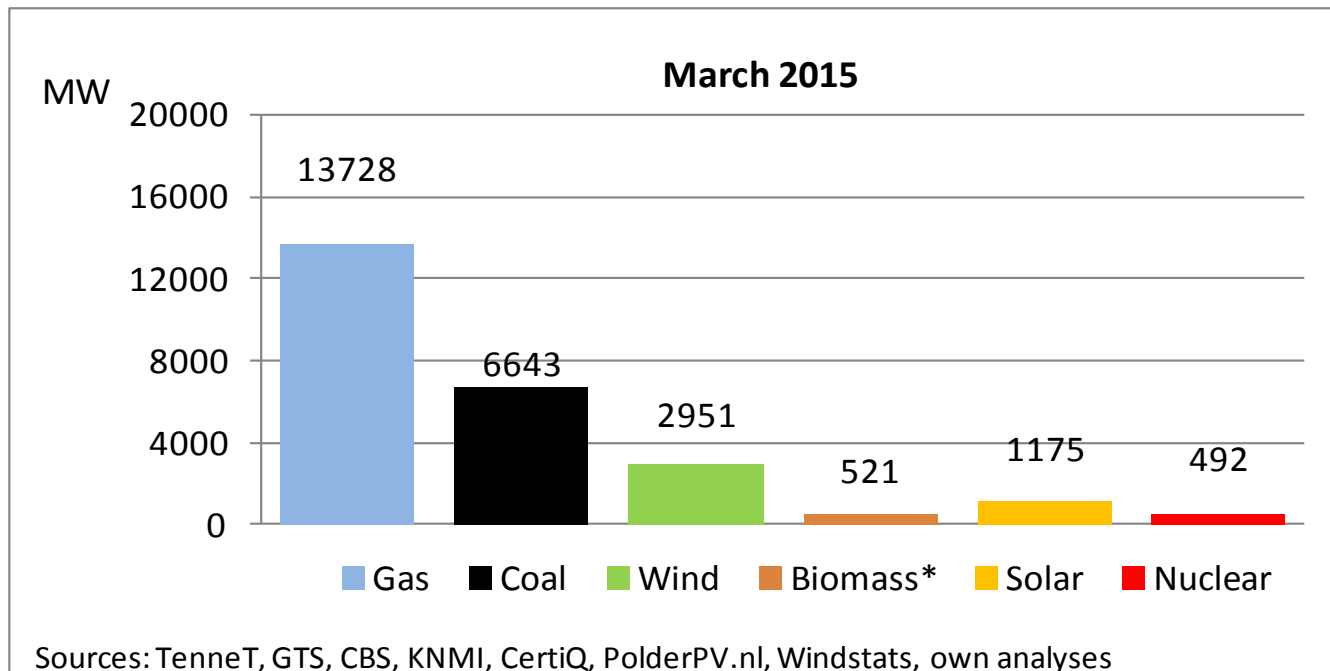
CO2 Emissions

March 2015

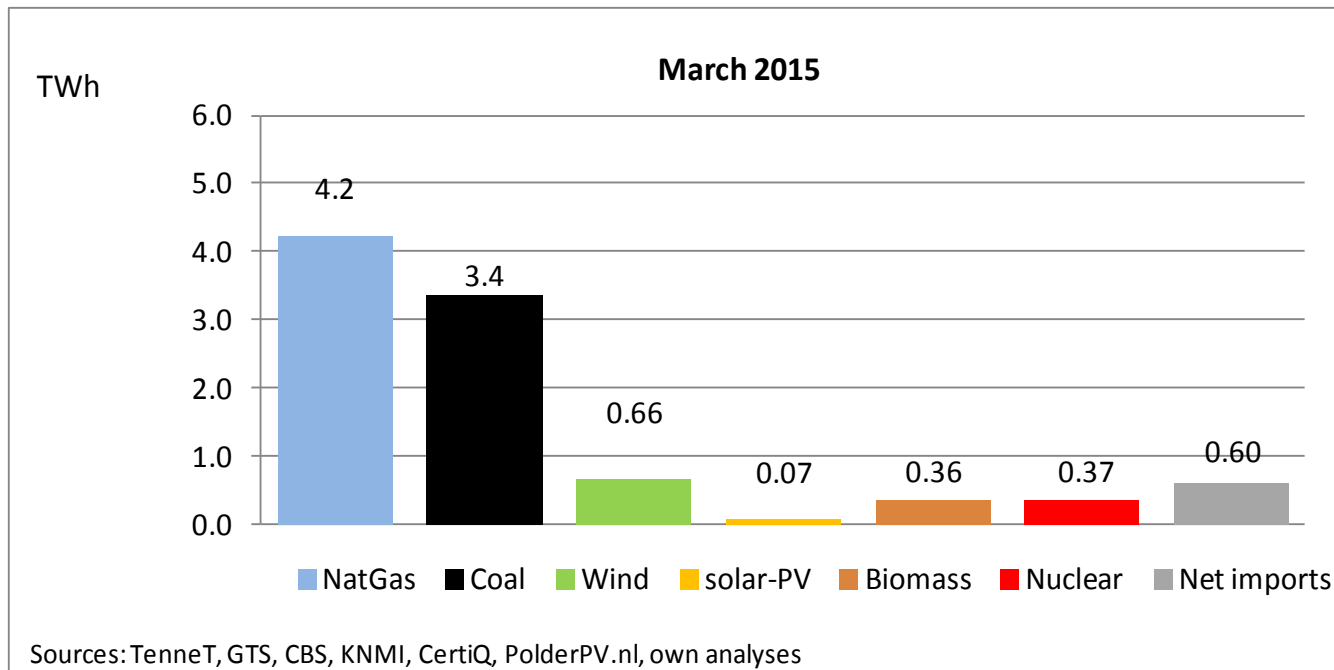


The national CO2 emission in March 2015, excluding power imports, feedstock and international shipping & aviation, has been estimated at 14,8 Mton. This was 8% higher than in March 2014 , primarily caused by more gas consumption, more coal utilization, and lower power imports.

Power Generation Capacity March 2015



Wind power increased by 62 MW last month, while the estimated increase in solar energy was 30 MW. The first 800 MW part of a new coal fired power station at Eemshaven has come on stream.

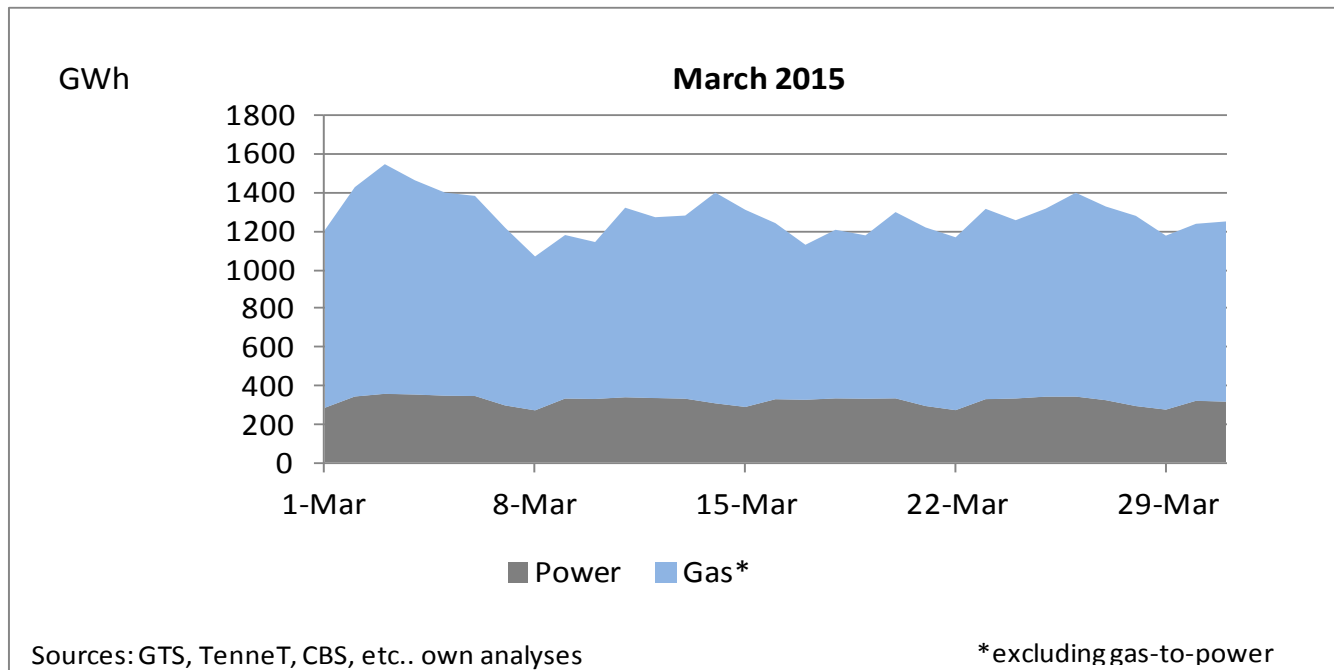


In March 2015, power consumption in 2014 was 9.9 TWh, 4% higher than in March 2014. Imports decreased by 23%, exports increased by 50%. The usage of coal for power generation increased by 20% y-o-y. In March, the average contribution from renewables to the power supplies was 10.7%.

SELECTED MONTHLY PROFILES

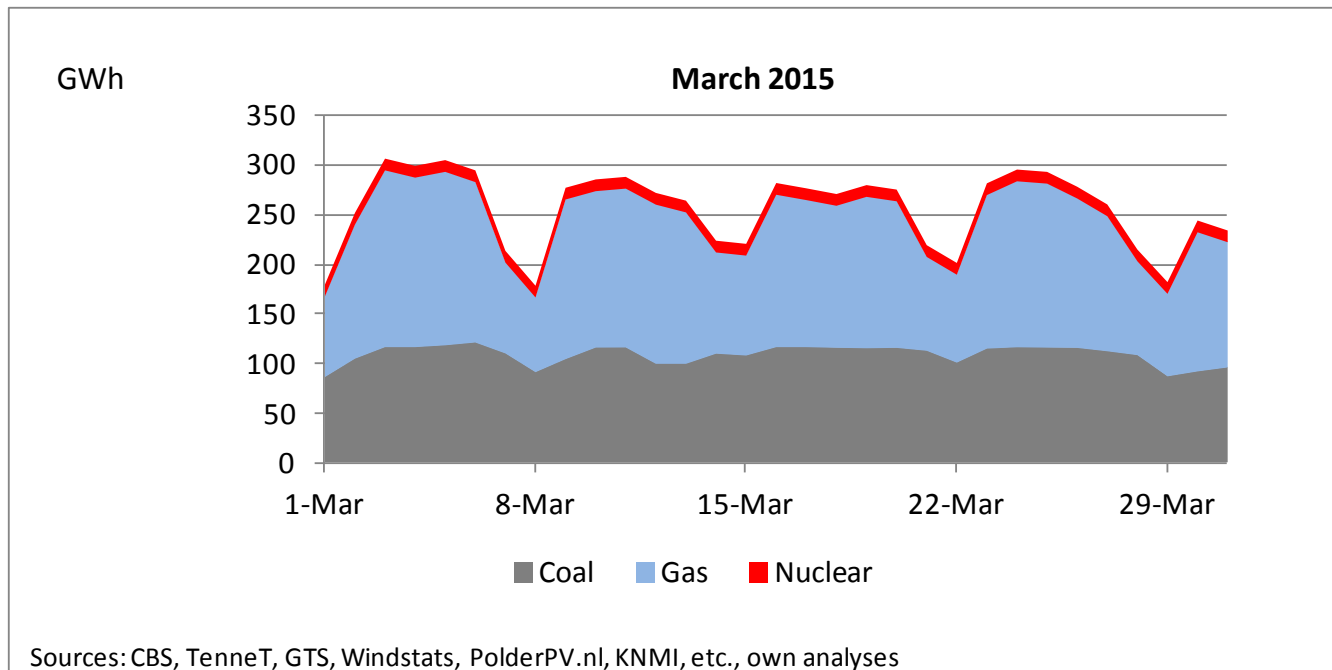
(using daily data)

Gas and Power Demand March 2015



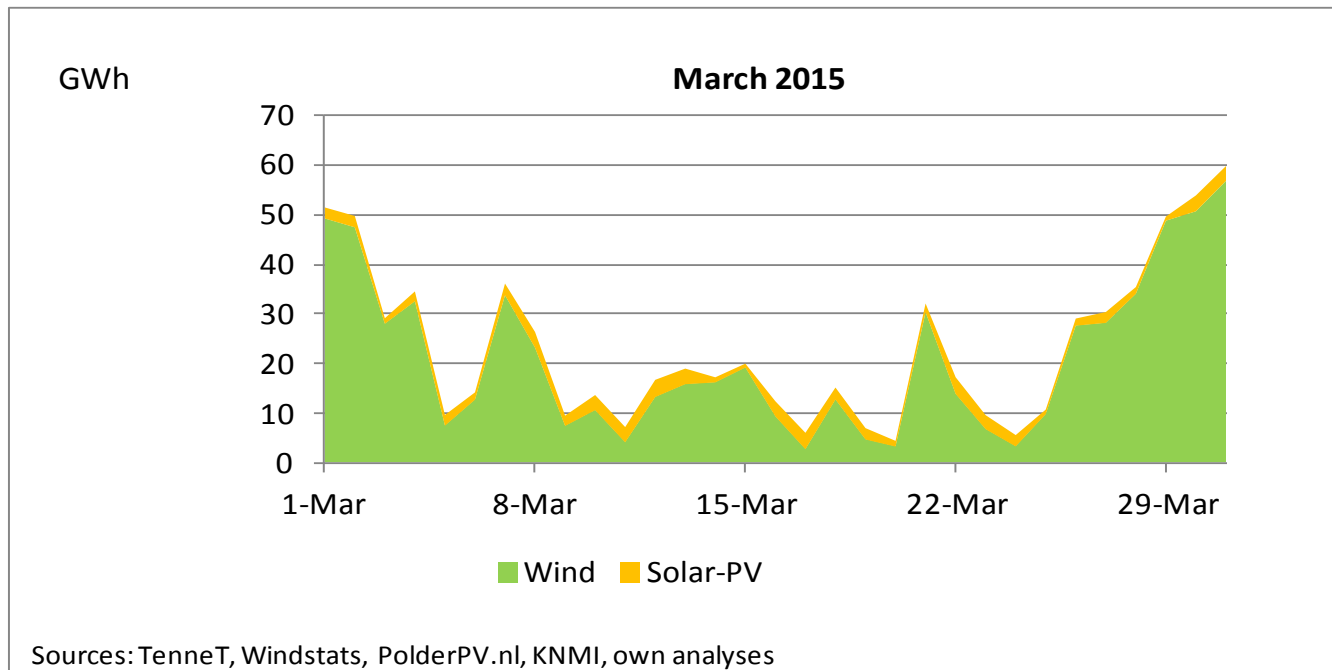
Daily power demand shows a week-weekend pattern. Daily gas demand (excluding gas demand for power) is mainly used for the heating market and affected by ambient temperature.

Conventional Power Production March 2015



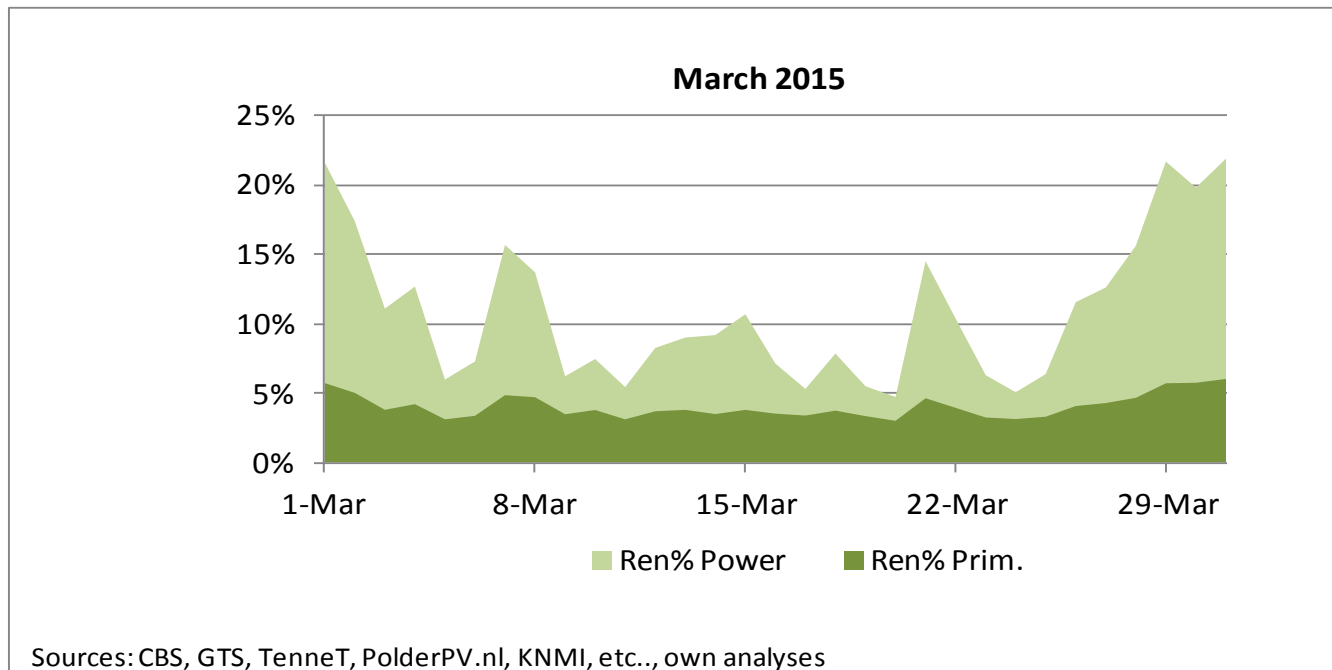
Daily conventional power generation peaked on March 2nd. Depending on power demand, power imports and renewables production, coal usage for power generation showed a weak week/weekend pattern.

Wind and Solar Power Production March 2015



Wind generation peaked on March 31 at more than 55 GWh. Solar PV was low in March, but increased by 20% compared to the March 2014
1 GWh is sufficient to provide power for a year to 300 households

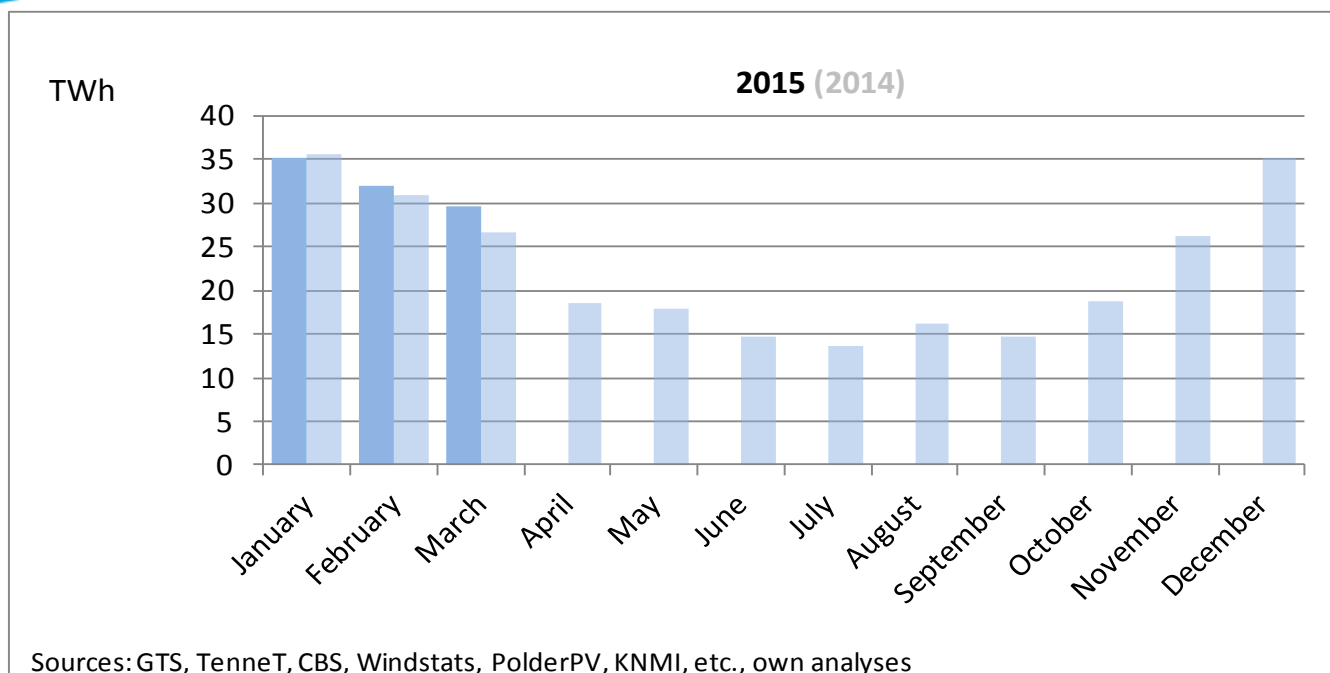
Contribution of Renewable Energy March 2015



Renewable energy peaked to 6% on March 31st, while the fraction of renewable power peaked to 22% that day. These high values have been caused by high wind speeds in the last couple of days in March 2015, resulting in high wind power.

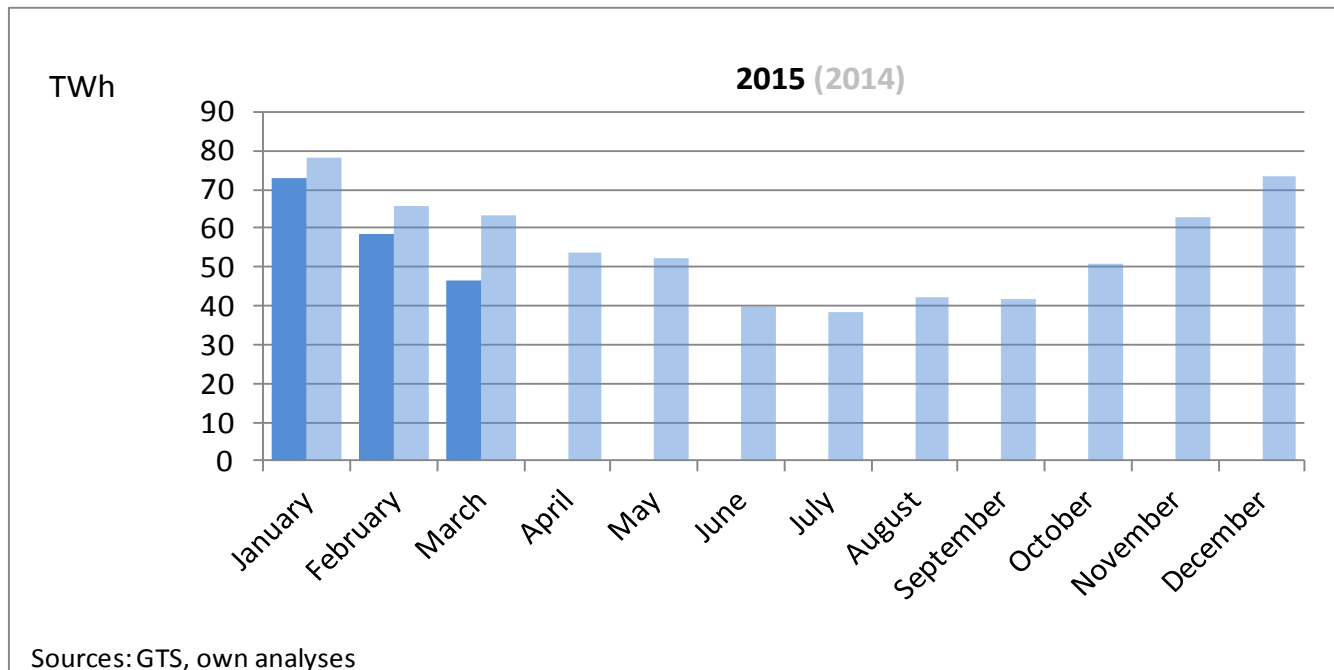
SELECTED MONTHLY ENERGY DATA

Gas Demand 2015 (and 2014)



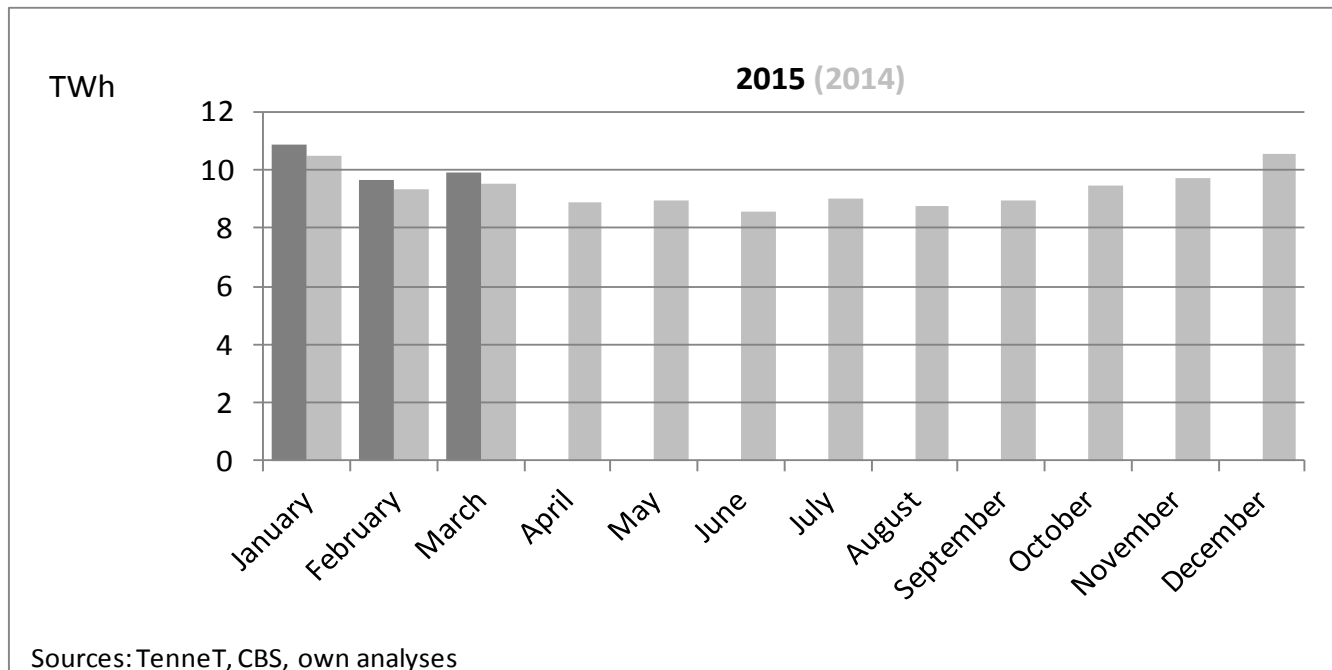
In March 2015 gas demand (excluding gas demand for power production) was substantially higher than in March 2014, mainly due to lower temperatures in 2015

Gas Production 2015 (and 2014)



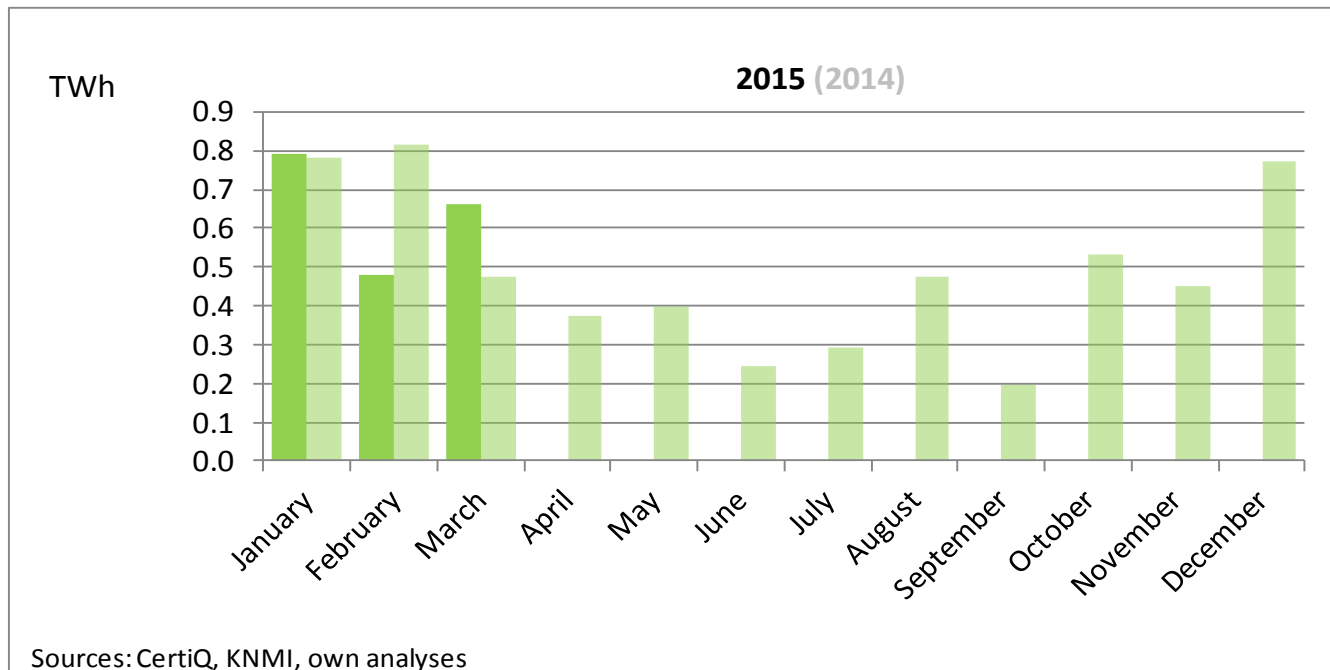
In March 2015, Dutch gas production was 27% lower than in March 2014.
10 TWh gas is sufficient to supply heat all houses in Amsterdam for two years

Power Demand 2015 (and 2014)



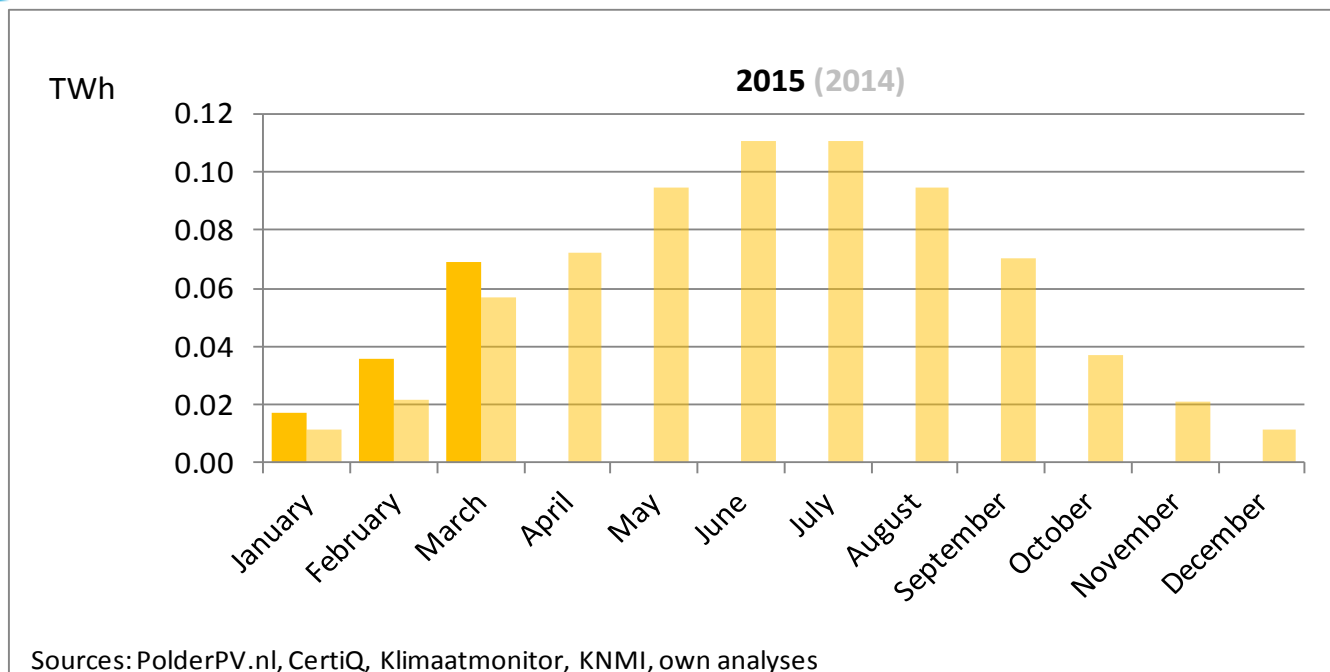
For the third consecutive month, power demand was higher than previous years, indicating a continued growth of the Dutch economy

Wind Production 2015 (and 2014)



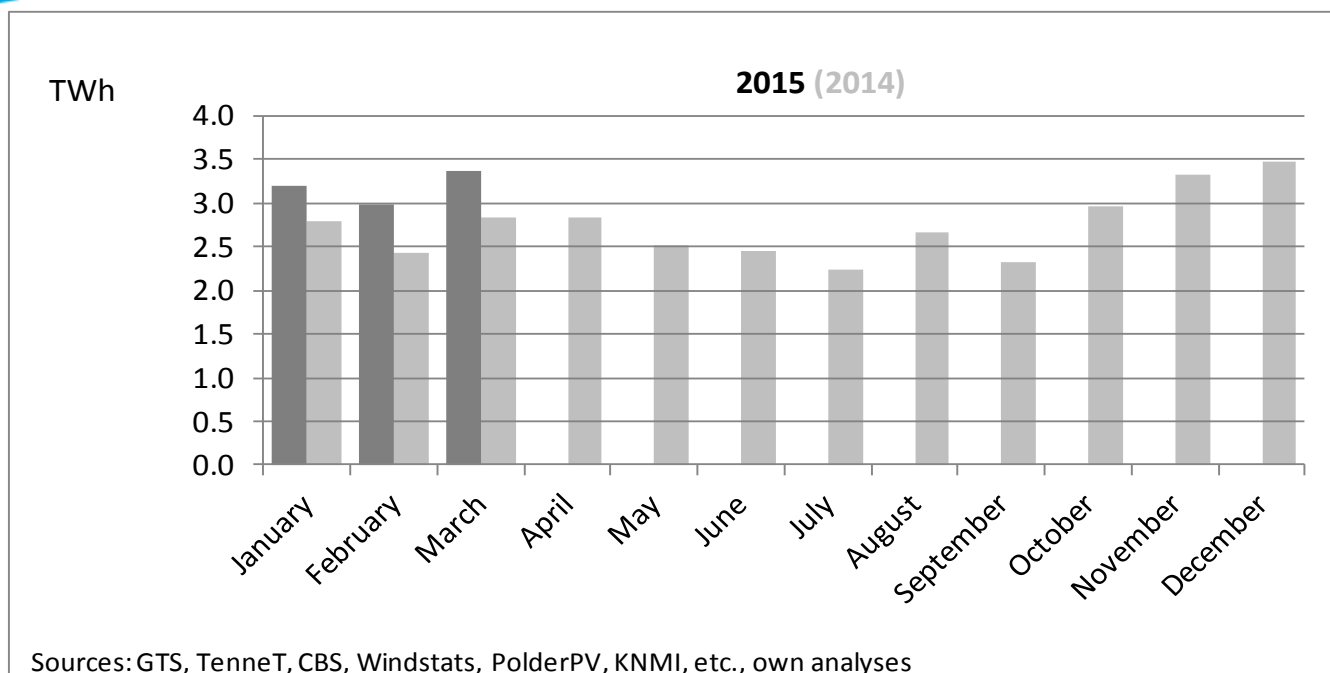
Wind power production is very volatile y-o-y. In February 2015, wind power generation was much lower than in previous year. In March 2015, the production of wind power was 40% higher than last year.

Solar PV Production 2015 (and 2014)



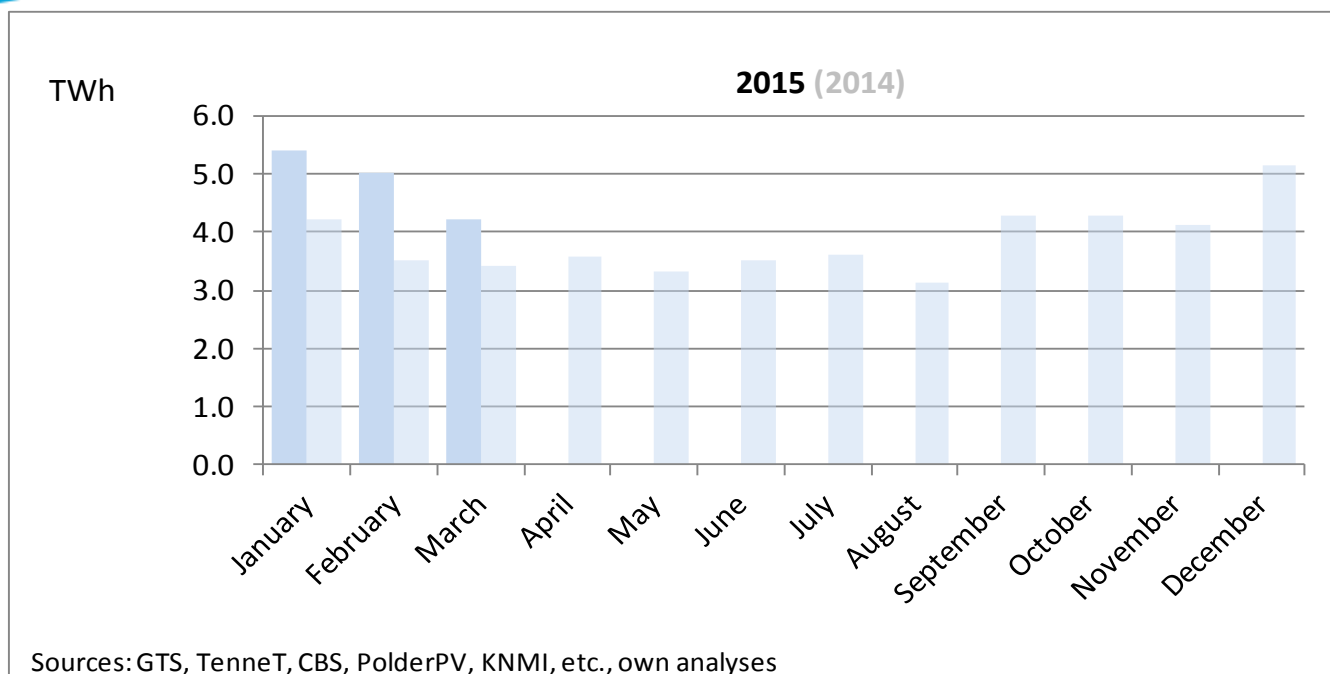
In March 2015, Solar PV was 21% higher than in previous year, mainly due to increased Solar PV capacity.

Coal-to-Power 2015 (and 2014)



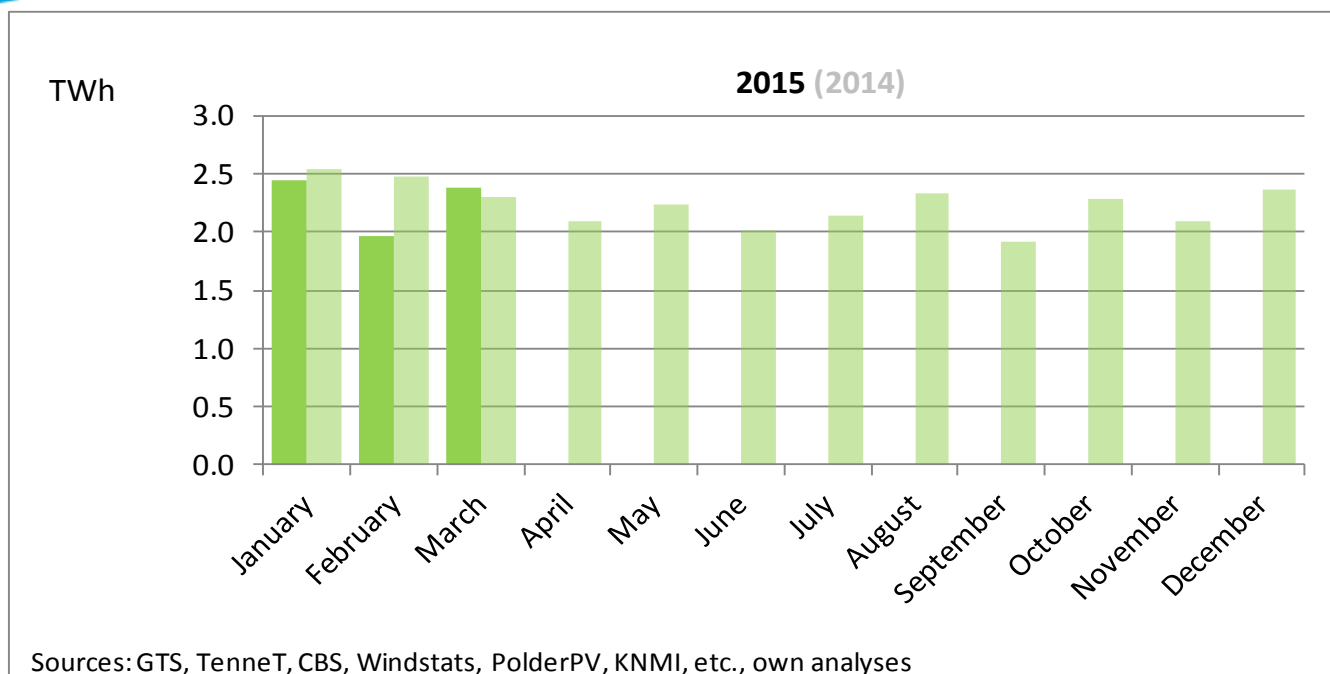
For the third consecutive month, coal utilization for power generation has increased by about 20%.

Gas to Power 2015 (and 2014)



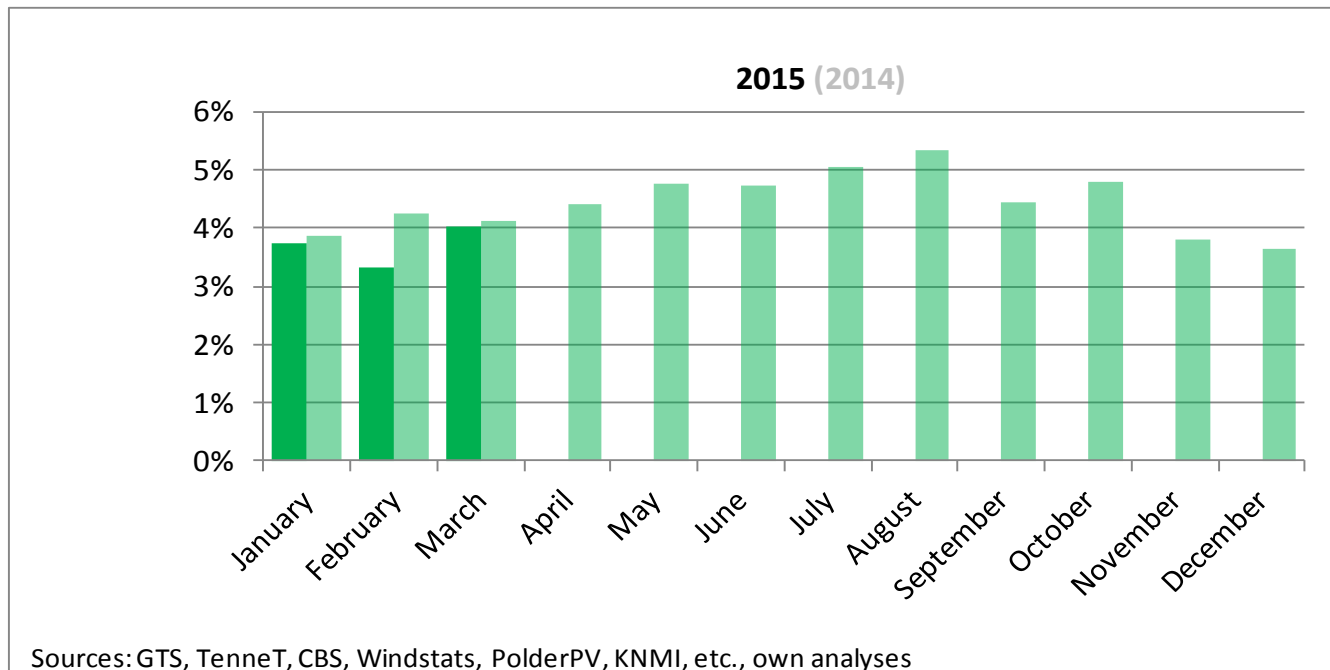
In March, power production by gas-fired power stations and cogeneration has increased significantly compared to previous year. Main reason are the decreased net imports to the Netherlands.

Renewable Energy All Sources 2015 (and 2014)



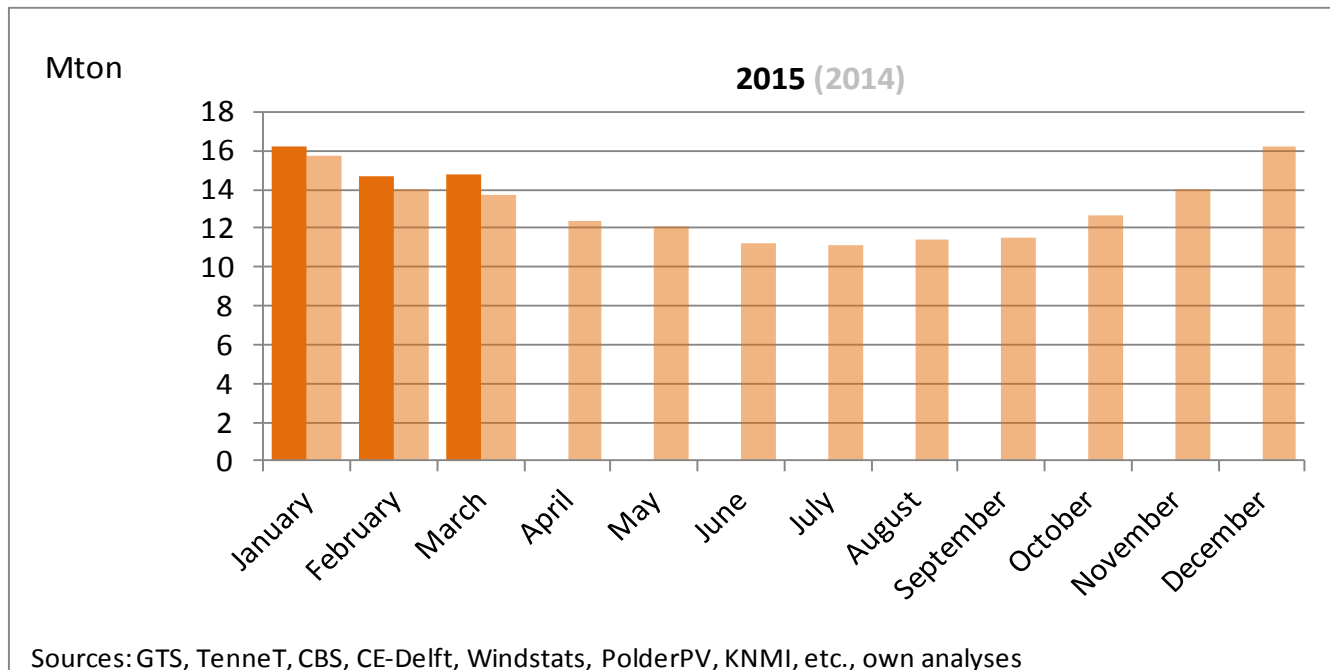
In March 2015, total renewable energy production in The Netherlands increased by about 3% compared to March 2014. Lower contributions from biomass were compensated by higher contributions from wind and sun.

Renewable Energy Percentage 2015 (and 2014)



In March 2015, the estimated national percentage of renewable energy as fraction of total energy demand (EU definition) has been estimated at 4.0%.

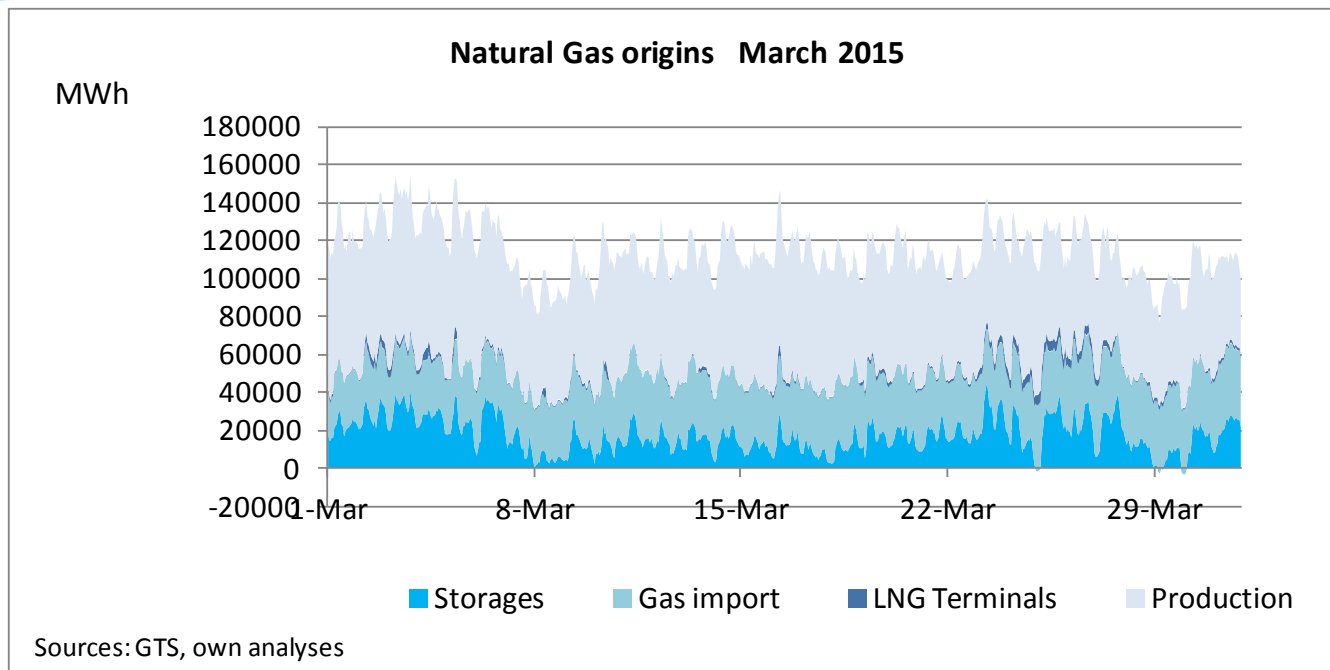
CO2 Emissions 2015 (and 2014)



For the third consecutive month, Dutch CO2 emissions have increased compared to previous year. The increase in March was 8%. The main causes are a higher energy usage due to lower temperatures, economic growth and less power imports.

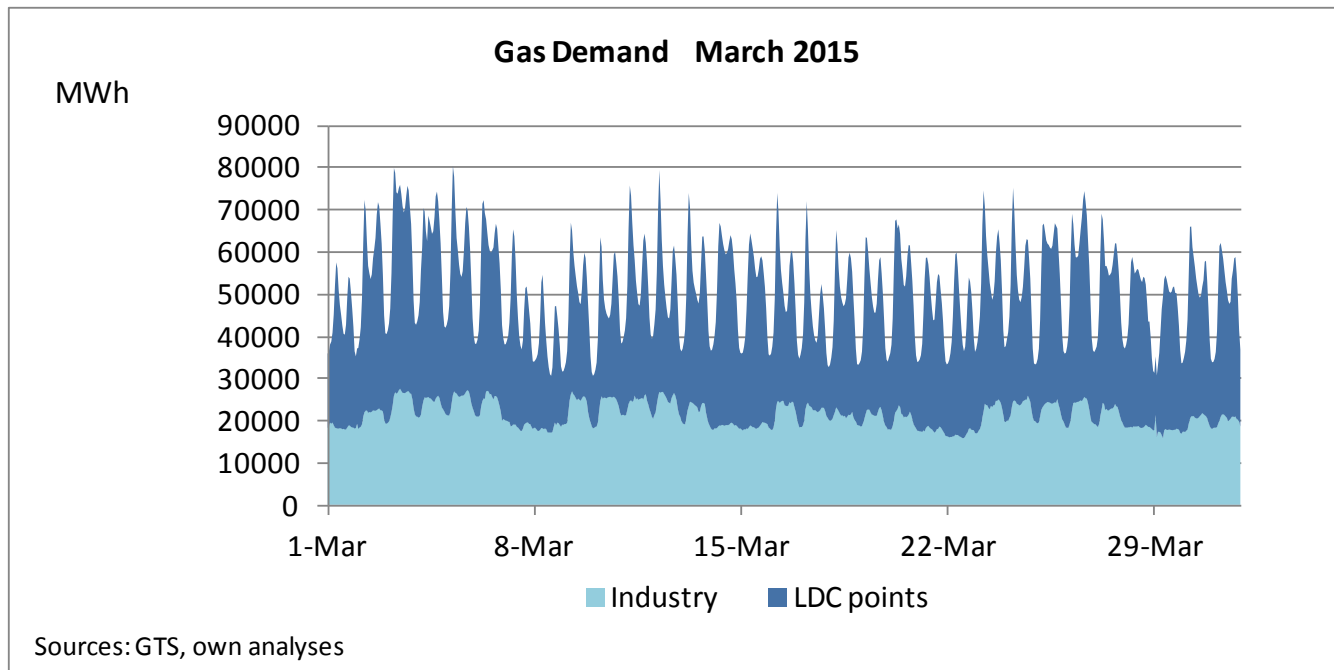
SELECTED HOURLY ENERGY DATA

Gas Supply March 2015



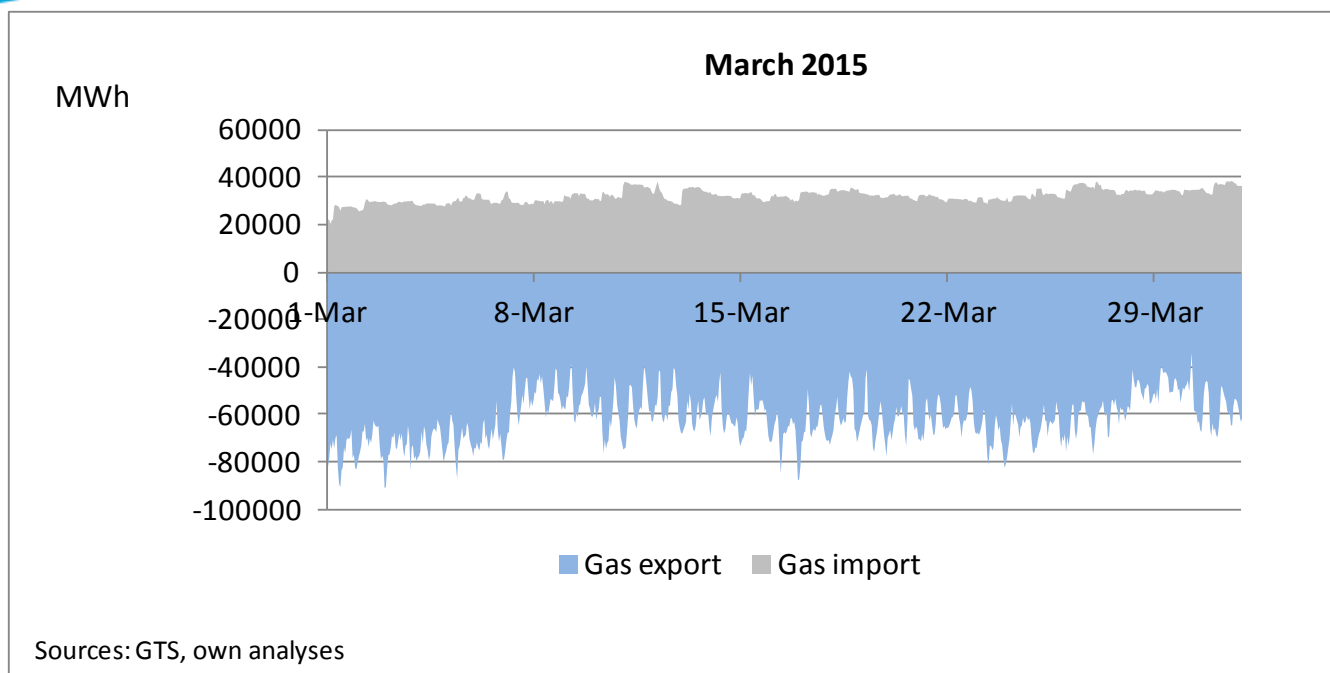
In March 2015, hourly gas production peaked at 150.000 MW (150 GW). LNG production in March was limited to 1,2 TWh, although five times higher than in March 2014.

Gas Demand Including Gas-to-Power March 2015



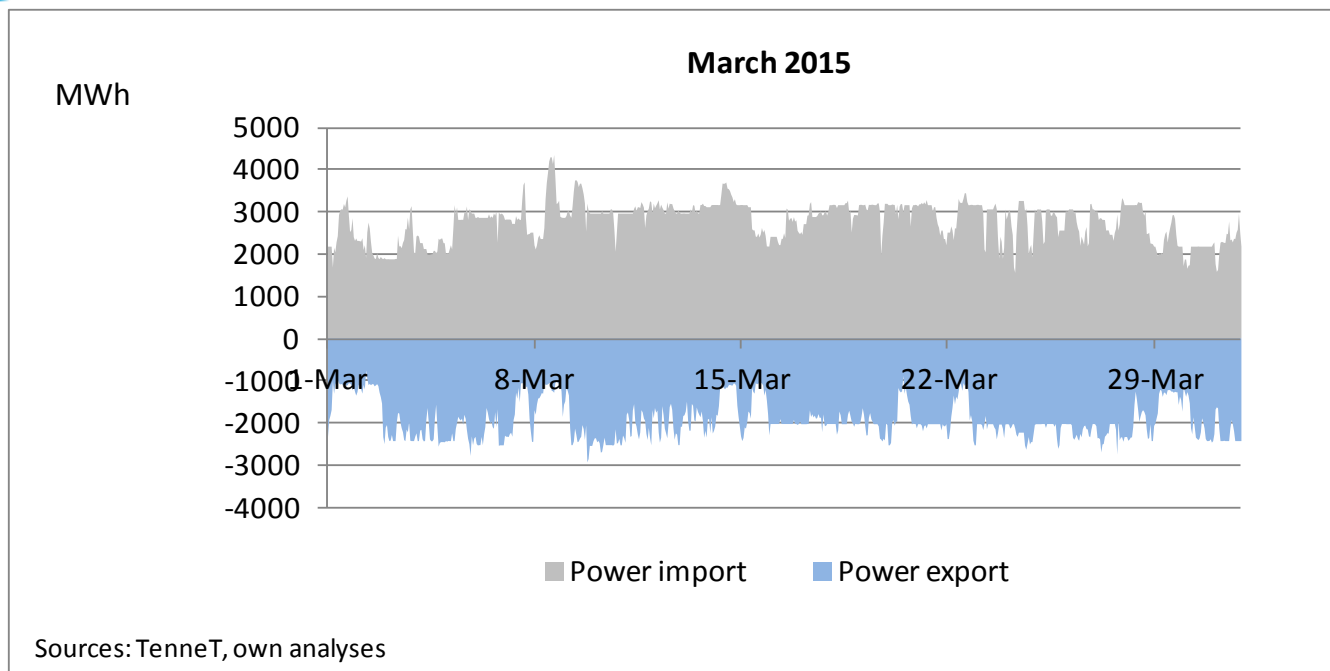
On March 3rd, gas demand in The Netherlands peaked to 80.000 MW (80 GW). The peak in gas demand has been caused by a combination of relatively low temperatures and high demand of gas for power generation.

Gas Imports & Exports March 2015



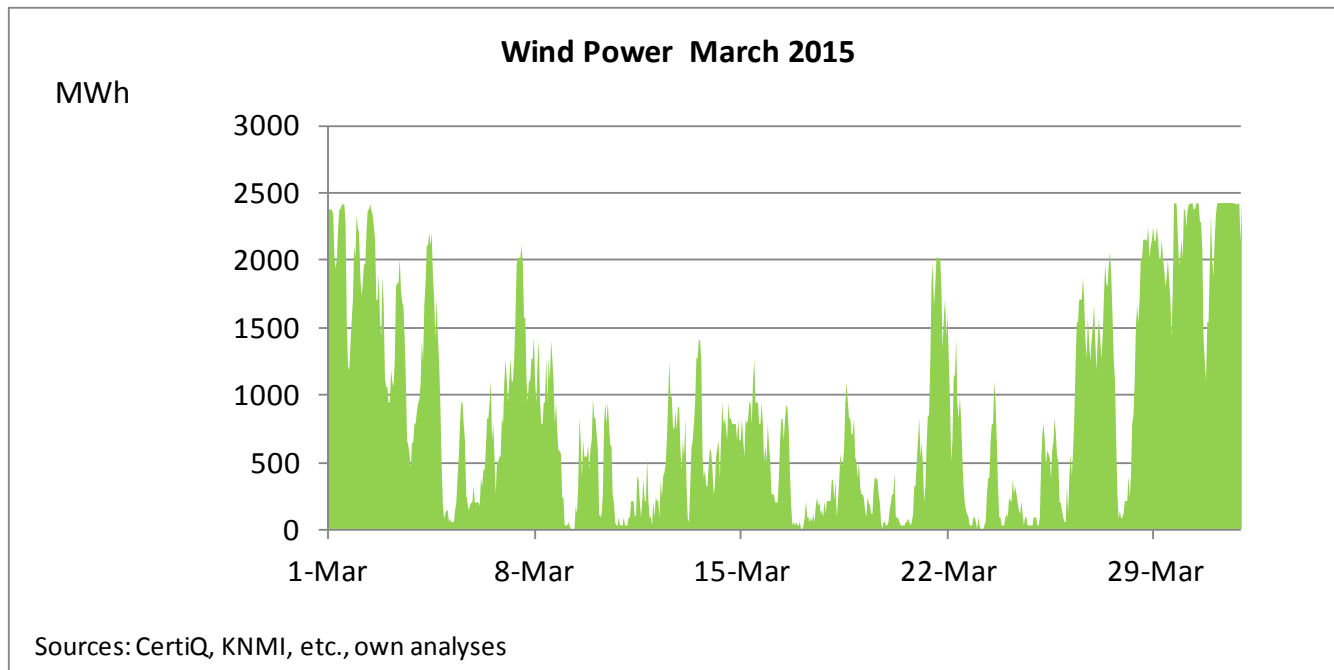
In March 2015, gas exports were 46 TWh, 9% lower than previous year. On the other hand, gas imports were 20% higher than in March 2014.

Power Imports & Exports March 2015



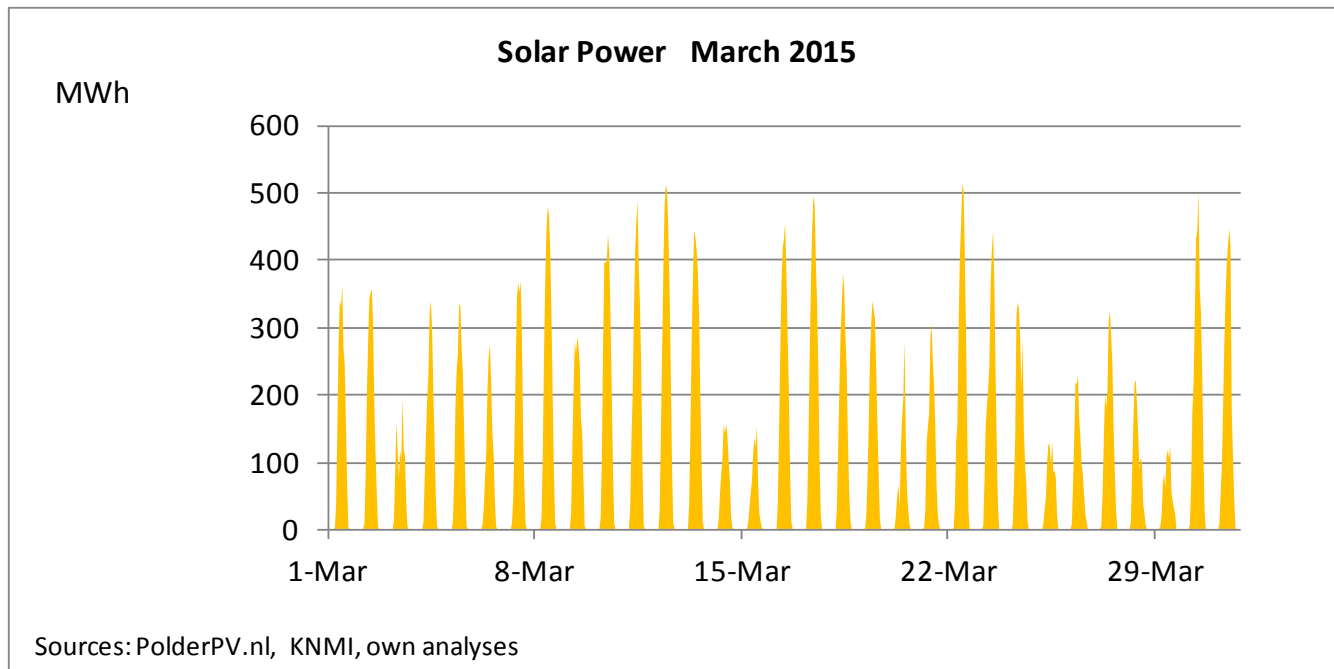
In March 2015, power imports 2.1TWh, 23% less than in March 2014. Power exports increased to 1.5 TWh, 51% higher than previous year.

Wind Power March 2015



March 2015 was characterized by high wind availability in the beginning and the end of the month, and low wind availability in between.

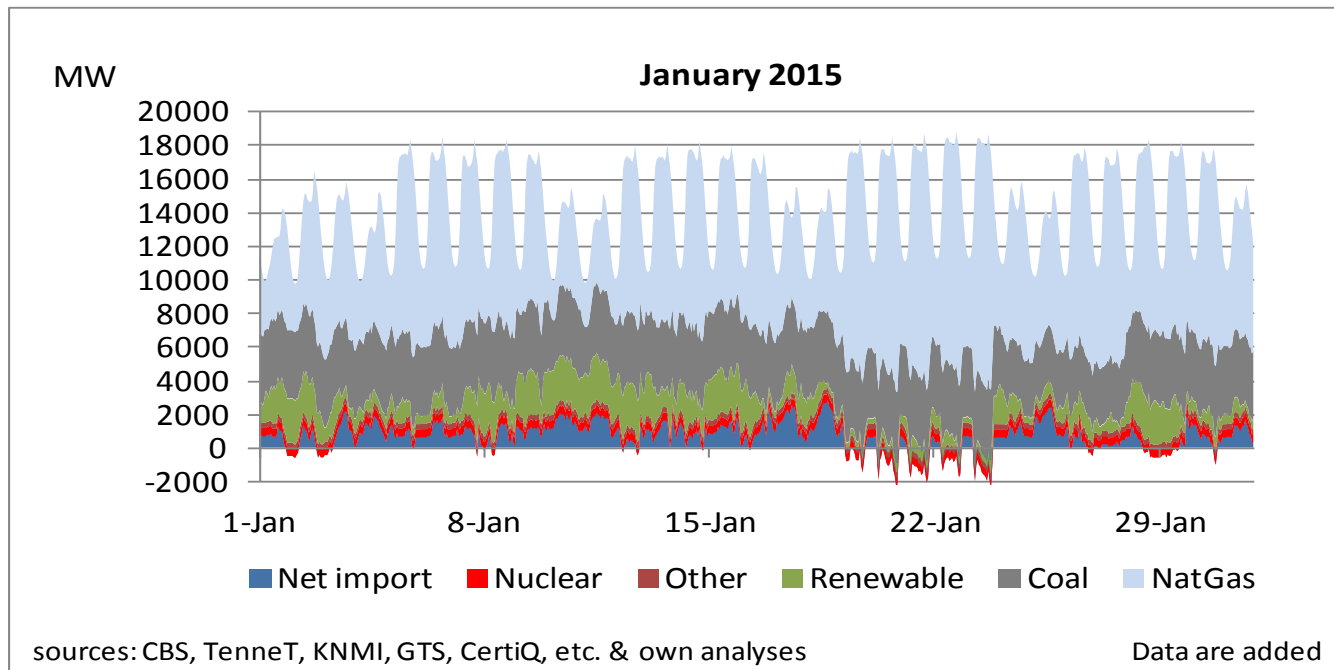
Solar PV Power March 2015



In March Solar-PV peaked to 500 MW, up from 360 MW in February 2015. In March 2015, solar-PV was 20% higher than previous year, due to higher solar-PV installed capacity. On March, there was a solar eclipse.

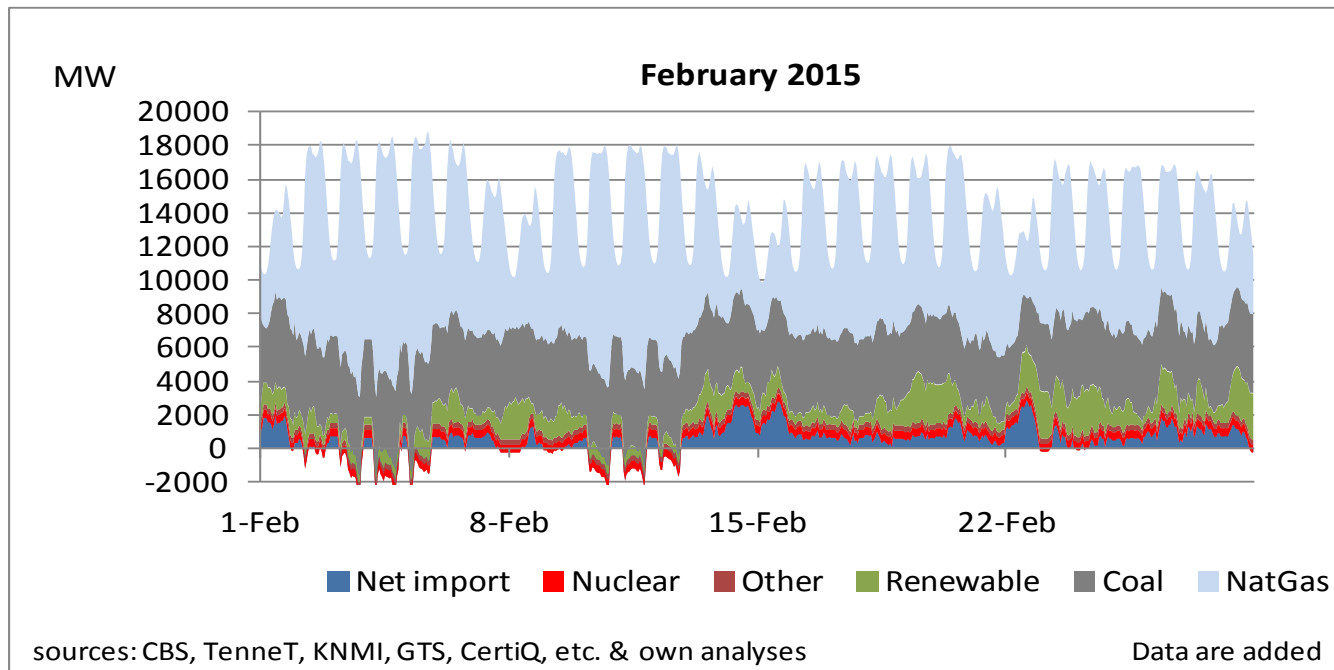
The following set of slides presents for each month in 2015 the hourly contributions of various energy sources to total power consumption in The Netherlands.

Power Generation January 2015



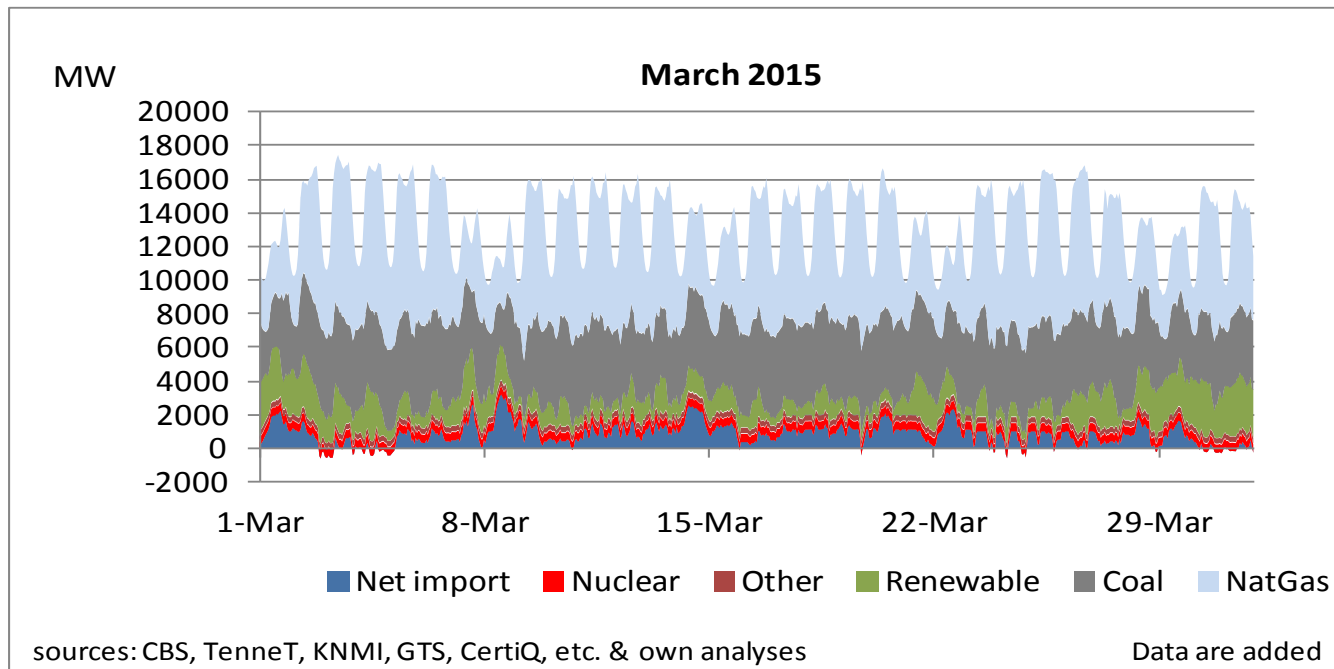
In the week of 20-24 January, power generation peaked, due to the net exports that occurred. The majority of the additional power generation has been generated by gas-fired installations.

Power Generation February 2015



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

Power Generation March 2015



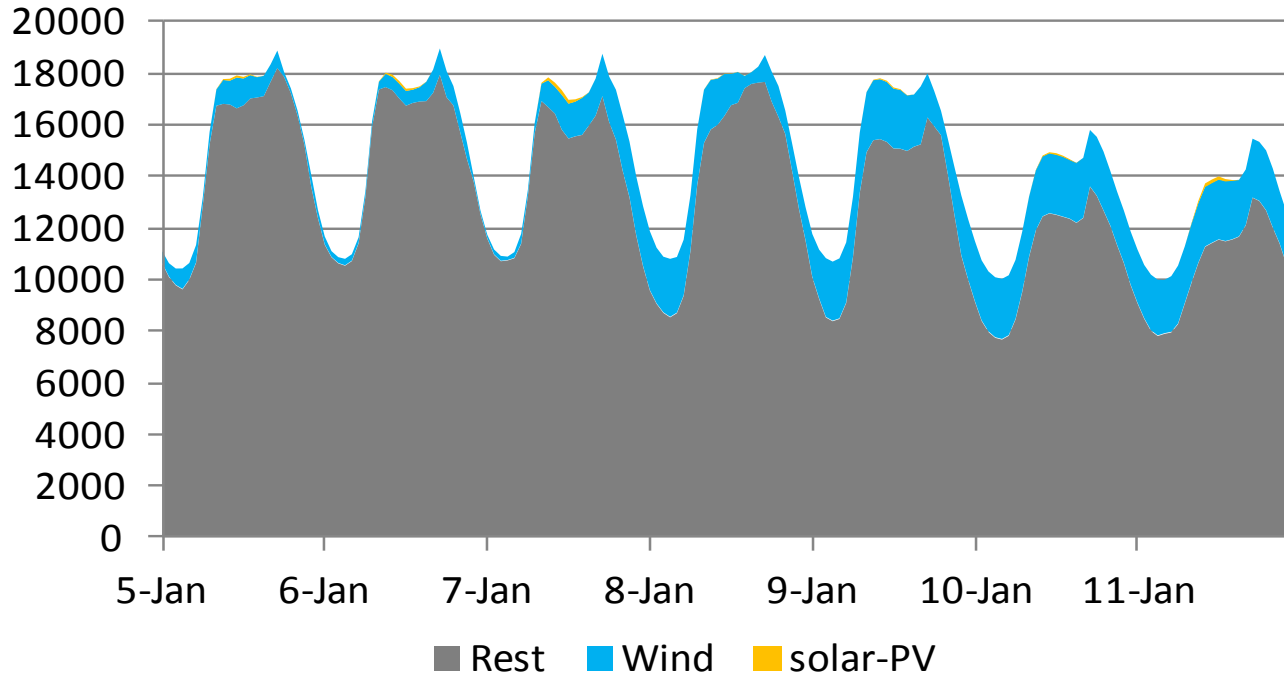
Relatively low imports of power occurred in March. On some Saturdays, some net exports were recorded.

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

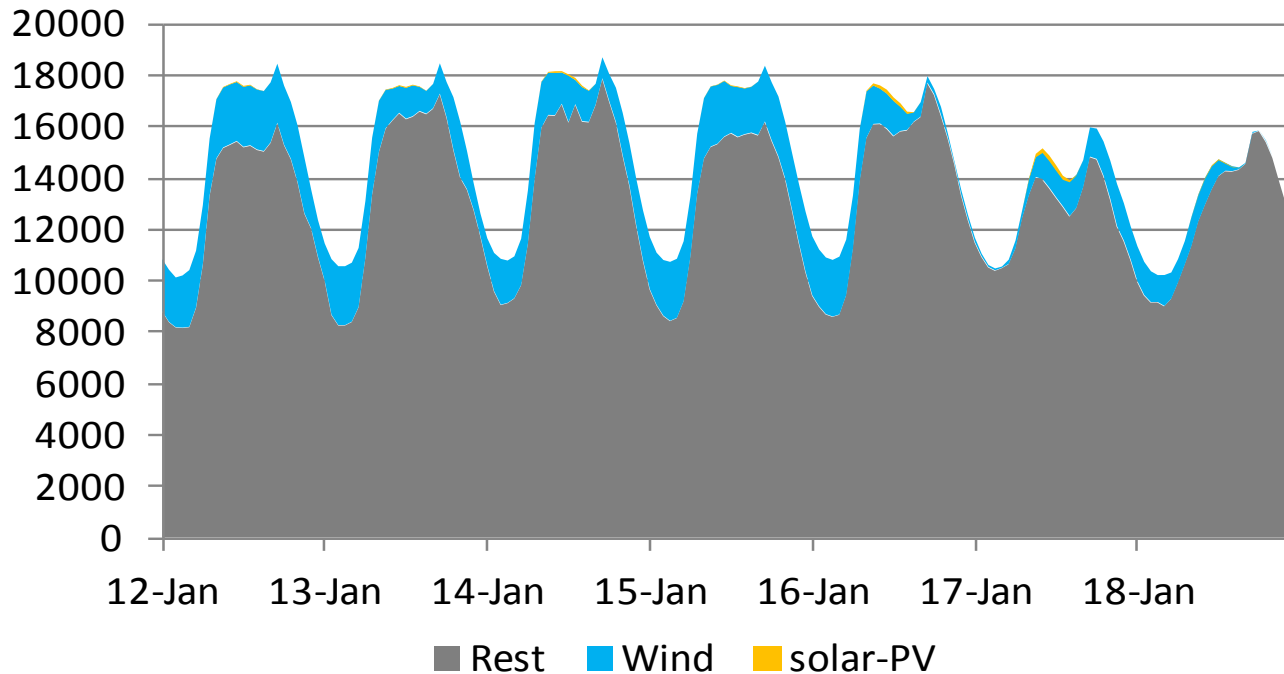


Sources: TenneT, CertiQ,, PolderPV.nl, KNMI, etc., own analyses

Hourly Solar-PV and Wind Generation 2015

MWh

2015

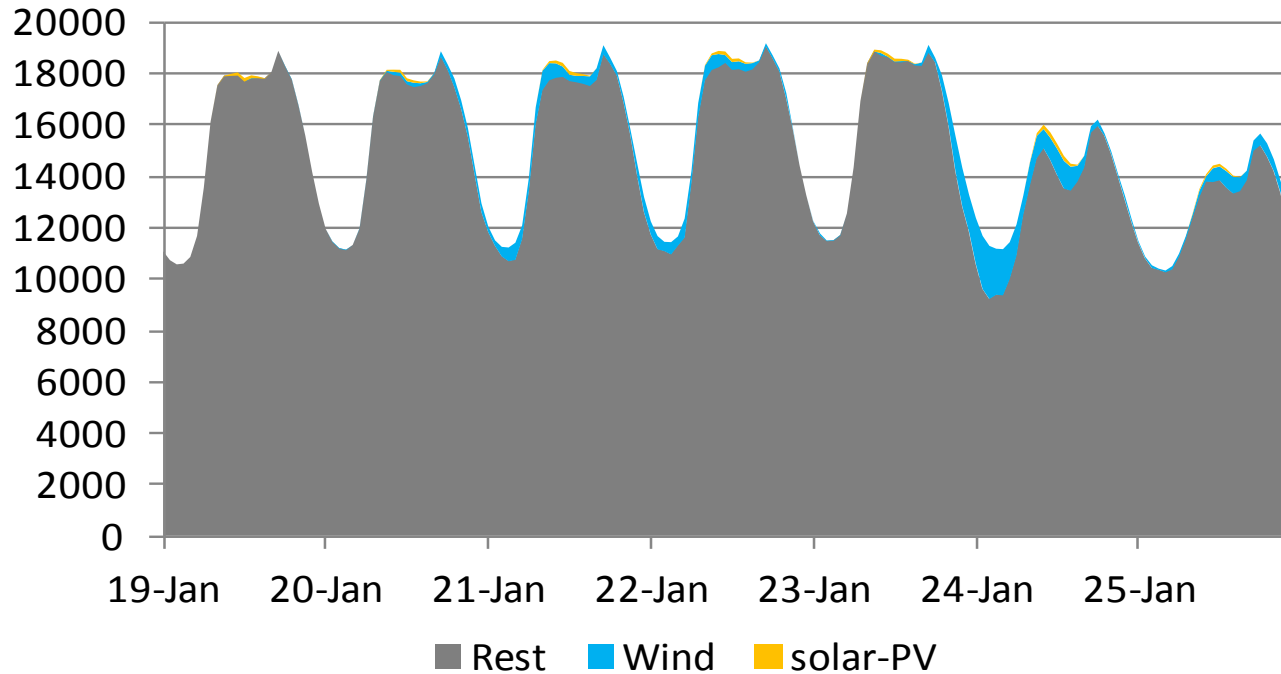


Sources: TenneT, CertiQ, PolderPV.nl, KNMI, etc., own analyses

Hourly Solar-PV and Wind Generation 2015

MWh

2015

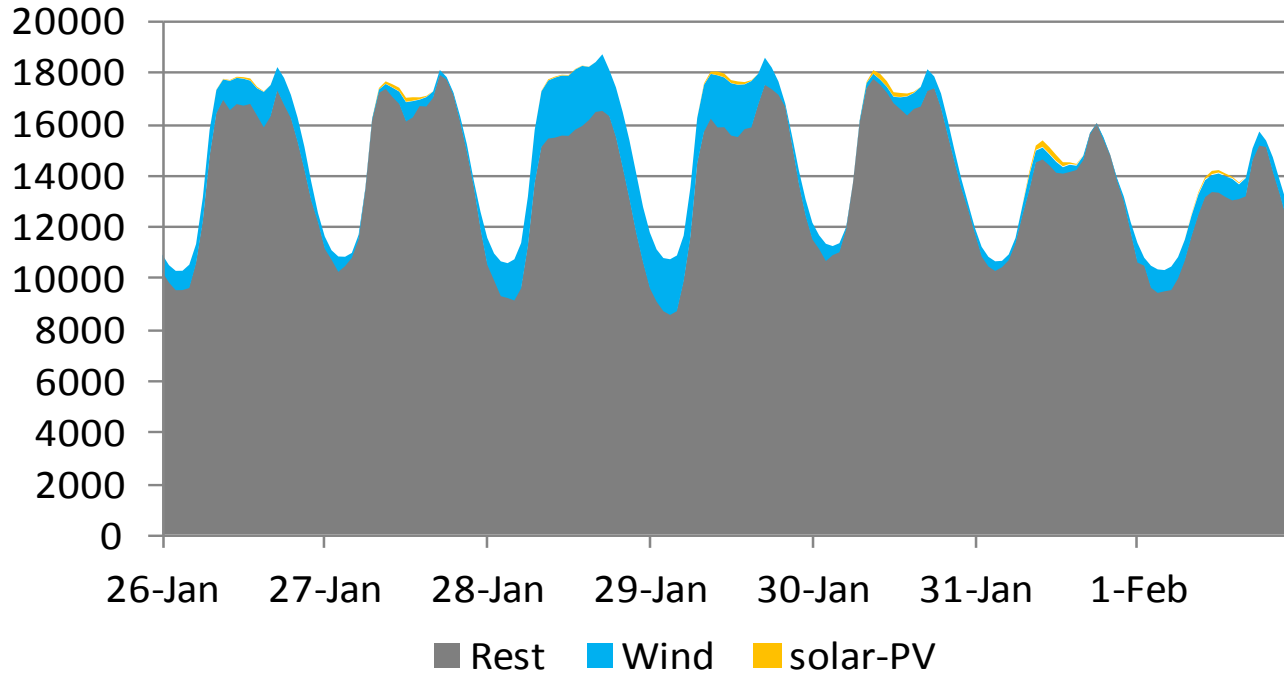


Sources: TenneT, CertiQ, PolderPV.nl, KNMI, etc., own analyses

Hourly Solar-PV and Wind Generation 2015

MWh

2015

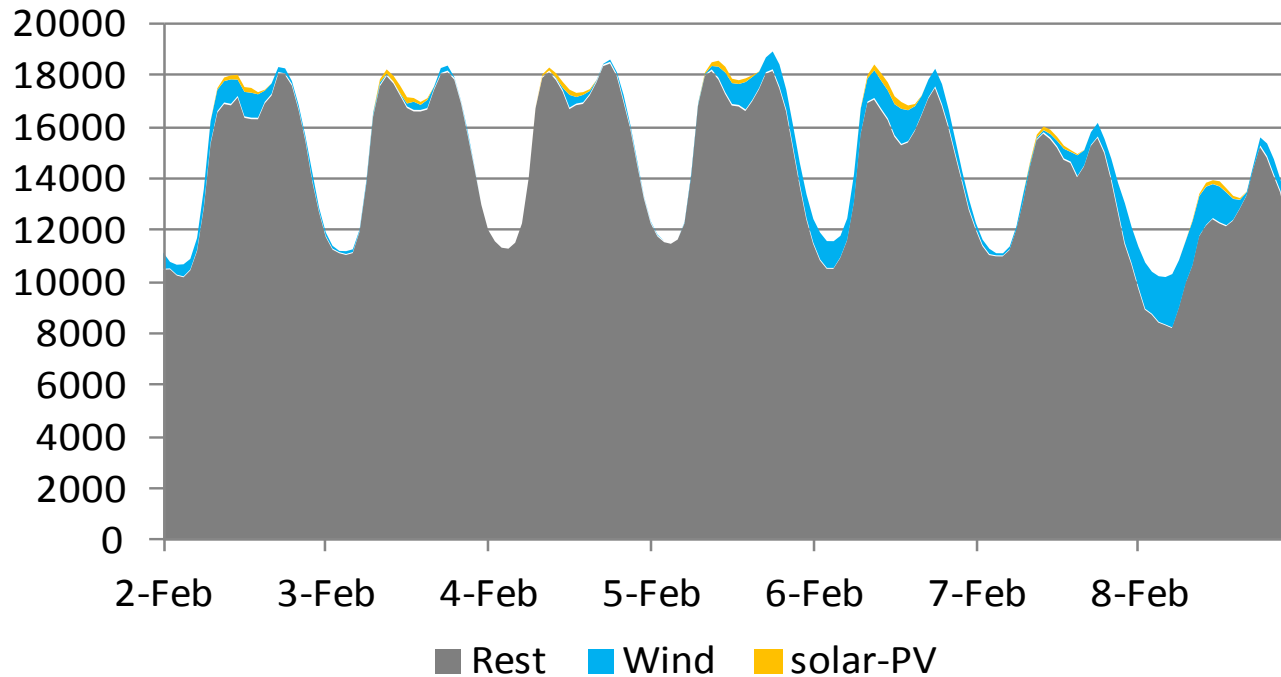


Sources: TenneT, CertiQ, PolderPV.nl, KNMI, etc., own analyses

Hourly Solar-PV and Wind Generation 2015

MWh

2015

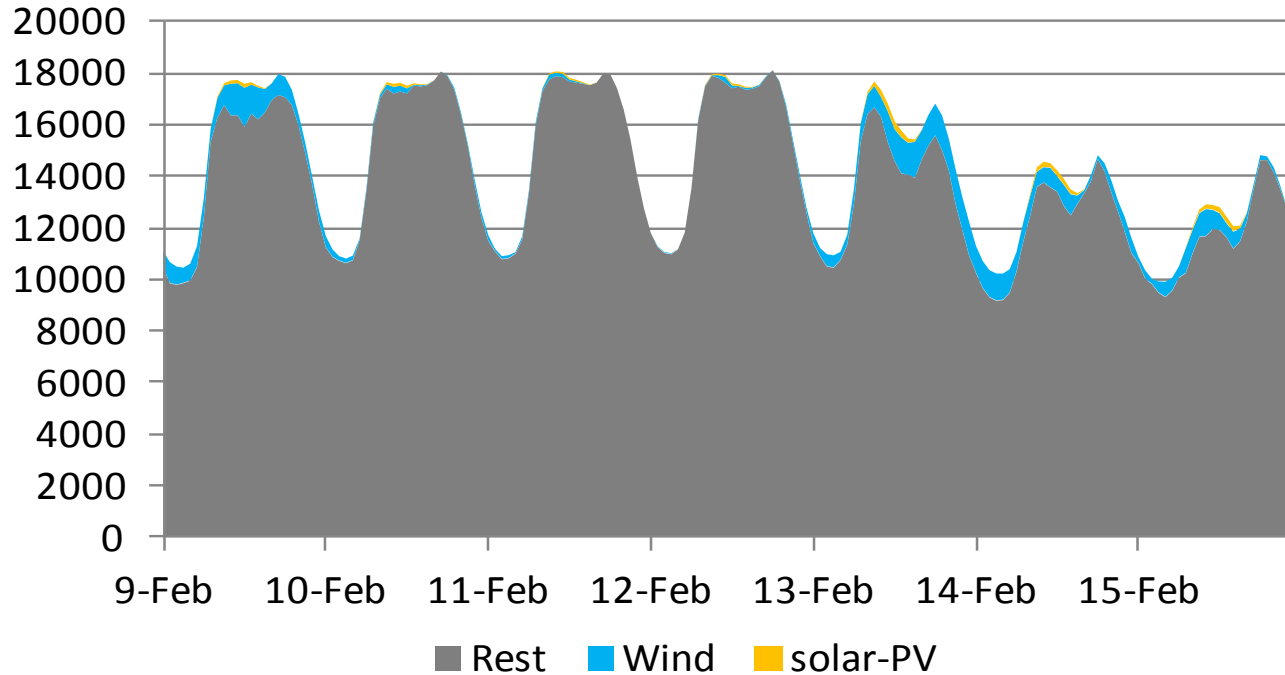


Sources: TenneT, CertiQ, KNMI, PolderPV.nl, etc., own analyses

Hourly Solar-PV and Wind Generation 2015

MWh

2015

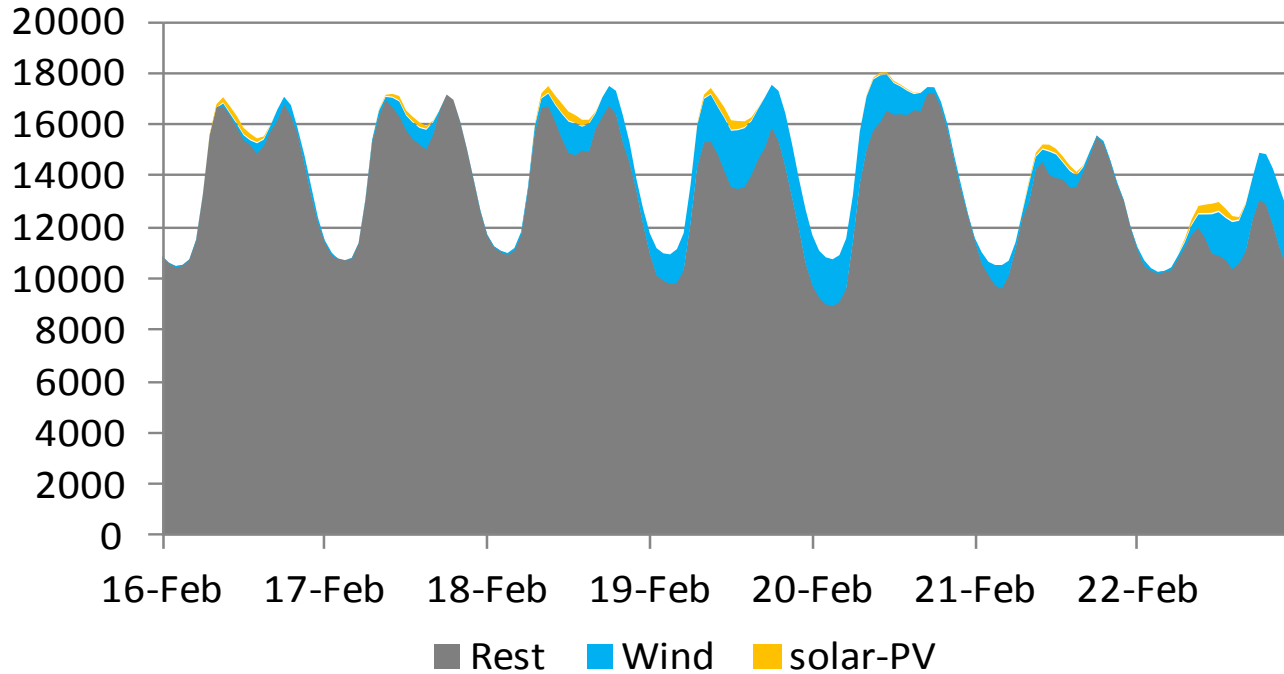


Sources: TenneT, CertiQ, KNMI, PolderPV.nl, etc., own analyses

Hourly Solar-PV and Wind Generation 2015

MWh

2015

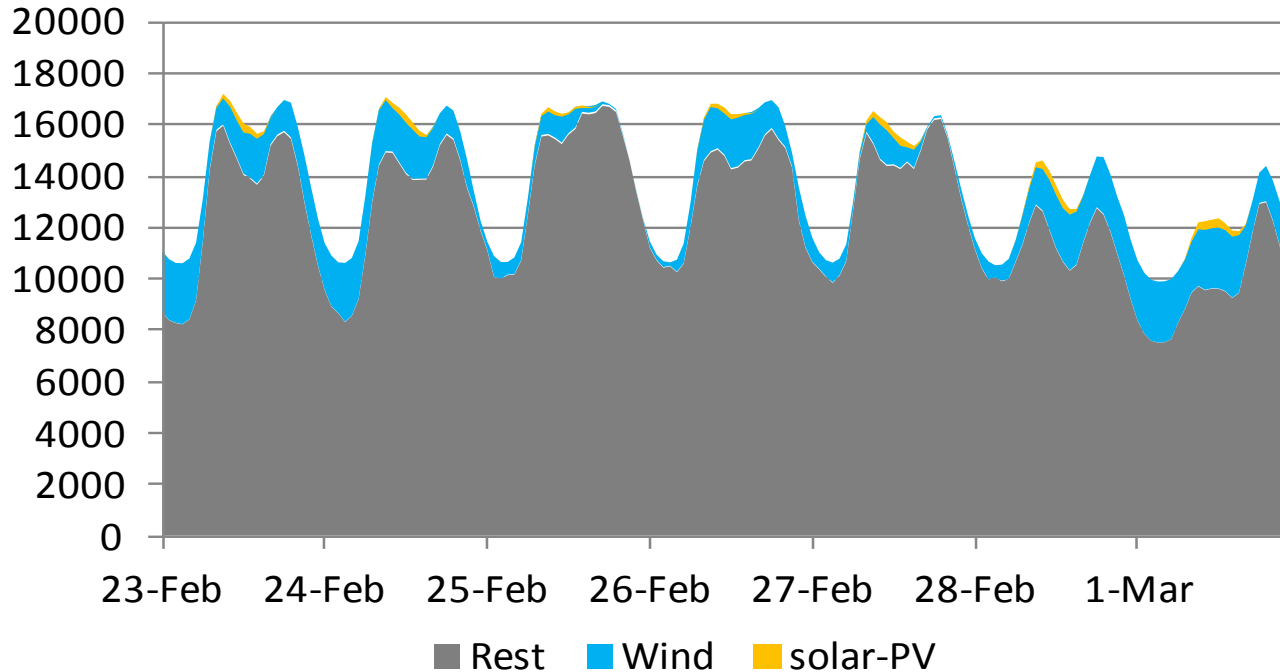


Sources: TenneT, CertiQ, PolderPV.nl, KNMI, etc., own analyses

Hourly Solar-PV and Wind Generation 2015

MWh

2015

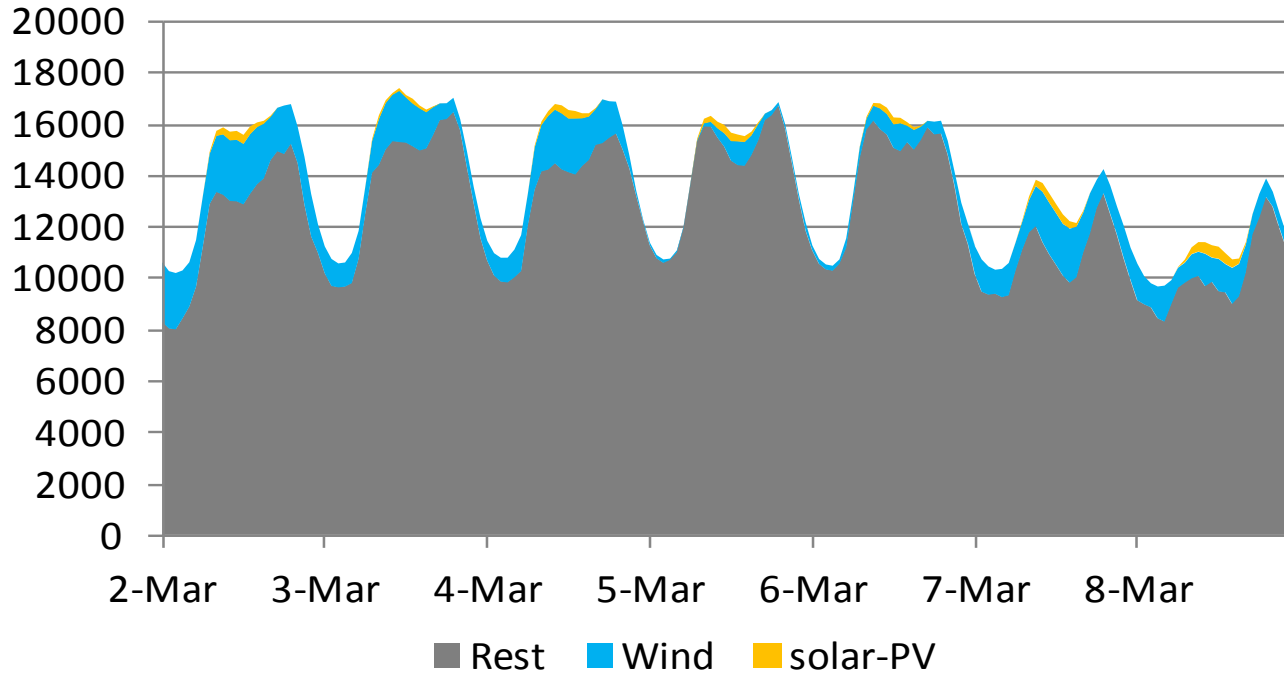


Sources: TenneT, CertiQ, PolderPV.nl, KNMI, etc., own analyses

Hourly Solar-PV and Wind Generation 2015

MWh

2015

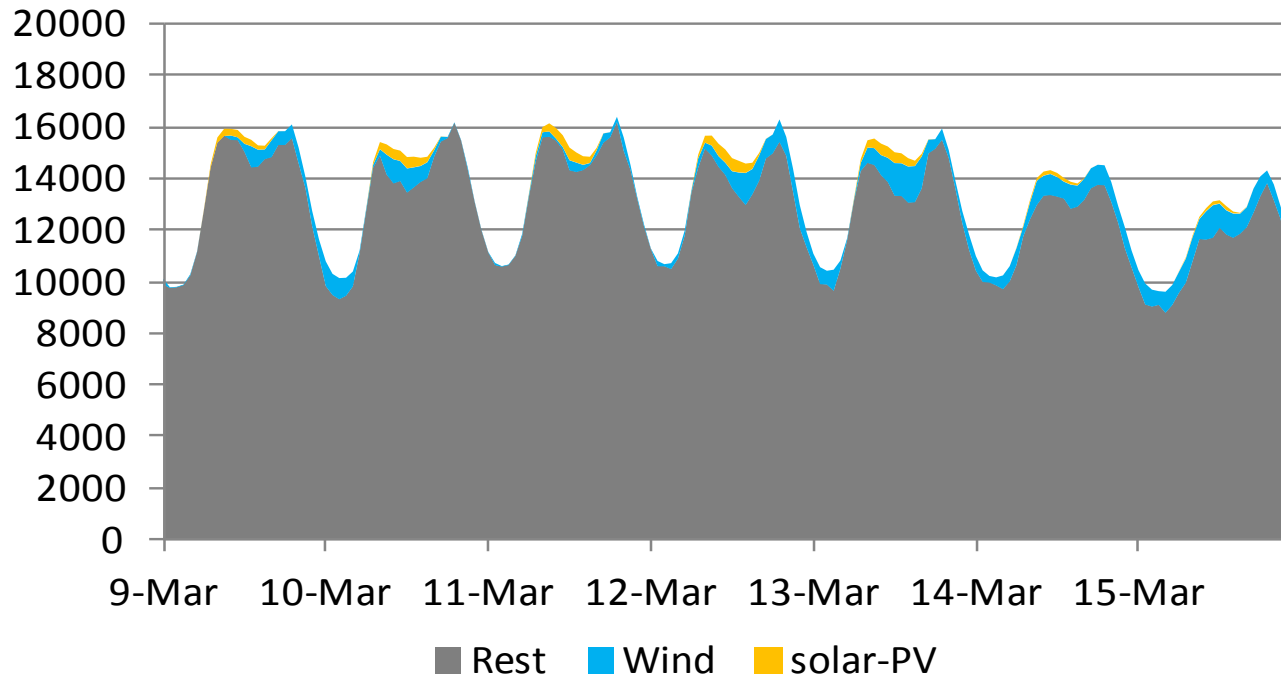


Sources: TenneT, CertiQ, Windstats, Klimaatmonitor, PolderPV.nl, KNMI, own analyses

Hourly Solar-PV and Wind Generation 2015

MWh

2015

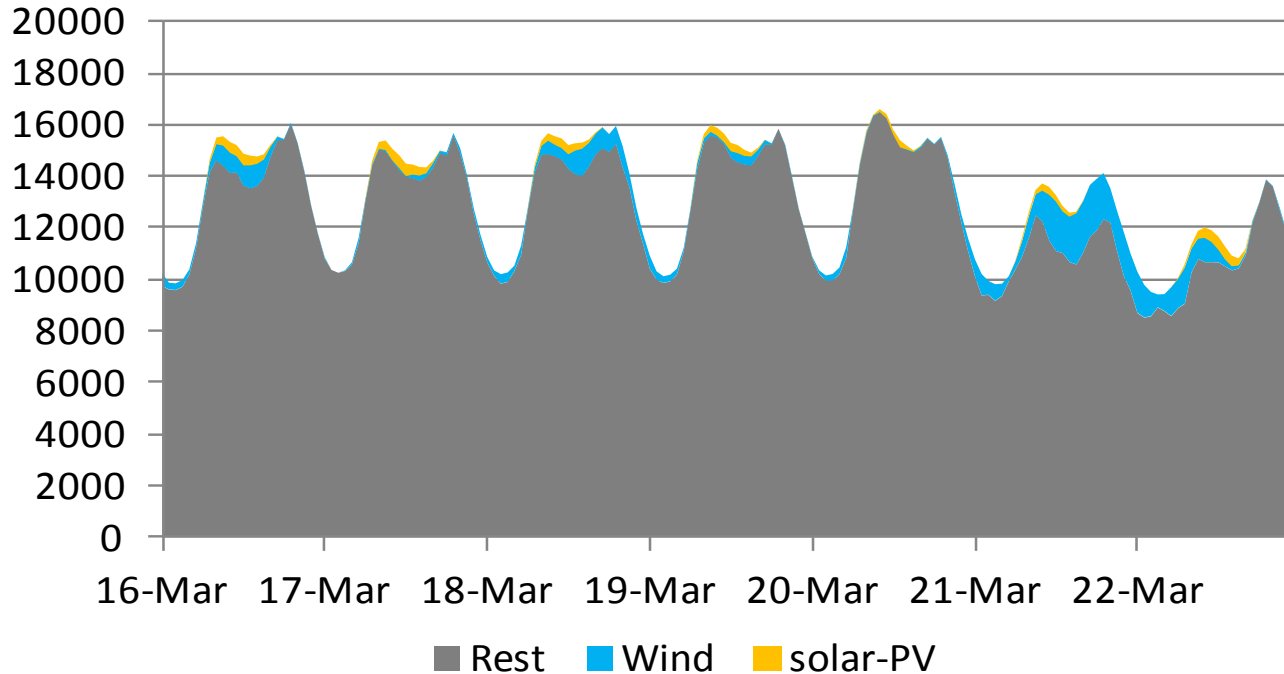


Sources: TenneT, CertiQ, Windstats, Klimaatmonitor, PolderPV.nl, KNMI, own analyses

Hourly Solar-PV and Wind Generation 2015

MWh

2015

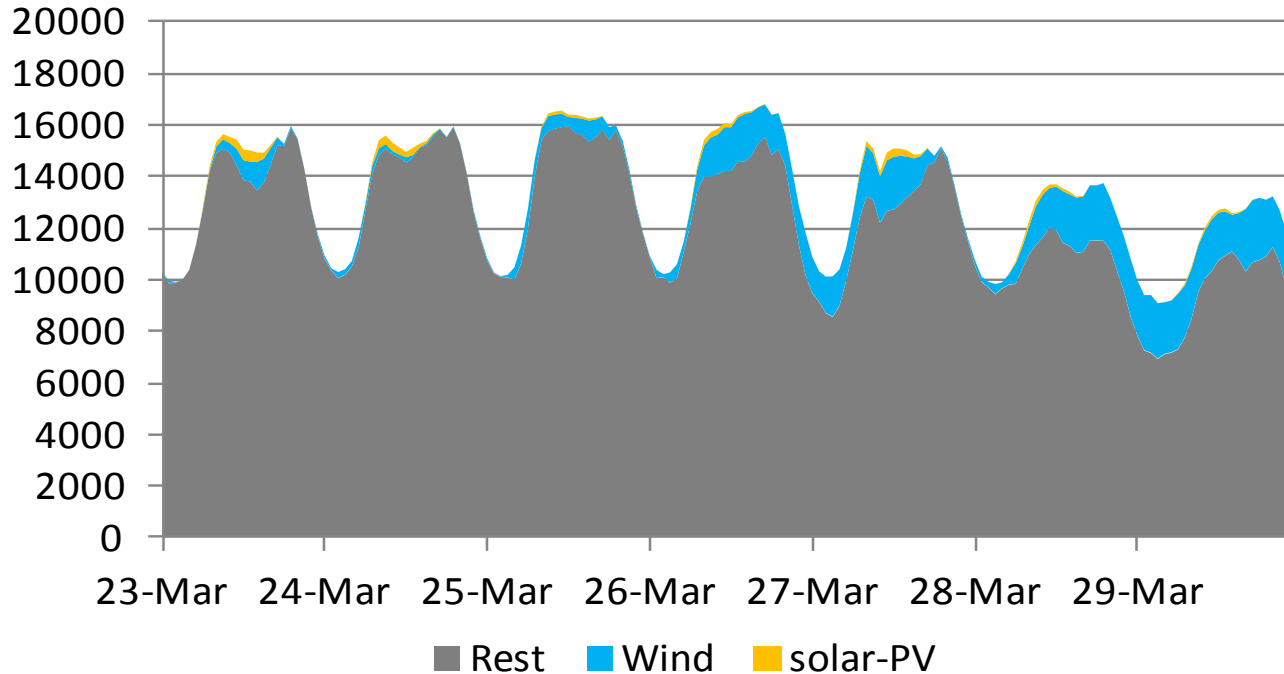


Sources: TenneT, CertiQ, Windstats, Klimaatmonitor, PolderPV.nl, KNMI, own analyses

Hourly Solar-PV and Wind Generation 2015

MWh

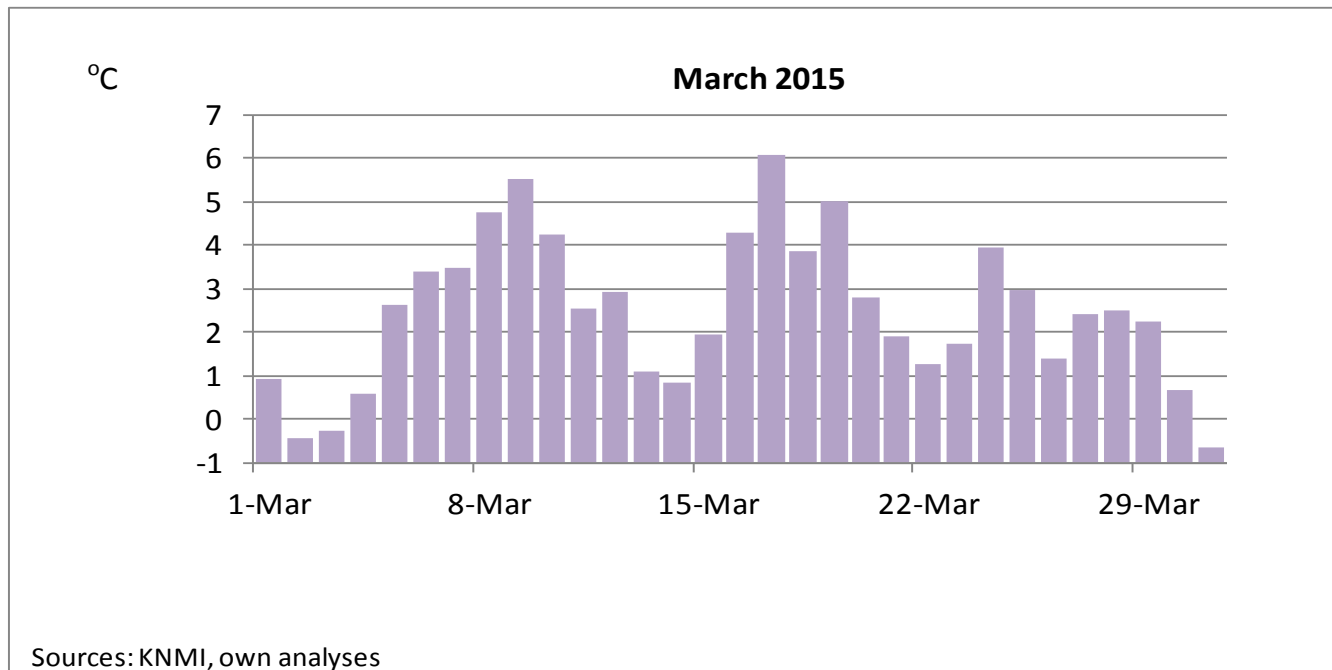
2015



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

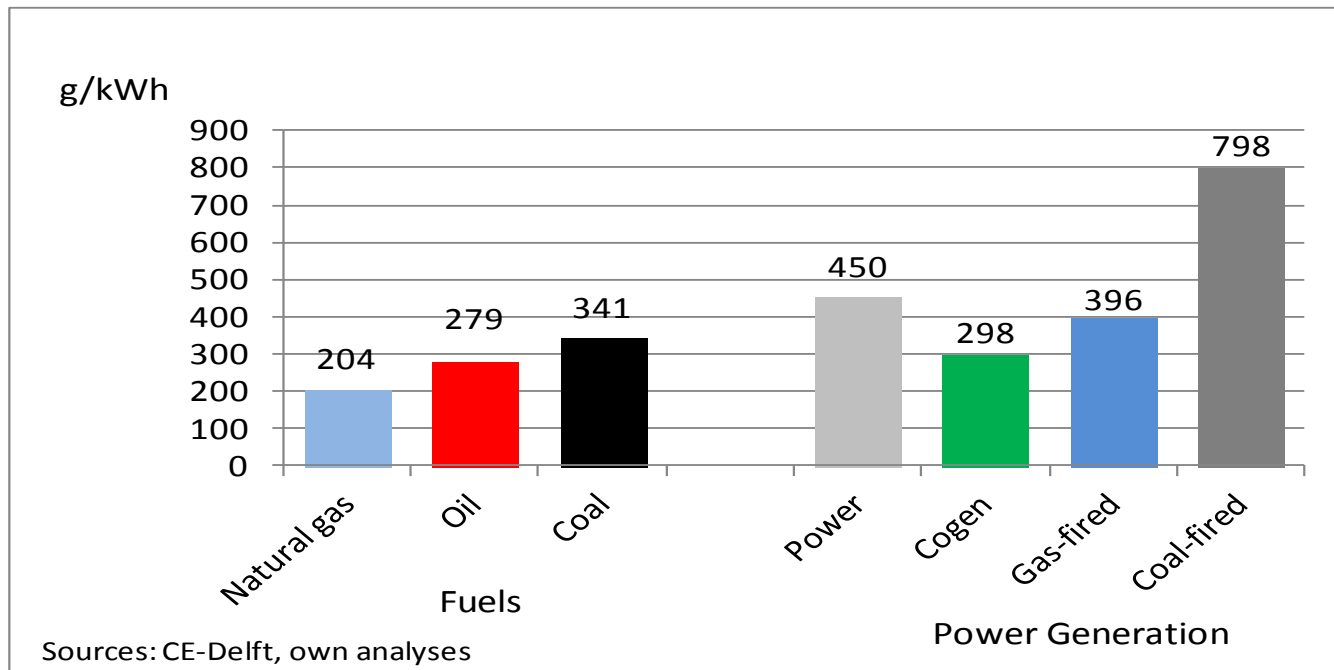
MISCELLANEOUS

Effective Temperature March 2015



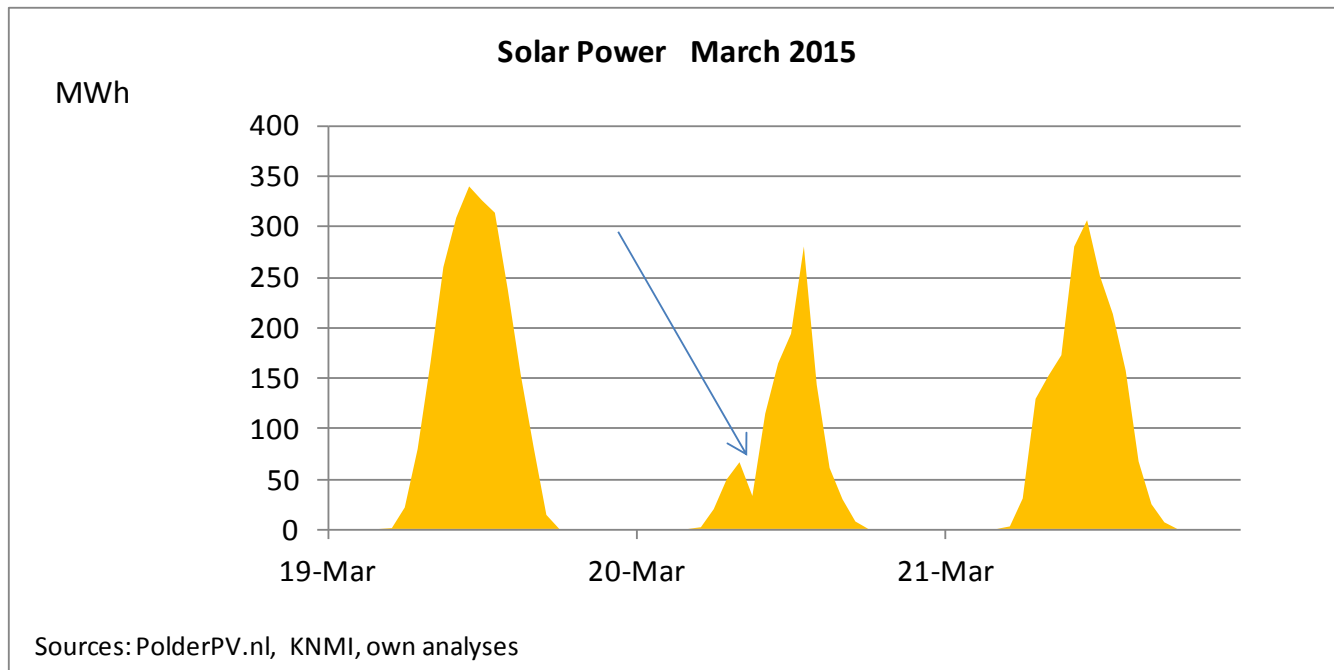
The effective temperature (temperature including wind shield factor) in March 2015.

Fuel Specific CO2 Emissions



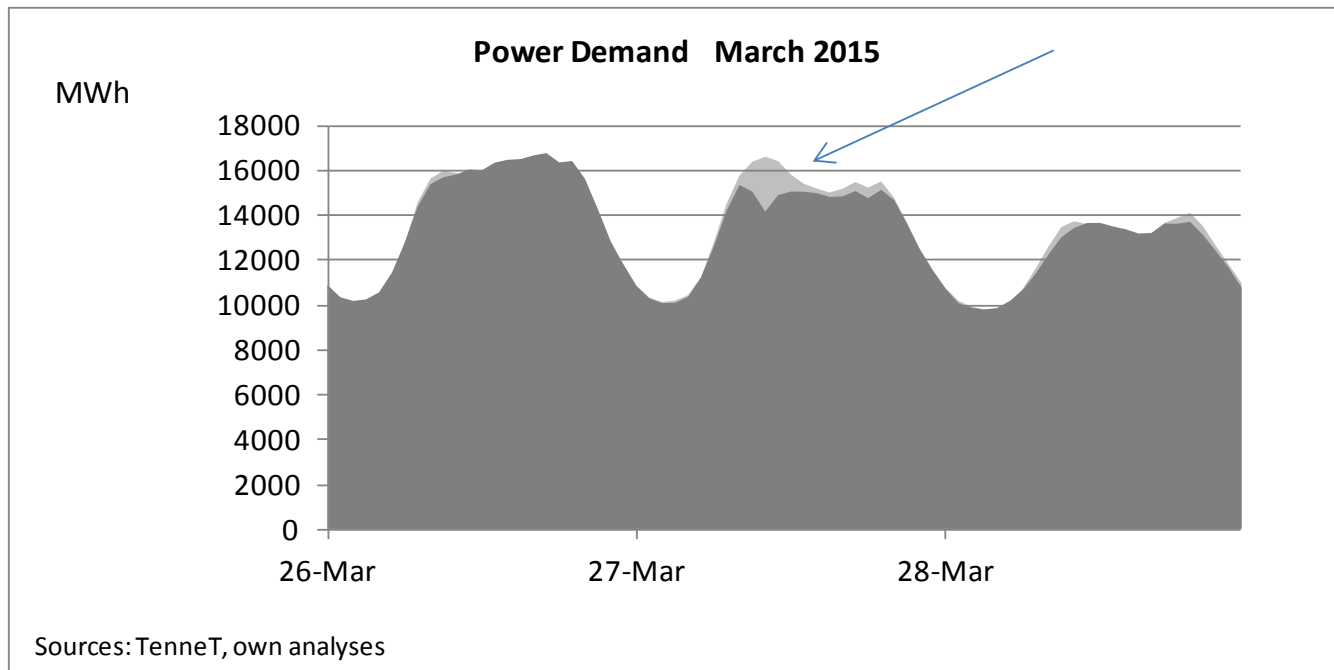
Characteristic CO2 emissions used in this presentation.

Solar-PV production affected by the solar eclipse on March 20th



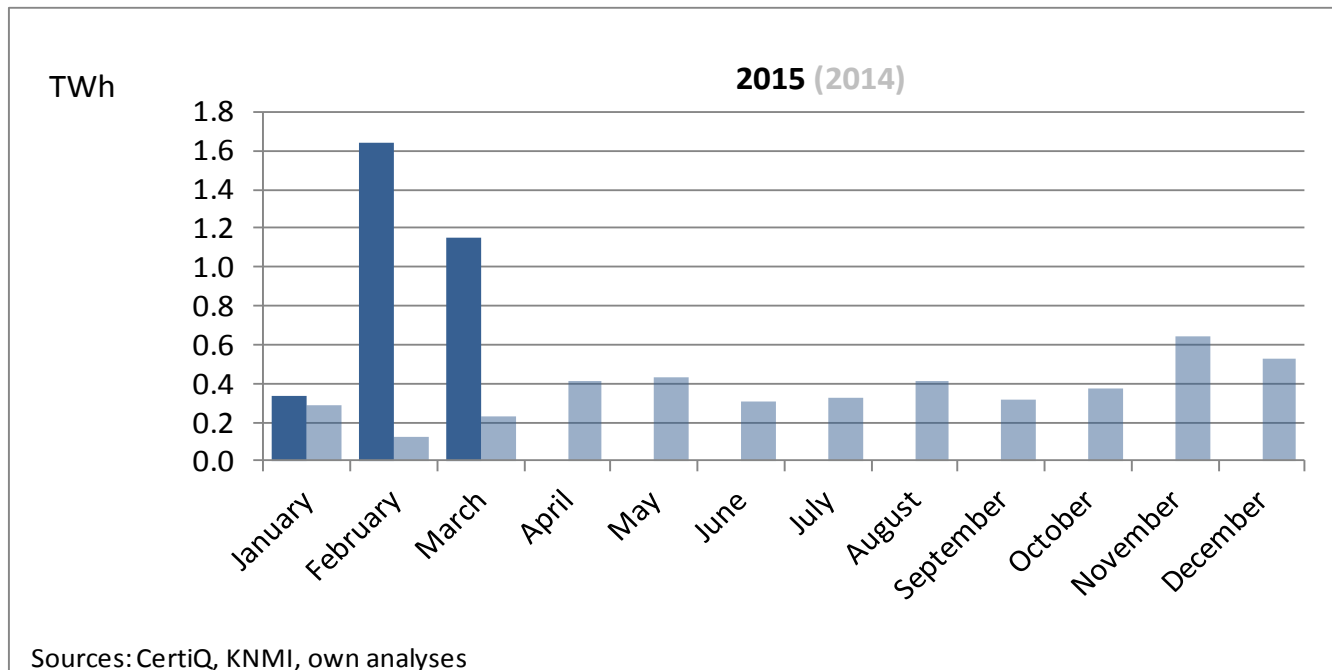
Effects of the solar eclipse on March 20th have been limited due to cloudiness. In the afternoon of March 20th, after the solar eclipse, the clouds have disappeared

Power consumption affected by the black-out on March 27th



On Friday March 27th, a black-out occurred in large parts of the Netherlands. Consequently, power consumption decreased during a number of hours. The power consumption of a week earlier has been depicted for comparison.

LNG imports 2015 (and 2014)



Send out of Gate terminal into the gas grid has increased significantly.

Epilogue

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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.