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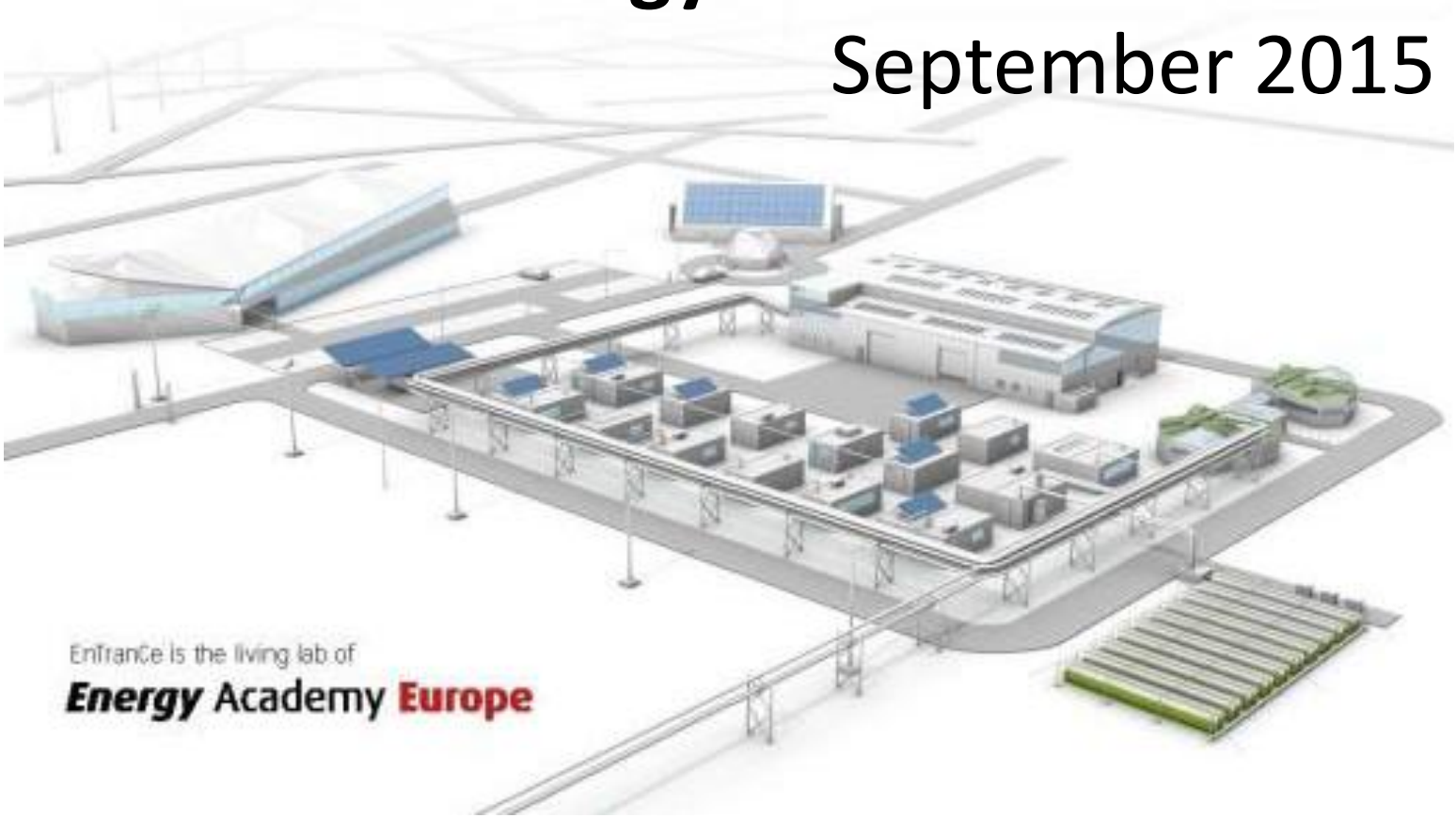
Renewable Energy in The Netherlands
September 2015



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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.

September 2015

In a Nutshell

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- The fraction of renewable energy in The Netherlands was 6.0%.
- Electricity production by wind was 140% higher y-o-y.
- Average utilization of wind capacity was 20% and of solar-PV, it was (just) 9%
- Coal usage in Dutch power generation increased by 80% y-o-y.
- Dutch energy related CO2 emissions increased by 9% y-o-y.
- The fraction renewable power was 9.7%, up from 7.2% last year.

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SELECTED ENERGY DATA FROM SEPTEMBER 2015

Final Energy Demand

September 2015

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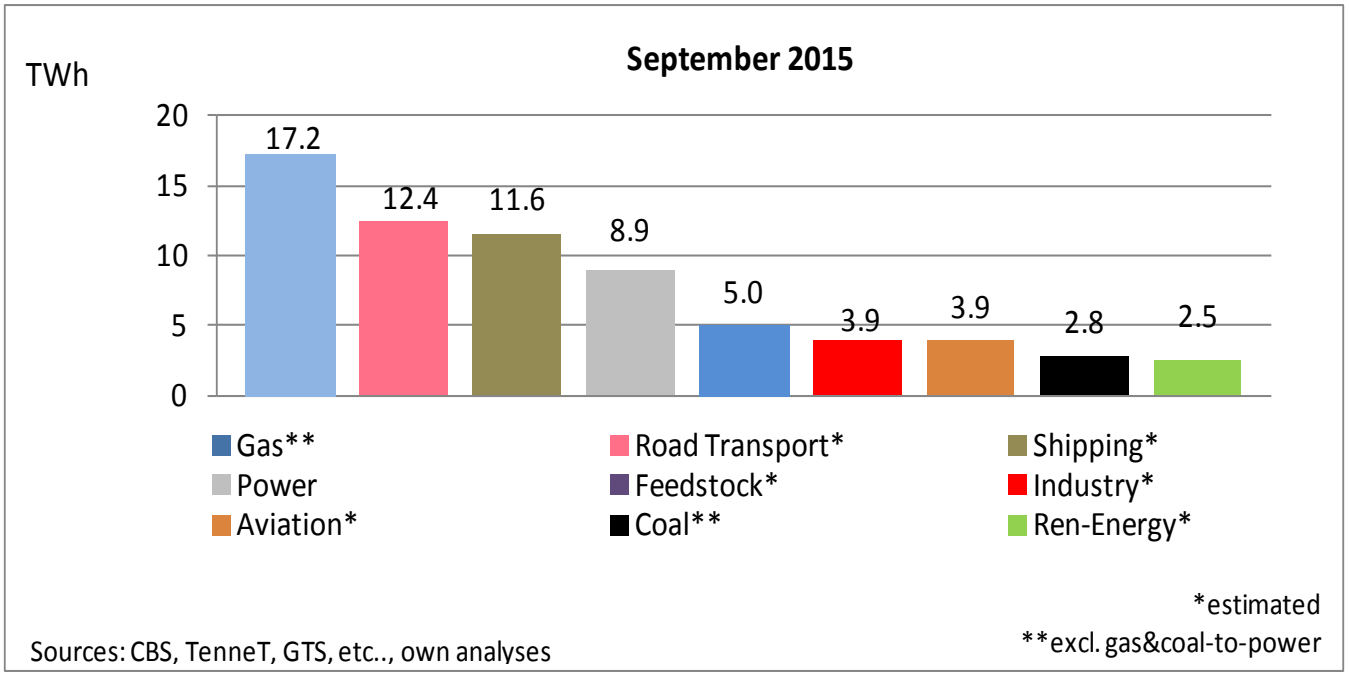
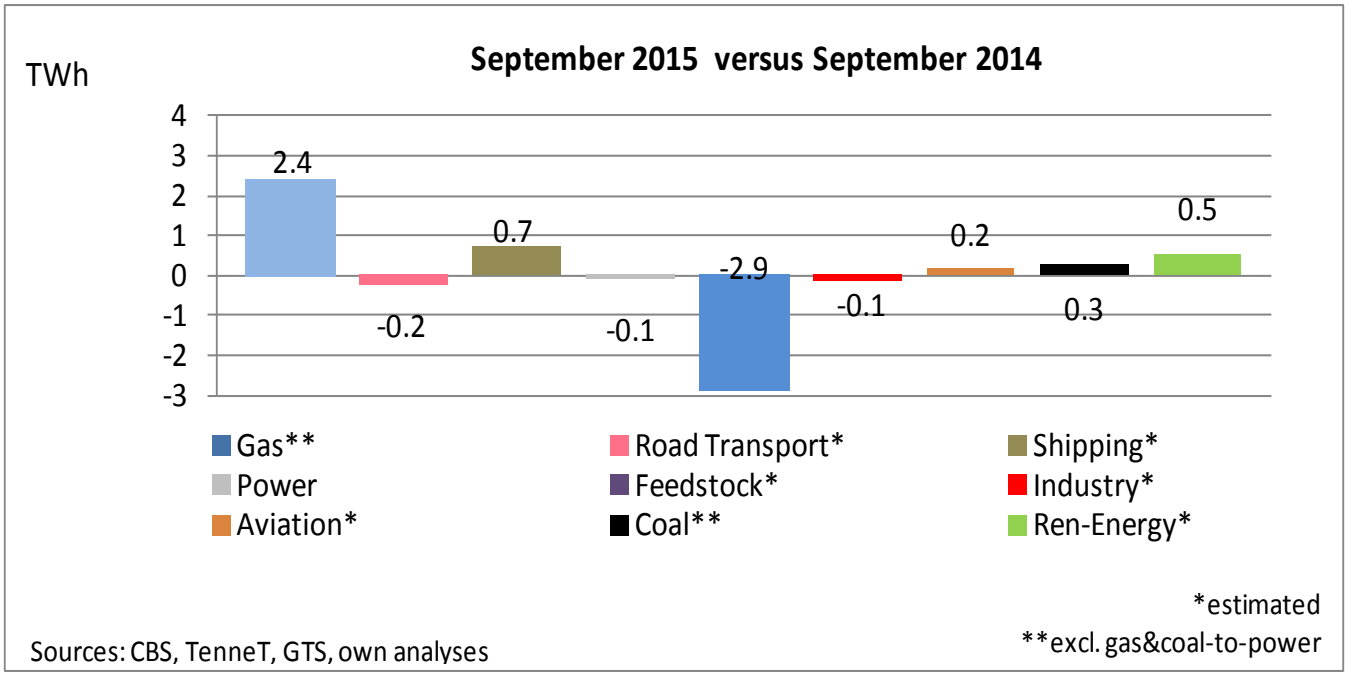


Energy is used for many different purposes. In September 2015, the most important energy applications were gas and various forms of transport. Renewables are given by comparison.

Final Energy Demand September 2015 (vs 2014)



In September 2015, energy used for feedstock has been estimated to be significantly lower than in 2014, while gas demand was significantly higher, mainly due to lower ambient temperatures than previous year.

CO2 Emissions September 2015

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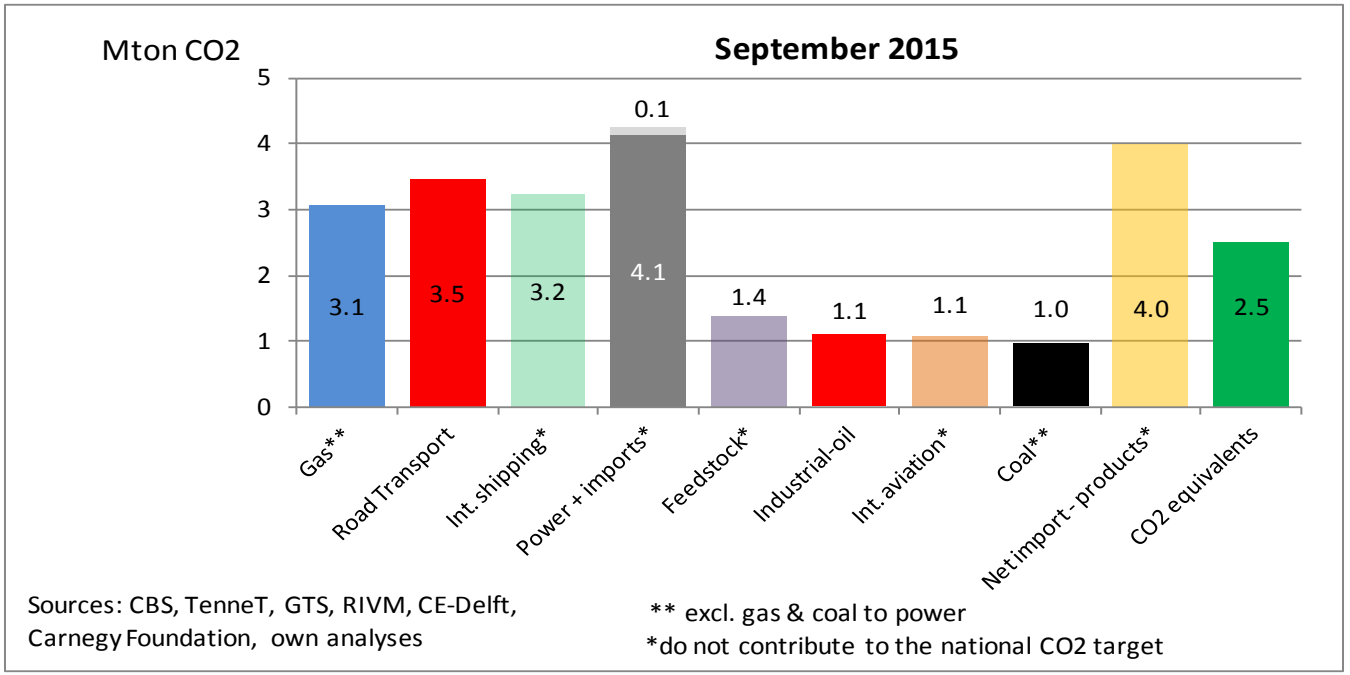

In September, the national energy-related CO2 emissions are estimated at 12.8 Mton, an increase by 9% y-o-y. The total Dutch CO2 footprint, including the CO2 sources that do not contribute to the official CO2 emission, and including emissions of CO2-equivalents from agriculture and industry, is estimated at 25 Mton.

Power Generation Capacity September 2015

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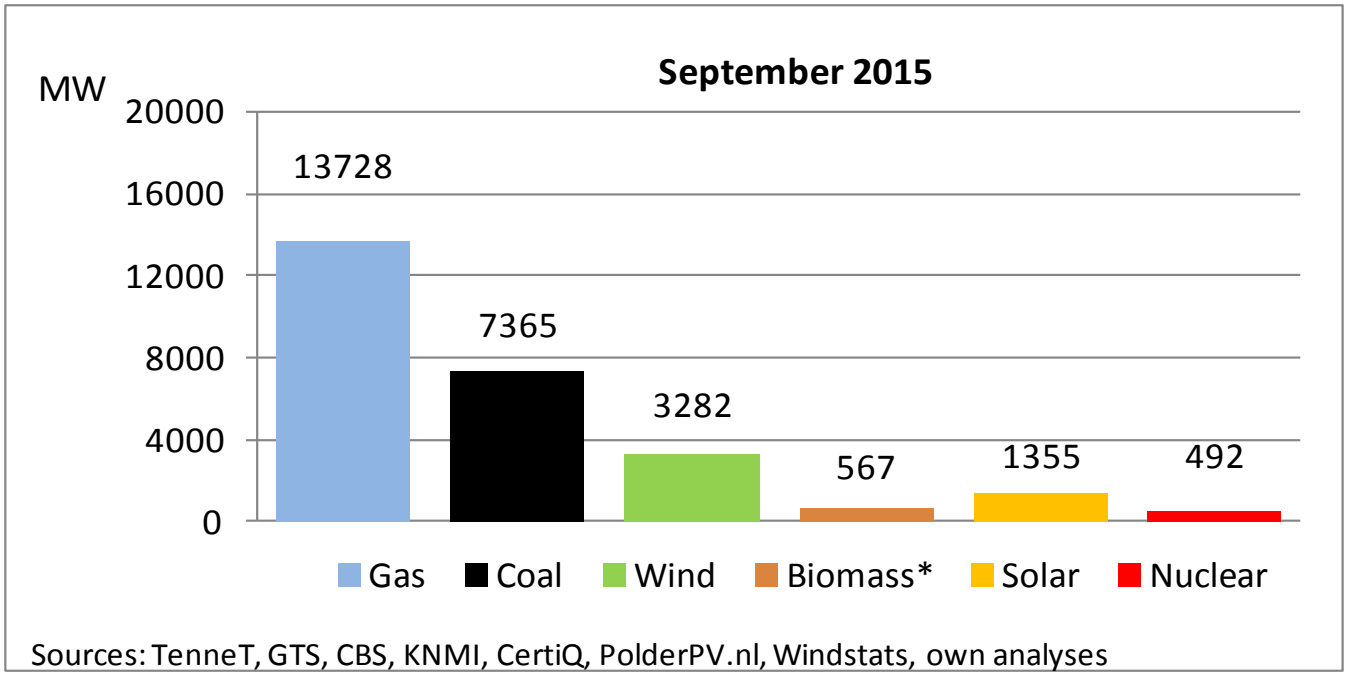

The capacity given is the so-called name-plate capacity. In practice, not all capacity is available for the electricity market due to planned and unplanned maintenance.

Power Supplies

September 2015

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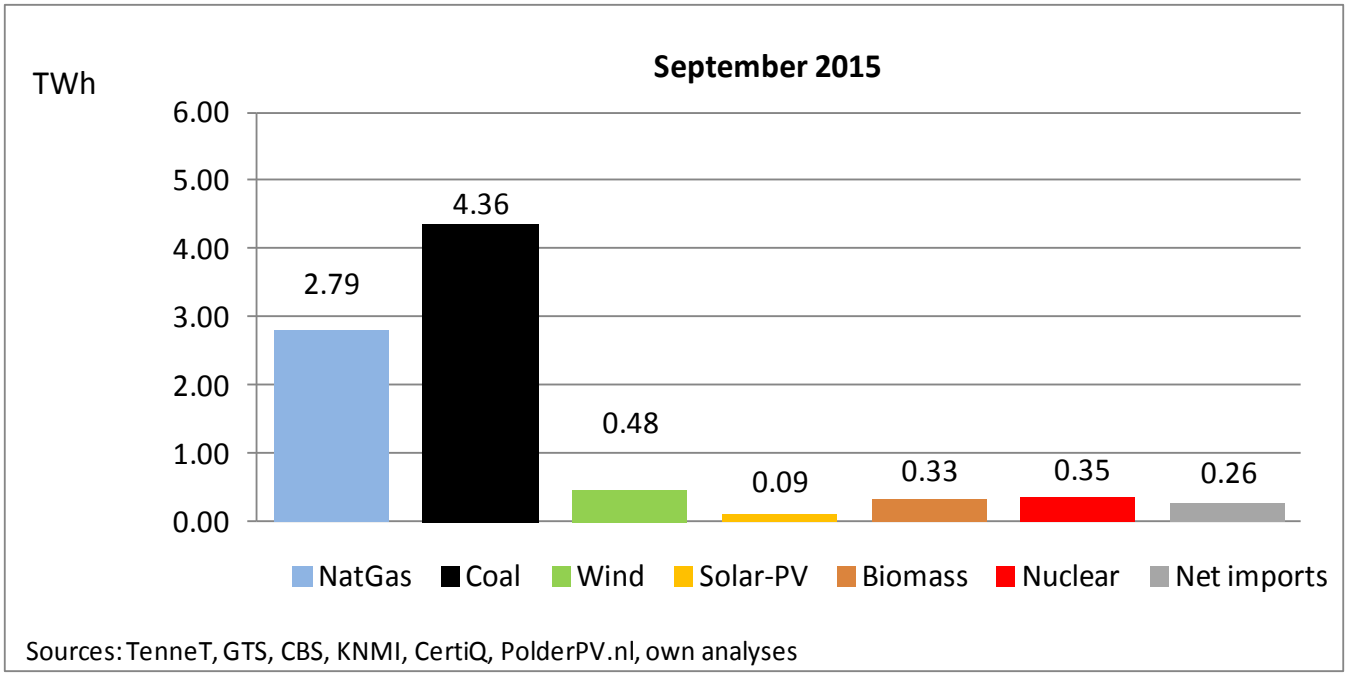
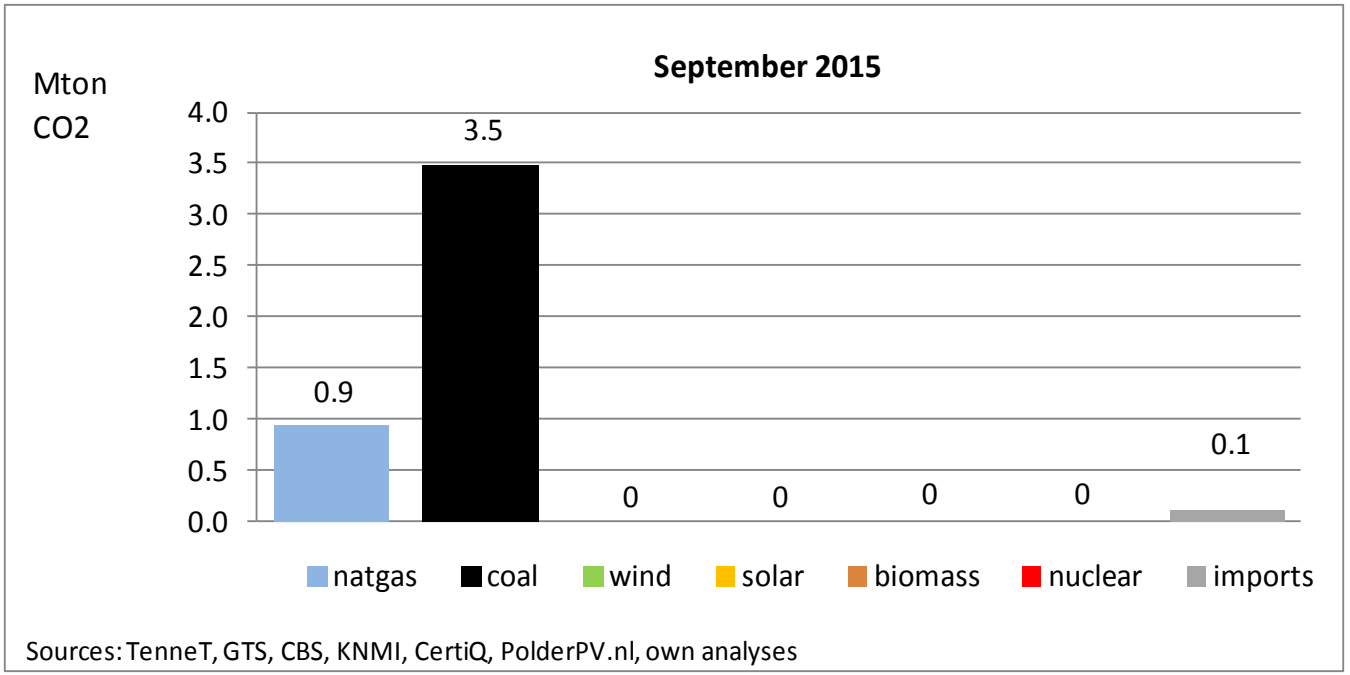


In September 2015, power consumption was 8.9 TWh, the same as last year. Most power has been generated by coal-fired power stations. In September 2015, renewables accounted for 9.7% in the power system, up from 7.2% last year.

CO2 from Power Generation

September 2015



The CO2 emissions from imports are given for comparison, as these emissions do not contribute to the National Dutch CO2 emission level. In September 2015, 85% of the CO2 emissions from the power sector came from coal-fired power stations.

SELECTED MONTHLY PROFILES

(using daily data)

Gas and Power Demand September 2015

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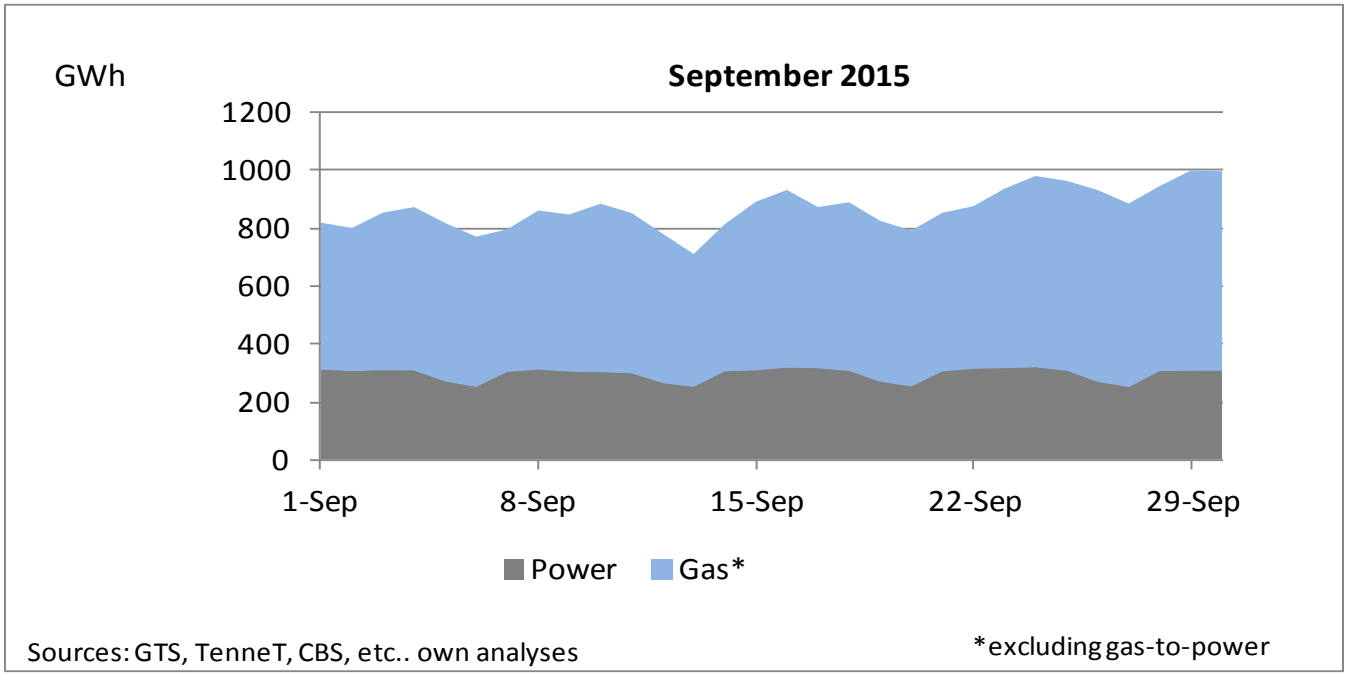
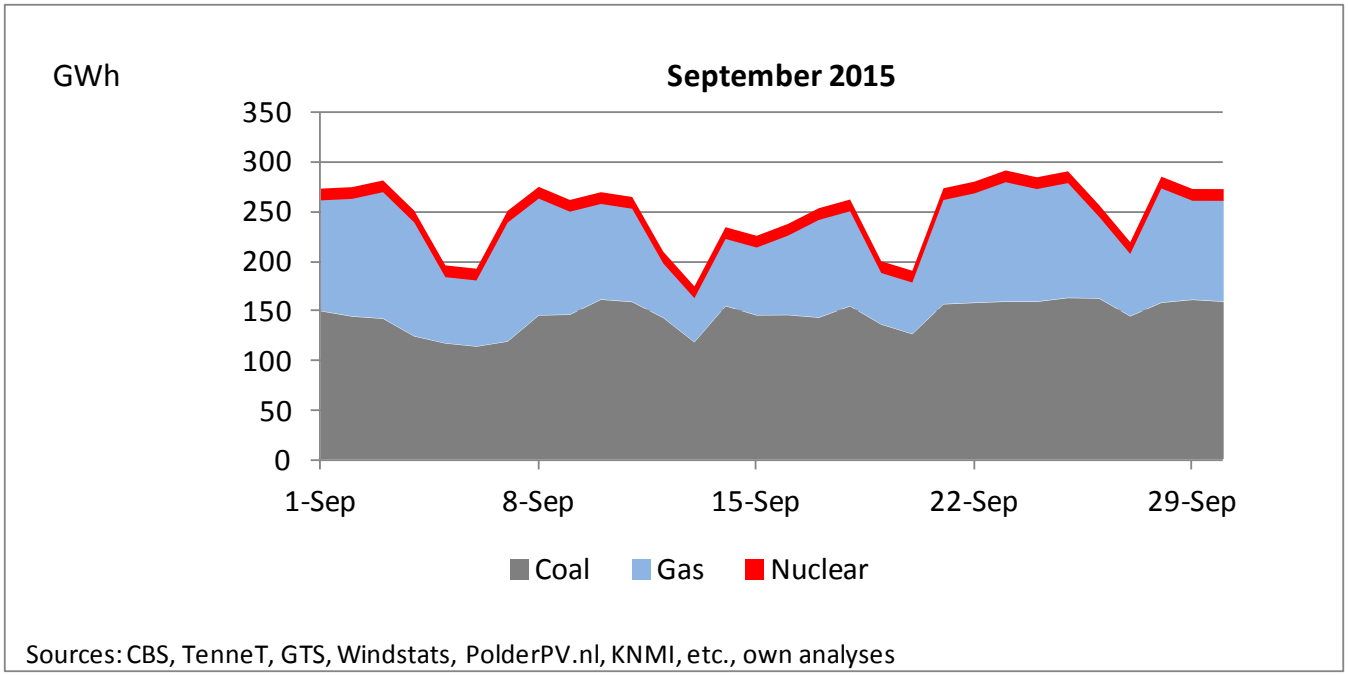


Daily power demand shows a week-weekend pattern. Daily gas demand (excluding gas demand for power) from industry has a similar pattern. In summer, little gas is used for the heating market.

Conventional Power Production September 2015



Sources: CBS, TenneT, GTS, Windstats, PolderPV.nl, KNMI, etc., own analyses

Coal-fired power stations showed a week-weekend pattern. Gas-fired generation used, is typically must-run capacity (e.g. cogeneration) and necessary to balance the system.

Wind and Solar Power Production September 2015

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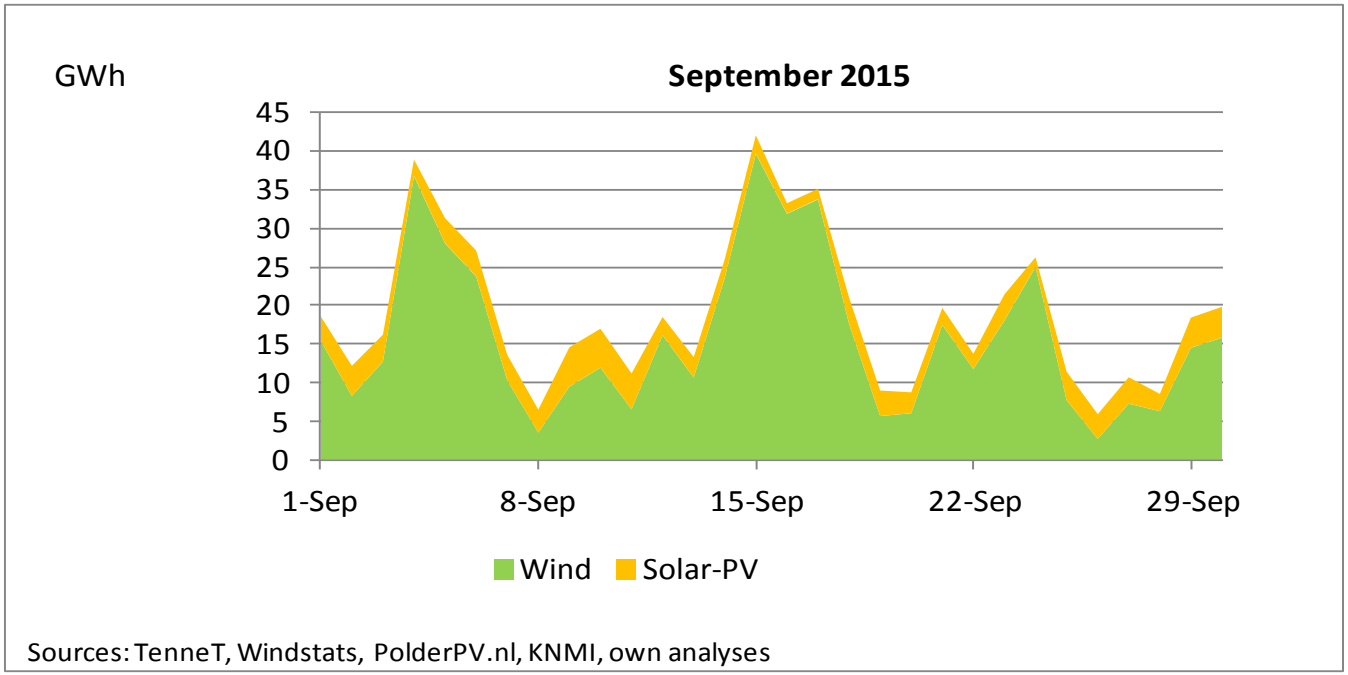

Sources: TenneT, Windstats, PolderPV.nl, KNMI, own analyses

September 2015 had was rather windy. Hence, wind energy production increased by 140% compared to September 2014. Furthermore, solar-PV electricity production increased by 30% y-o-y. 1 GWh is sufficient to provide power for a year to 300 households.

Contribution of Renewable Energy September 2015

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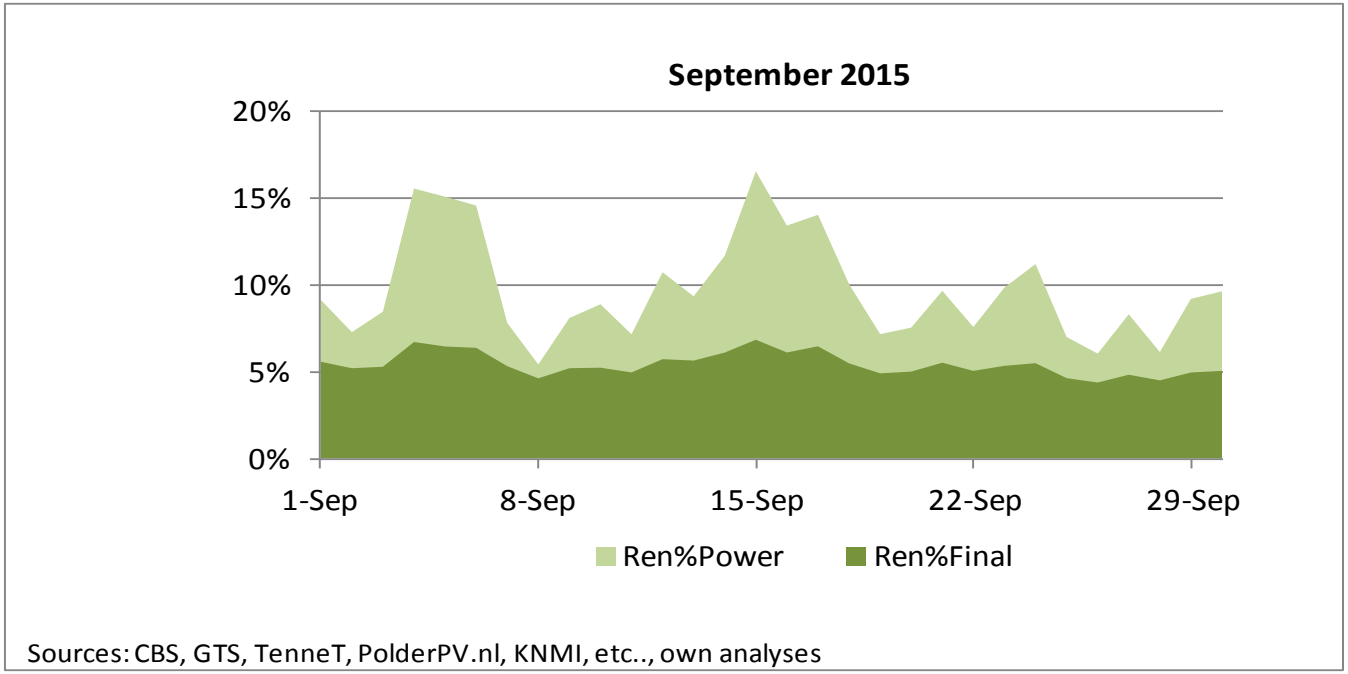

Sources: CBS, GTS, TenneT, PolderPV.nl, KNMI, etc.., own analyses

Renewable energy as a fraction of final energy consumption peaked at 6.8% on September 15, while the fraction of renewable power peaked to 16.5% that day. These contributions have been estimated using formal procedures.

SELECTED MONTHLY ENERGY DATA

Gas Demand
(excluding gas-to-power)
2015 (and 2014)

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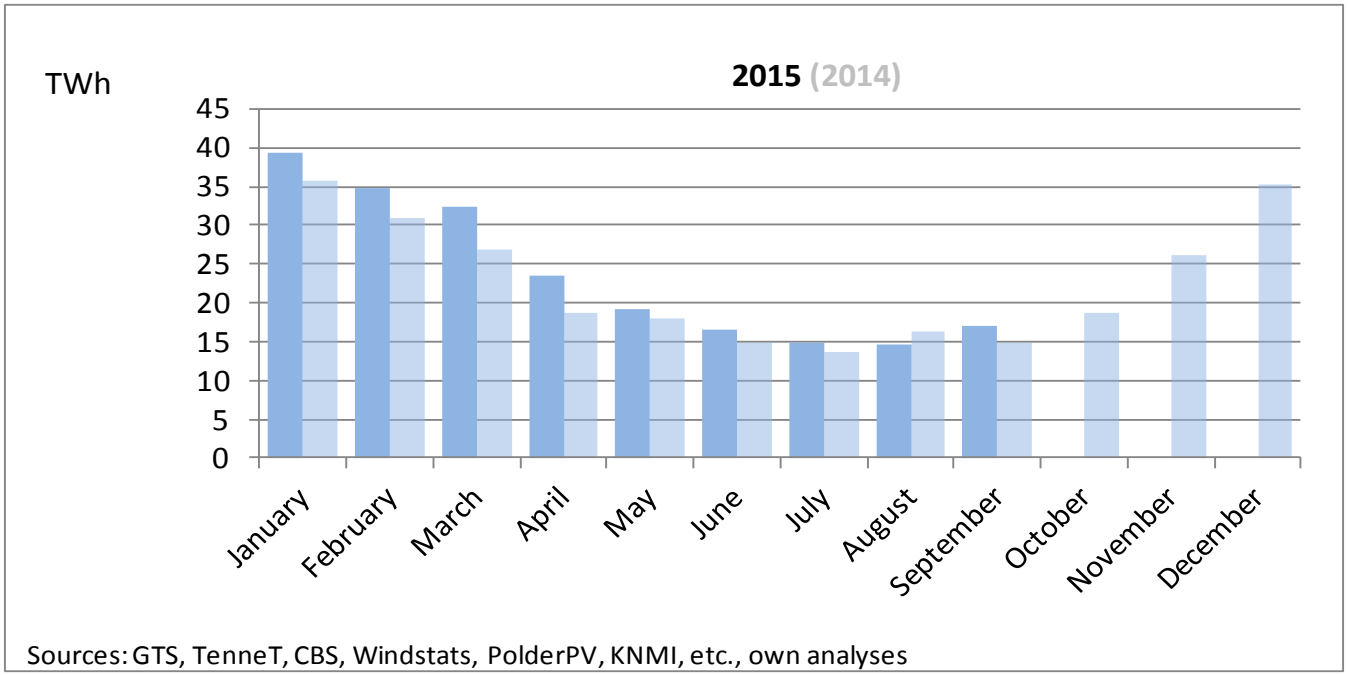
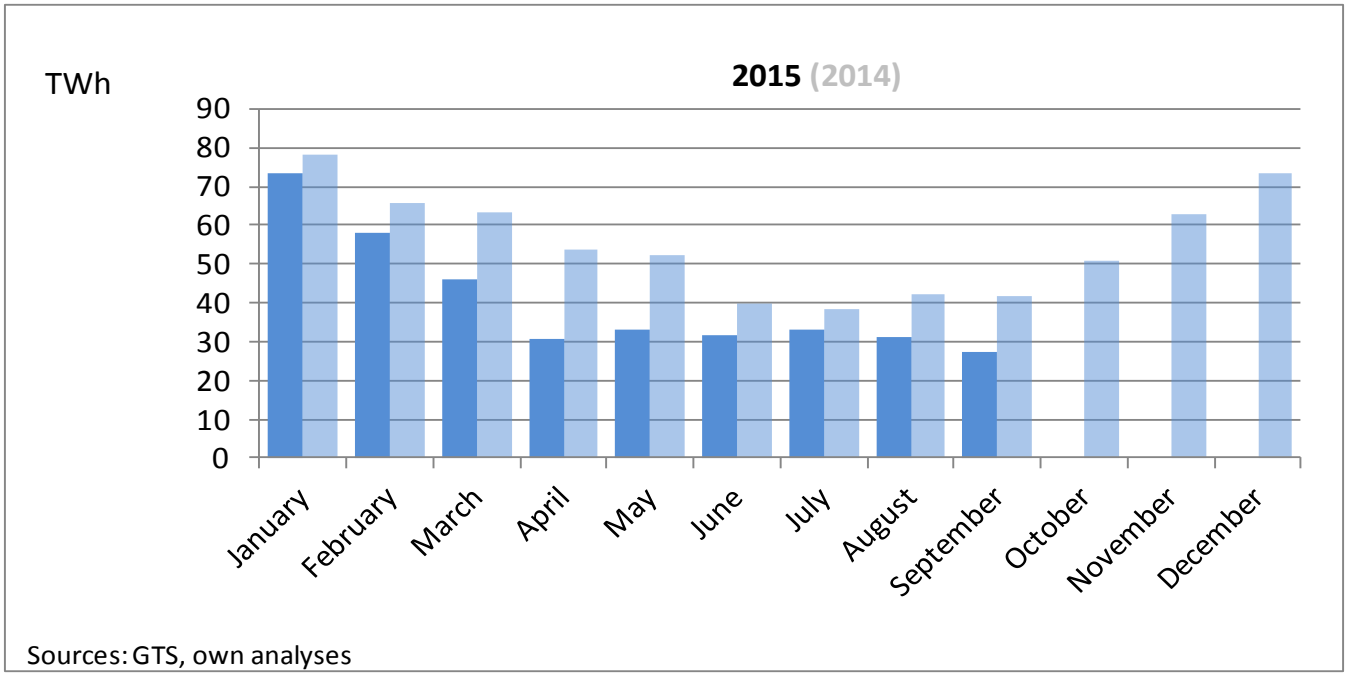


Sources: GTS, TenneT, CBS, Windstats, PolderPV, KNMI, etc., own analyses

Gas consumption in September was slightly higher than last year, mainly due to lower temperatures in 2015.

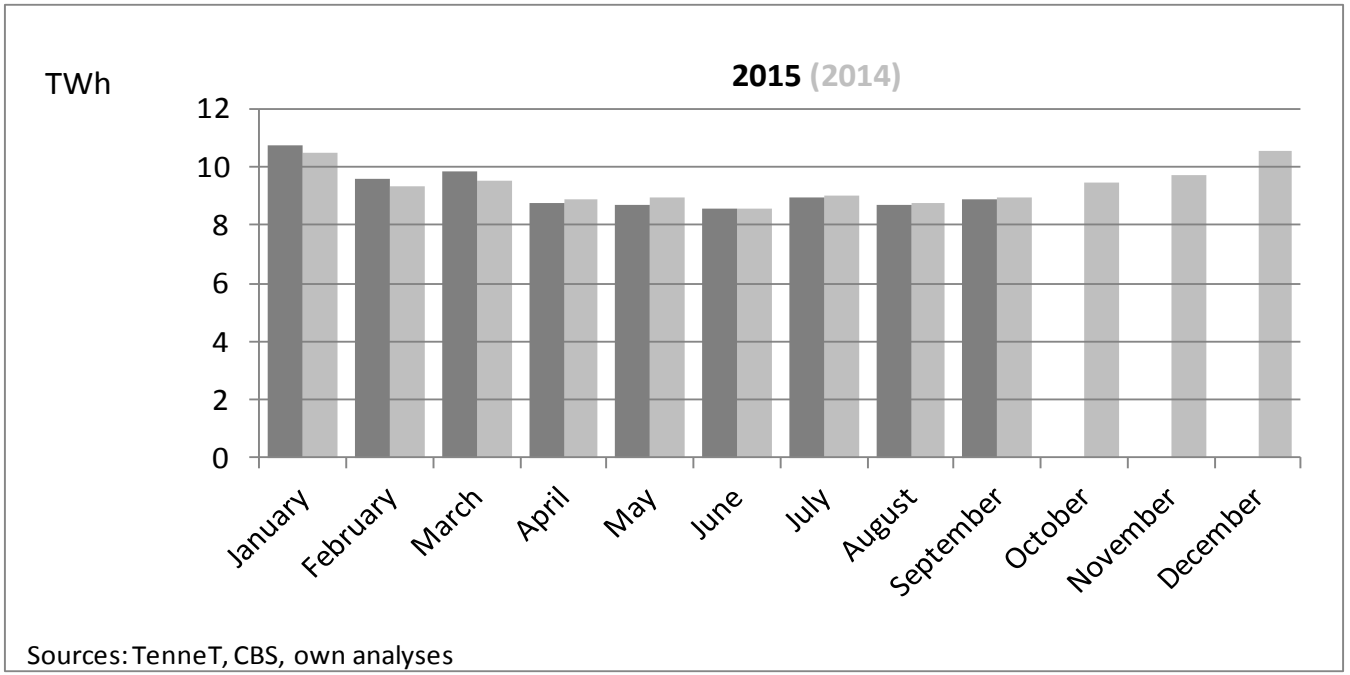
Gas Production 2015 (and 2014)



Sources: GTS, own analyses

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.

Power Demand 2015 (and 2014)



Sources: TenneT, CBS, own analyses

Power demand in September was the same as last year.

Wind Production 2015 (and 2014)

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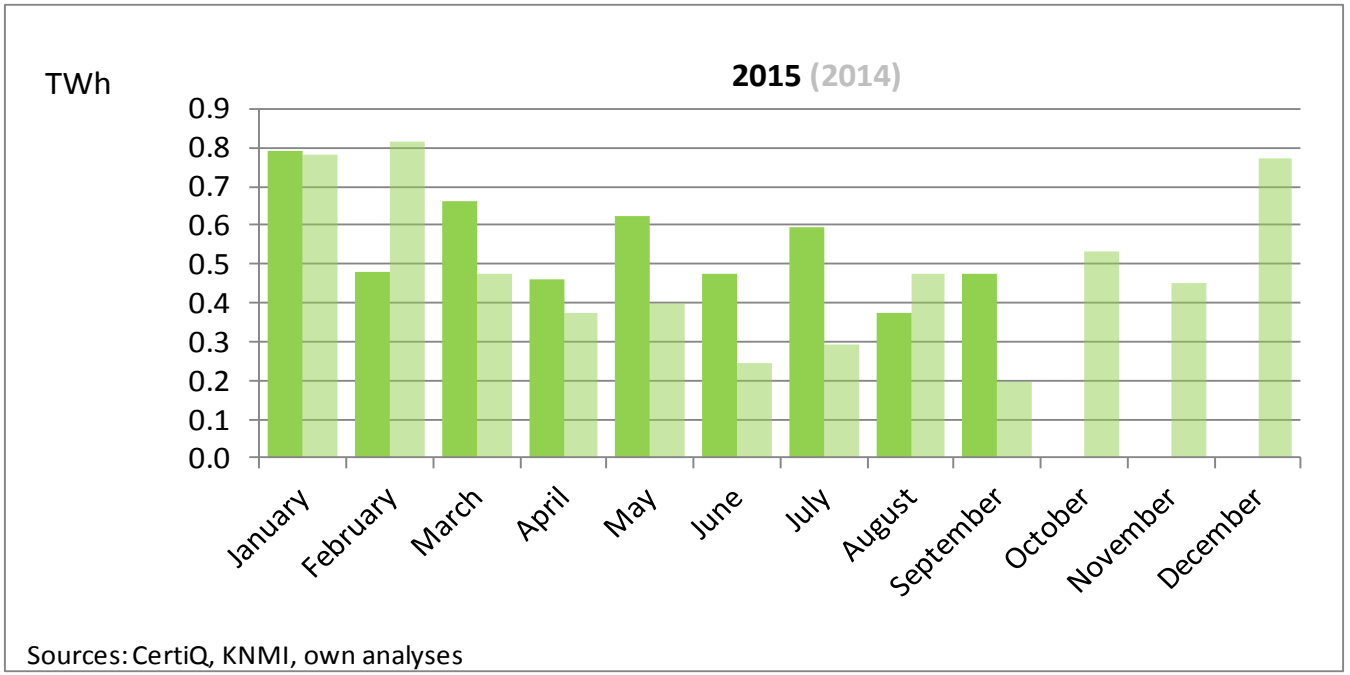
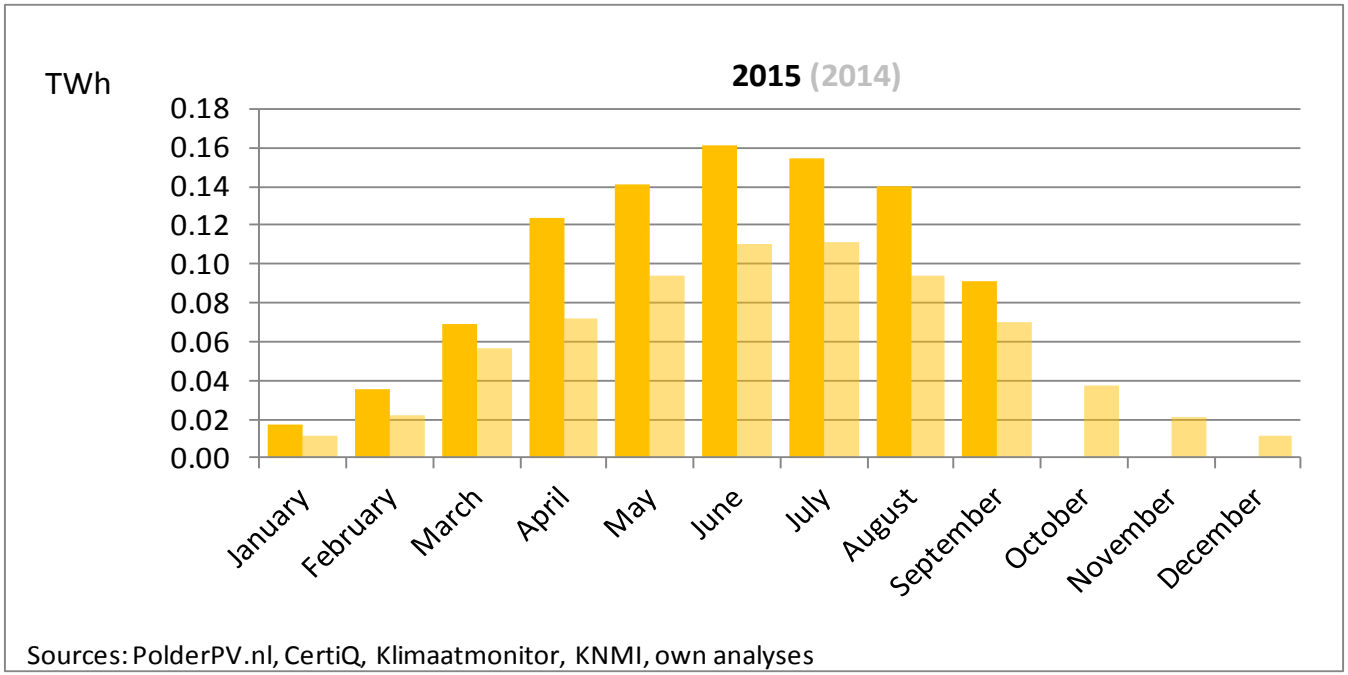


Sources: CertiQ, KNMI, own analyses

Wind power production is very volatile. Wind production in September 2015 was 140% lower that a year ago, while installed wind capacity increased by 20% y-o-y..

In September 2015, the average utilization of wind capacity was 20%.

Solar PV Production 2015 (and 2014)



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

In September 2015, electricity production by Solar PV in The Netherlands was relatively low, due to less sunshine. The average utilization rate of solar-PV capacity was 9% in September.

Coal-to-Power 2015 (and 2014)

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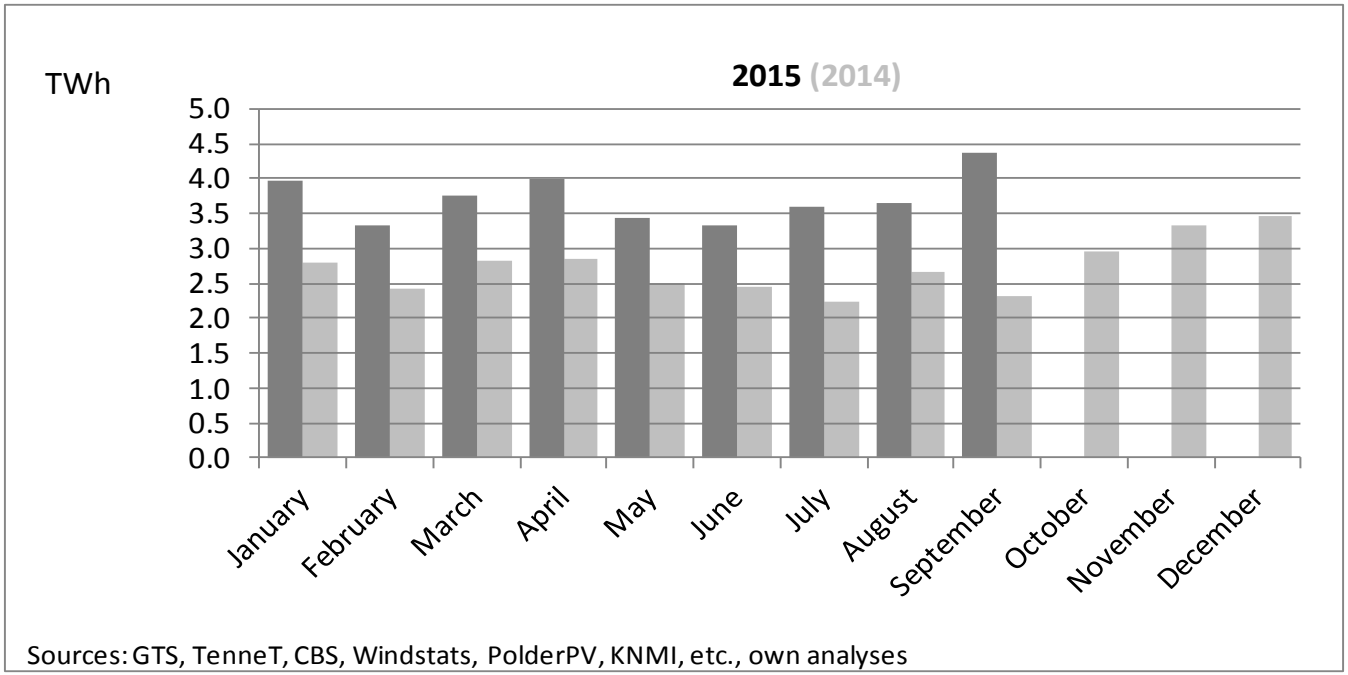

Sources: GTS, TenneT, CBS, Windstats, PolderPV, KNMI, etc., own analyses

In September coal utilization for power generation reached a record level. The average utilization rate of coal-fired power stations in the Netherlands is estimated at 82%. This percentage includes the effects of maintenance.

Gas to Power
2015 (and 2014)

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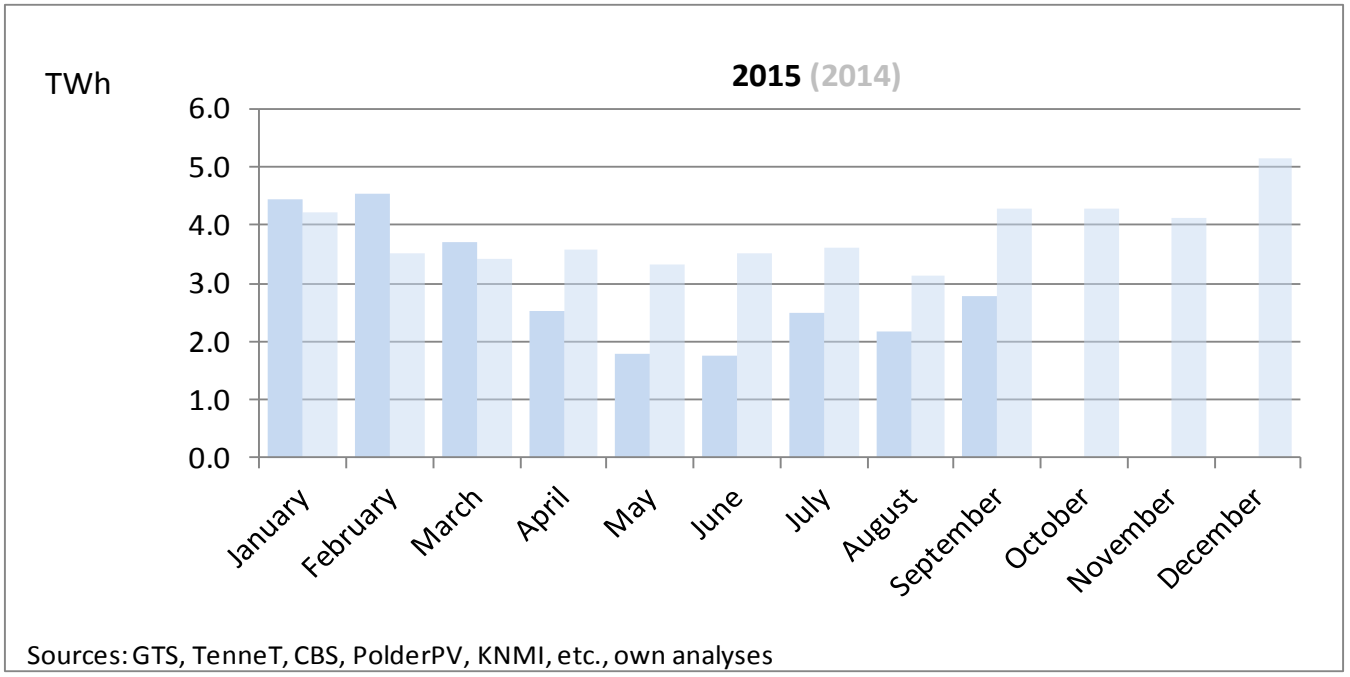
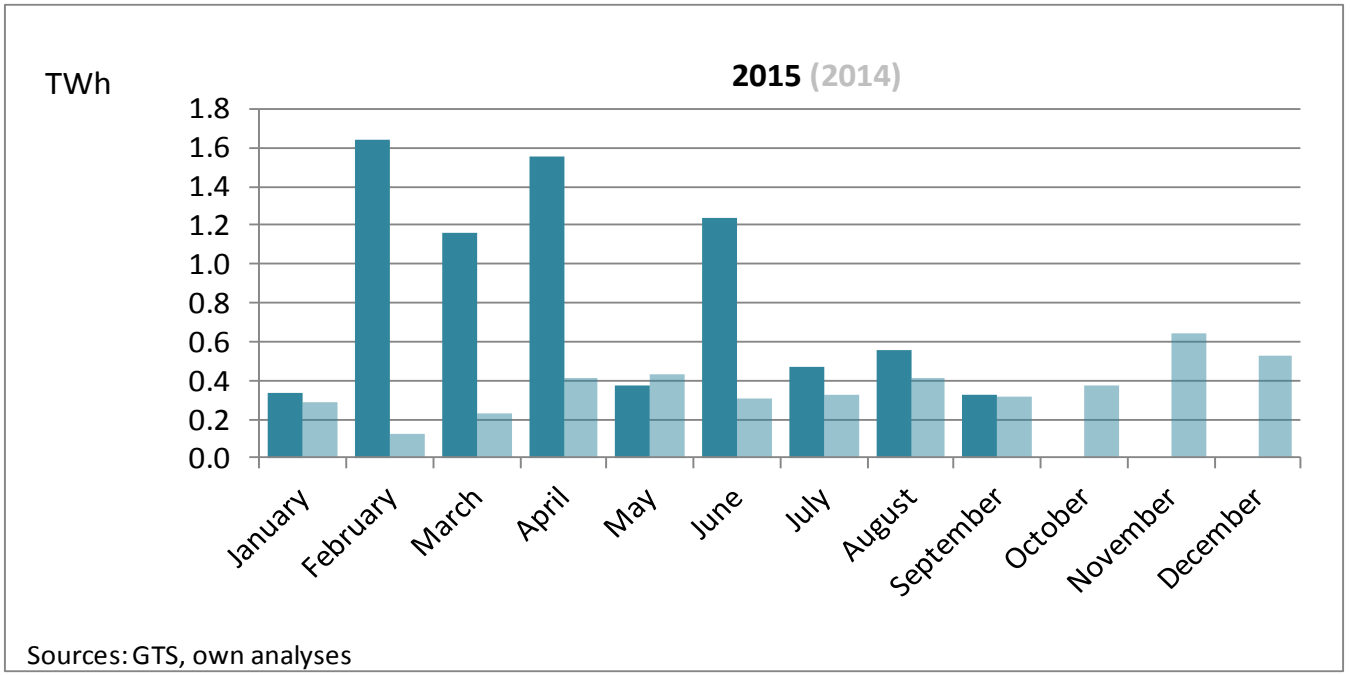


Sources: GTS, TenneT, CBS, PolderPV, KNMI, etc., own analyses

In September 2015, power production by gas-fired power stations and cogeneration recovered slightly, but is still much lower than previous year. In September, the average utilization rate of gas-fired capacity was 28%.

This percentage includes maintenance and mothballed installations.

LNG imports 2015 (and 2014)

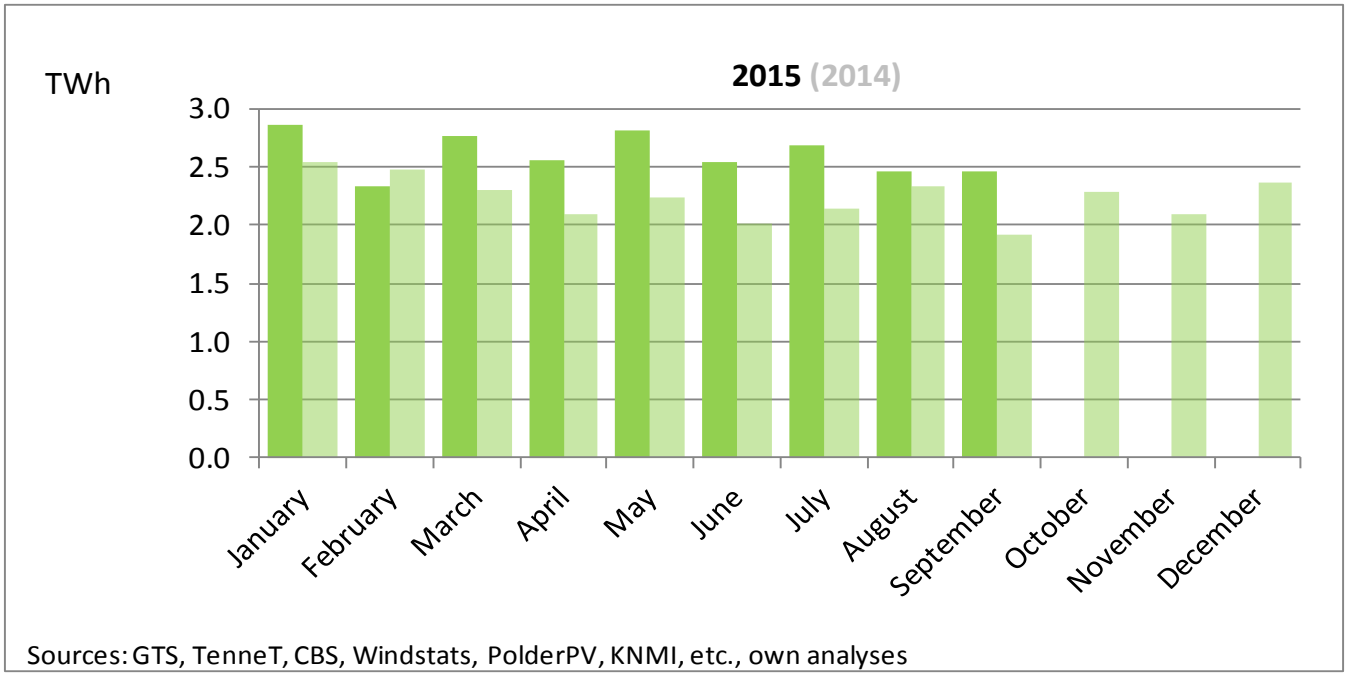


Sources: GTS, own analyses

On average, LNG imports in 2015 increased by 200% compared to 2014. This figure depicts the amount of LNG injected into the gas grid, as presented by GTS. The figure excludes therefore the usage of LNG as transport fuel

Renewable Energy All Sources

2015 (and 2014)



Sources: GTS, TenneT, CBS, Windstats, PolderPV, KNMI, etc., own analyses

The data show that in 2015, the renewable energy in The Netherlands was higher in any month so far. The average increase is 17% y-o-y.

Renewable Energy Percentage 2015 (and 2014)

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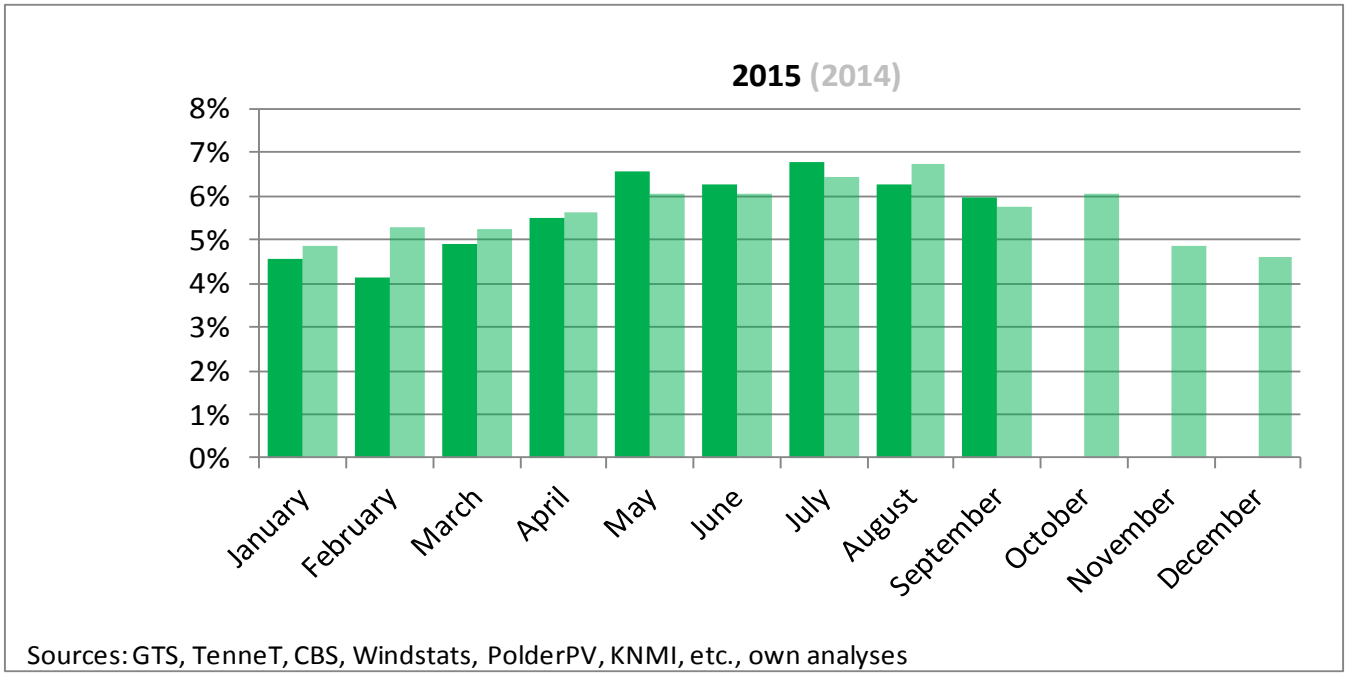

Sources: GTS, TenneT, CBS, Windstats, PolderPV, KNMI, etc., own analyses

On average, the percentage of renewable energy is this year similar than last year.

CO2 Emissions 2015 (and 2014)

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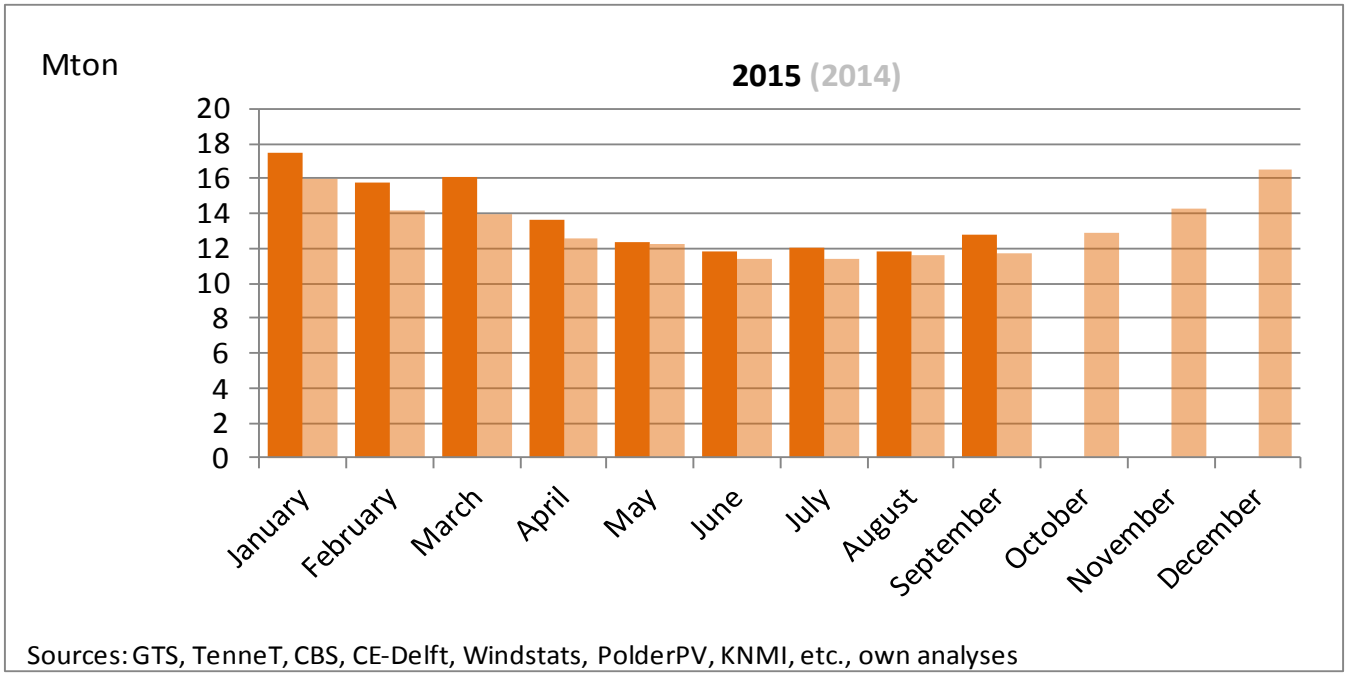
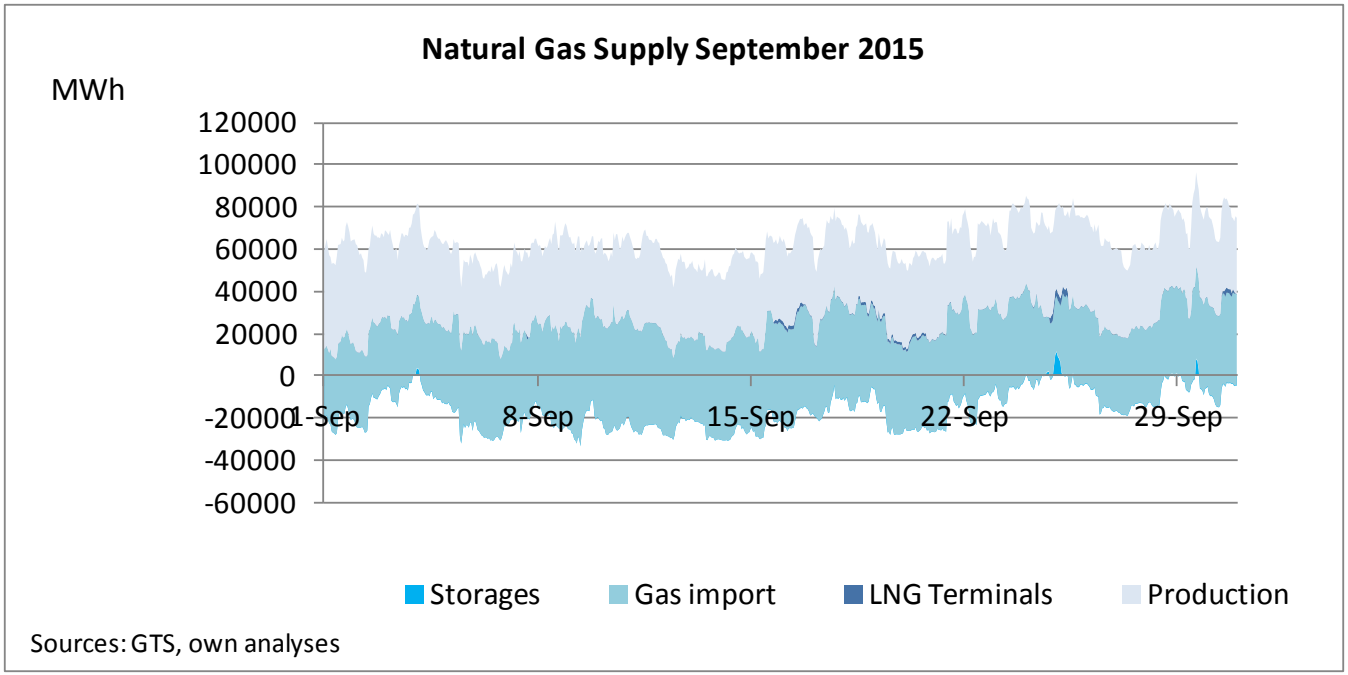


Sources: GTS, TenneT, CBS, CE-Delft, Windstats, PolderPV, KNMI, etc., own analyses

National CO2 emissions from the Netherland s are consistently higher than in 2014, mainly due high utilization of coal for Dutch power production.

SELECTED HOURLY ENERGY DATA

Gas Supply September 2015



In September 2015, substantial gas volumes were used to fill gas storages, depicted as negative values in the figure. This month, hardly any LNG was injected into the grid.

Gas Demand
Including Gas-to-Power
September 2015

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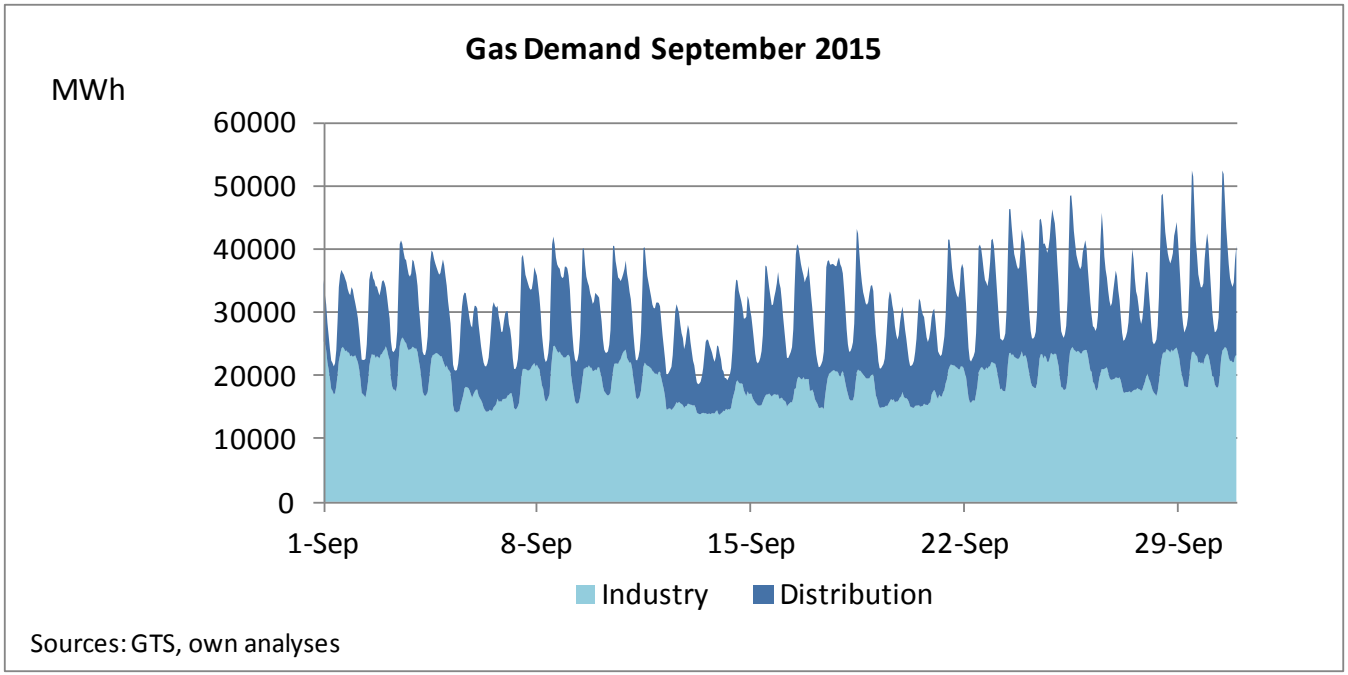
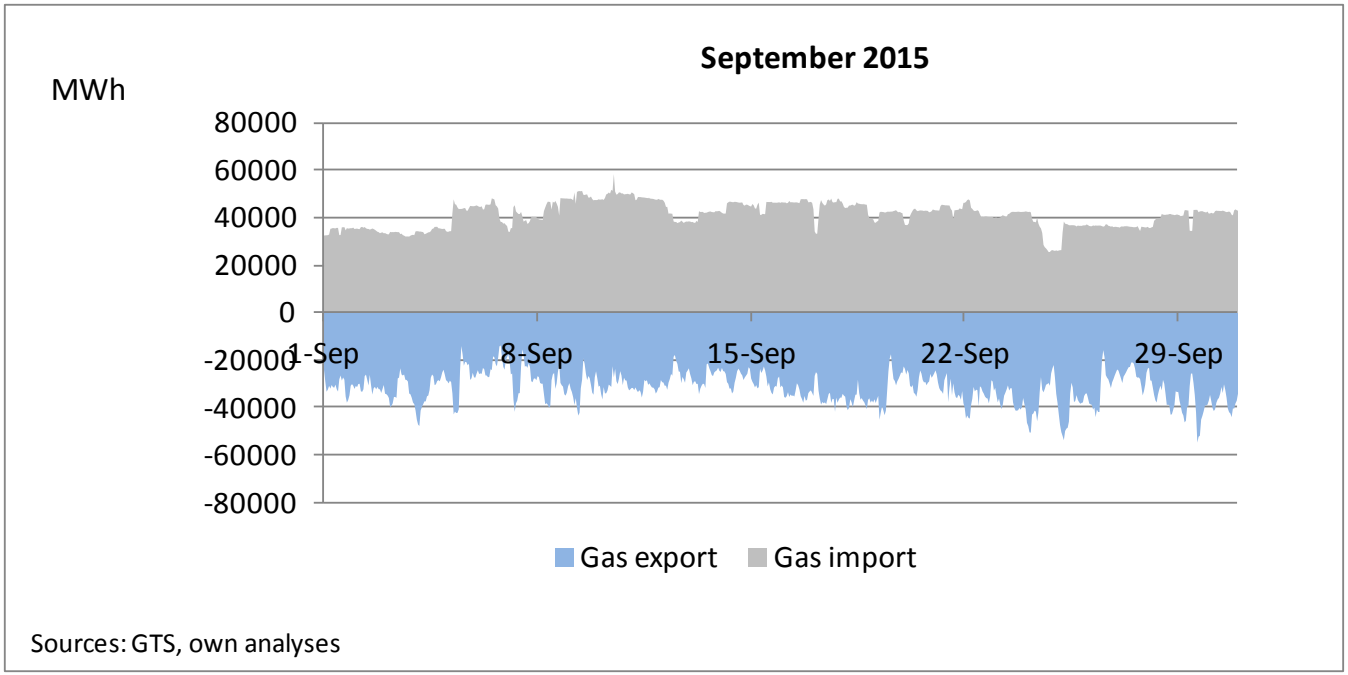


Sources: GTS, own analyses

In late September, temperatures dropped and gas demand in The Netherlands peaked to 51000 MW.

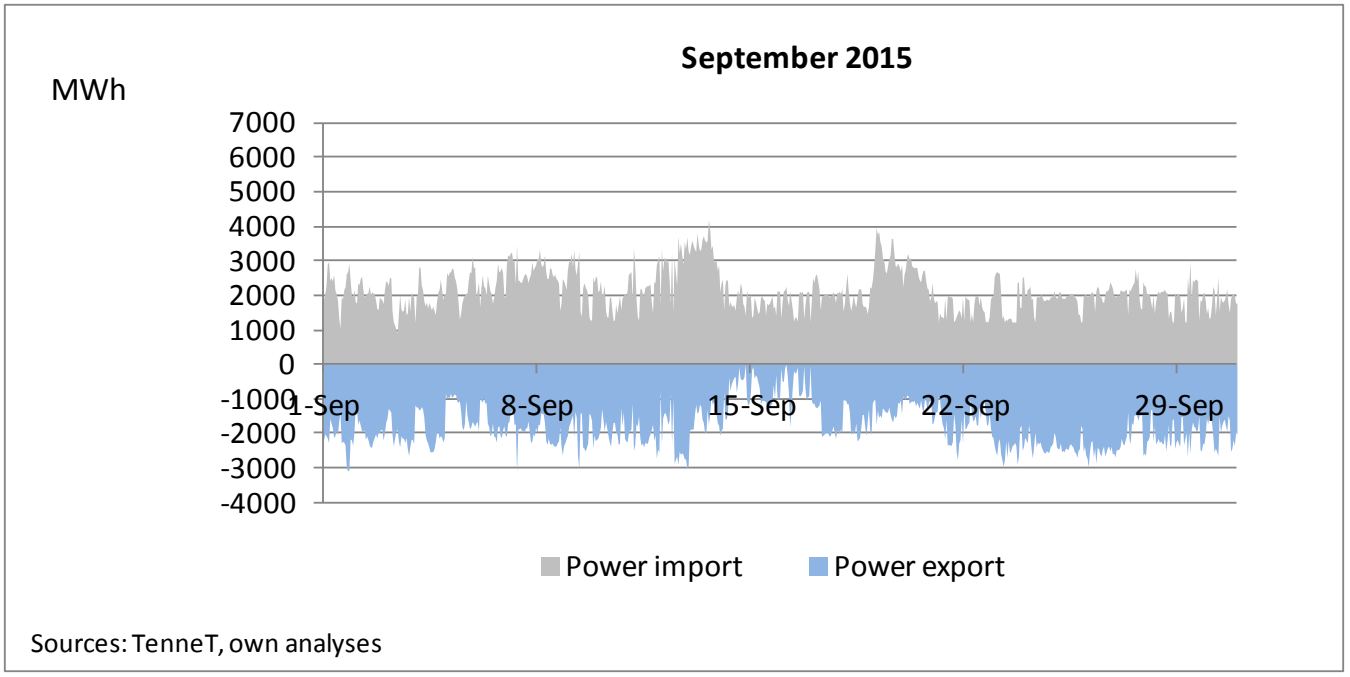
Gas Imports & Exports September 2015



Sources: GTS, own analyses

In September 2015, Dutch gas imports have been 7 TWh higher than Dutch gas exports. This is the fourth month in 2015 that the Netherlands was a net importing country (on a monthly basis)

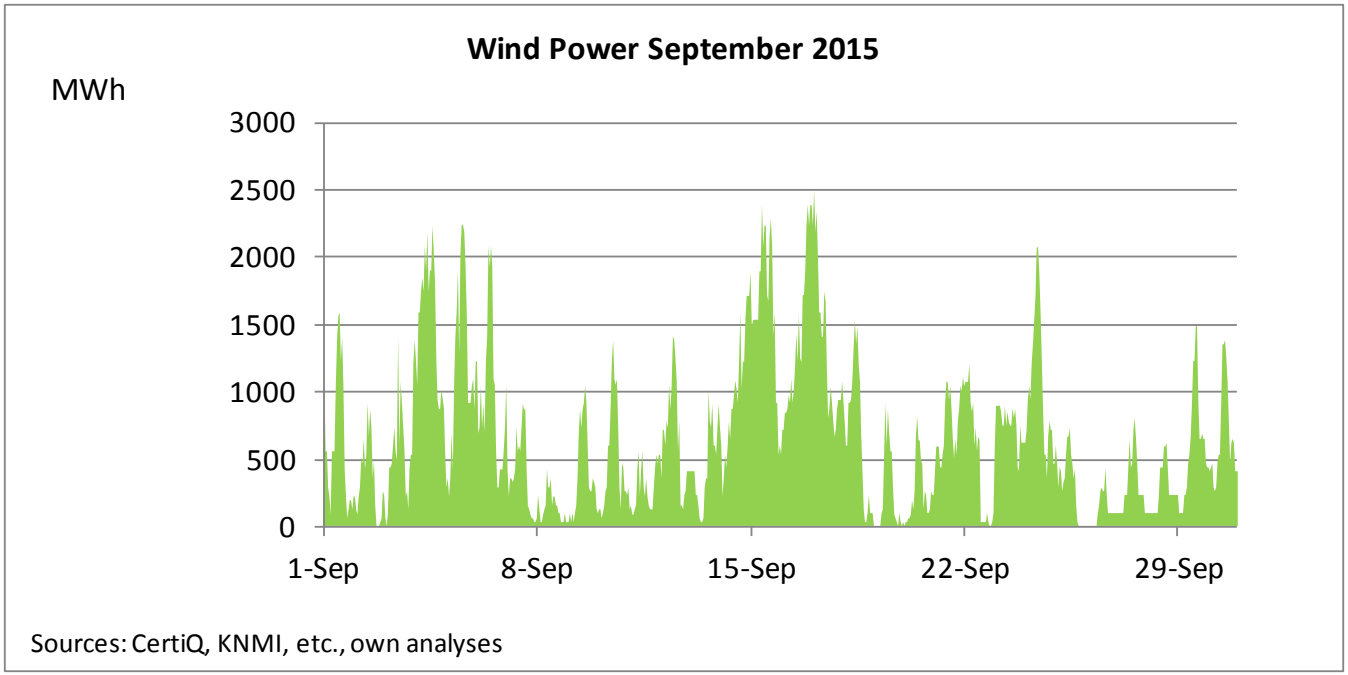
Power Imports & Exports September 2015



Sources: TenneT, own analyses

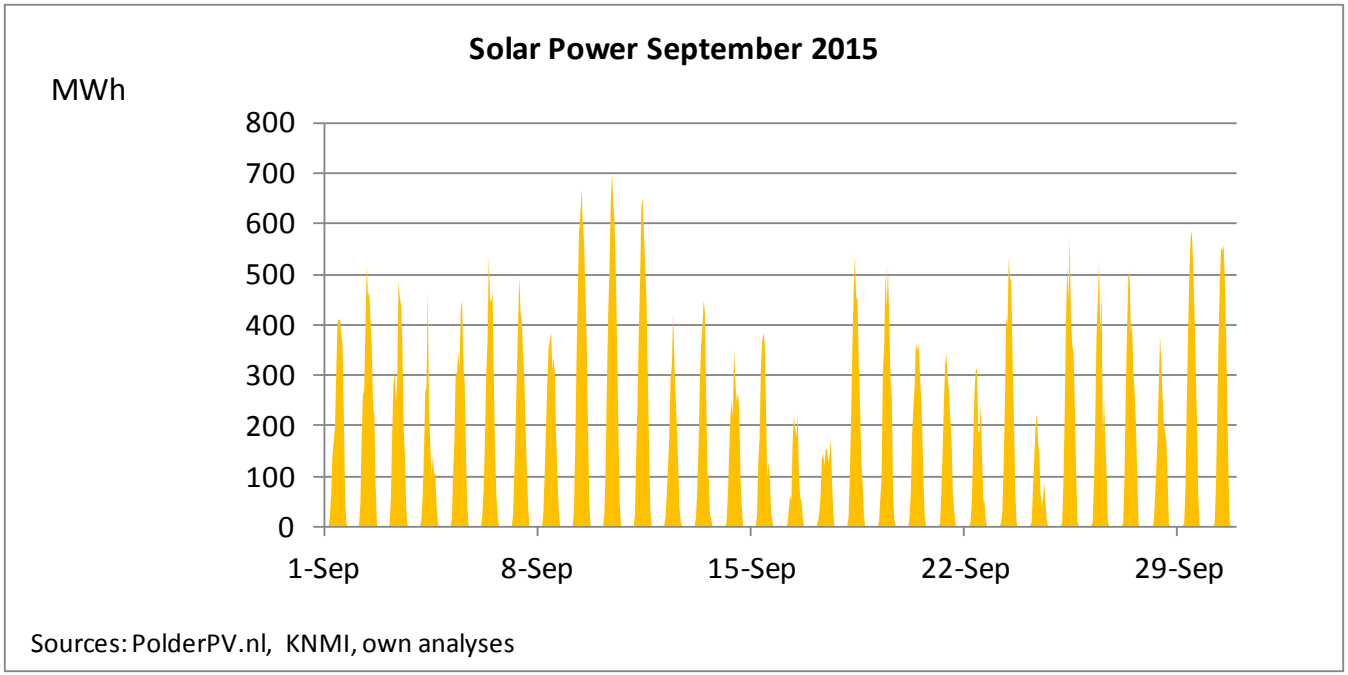
In September 2015, power imports and exports were similar, due to much lower imports than in previous months.

Wind Power September 2015



In The Netherlands, summers are characterized by a low availability of wind. September 2015 has been no exception to this rule, with a 20% utilization rate of the available wind capacity of 3280 MW.

Solar PV Power September 2015



September was not a sunny month. Solar-PV the amount of Solar-PV has been just 90 GWh. The utilization rate of the 1350 MW of solar PV installed was not more than 9%.

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

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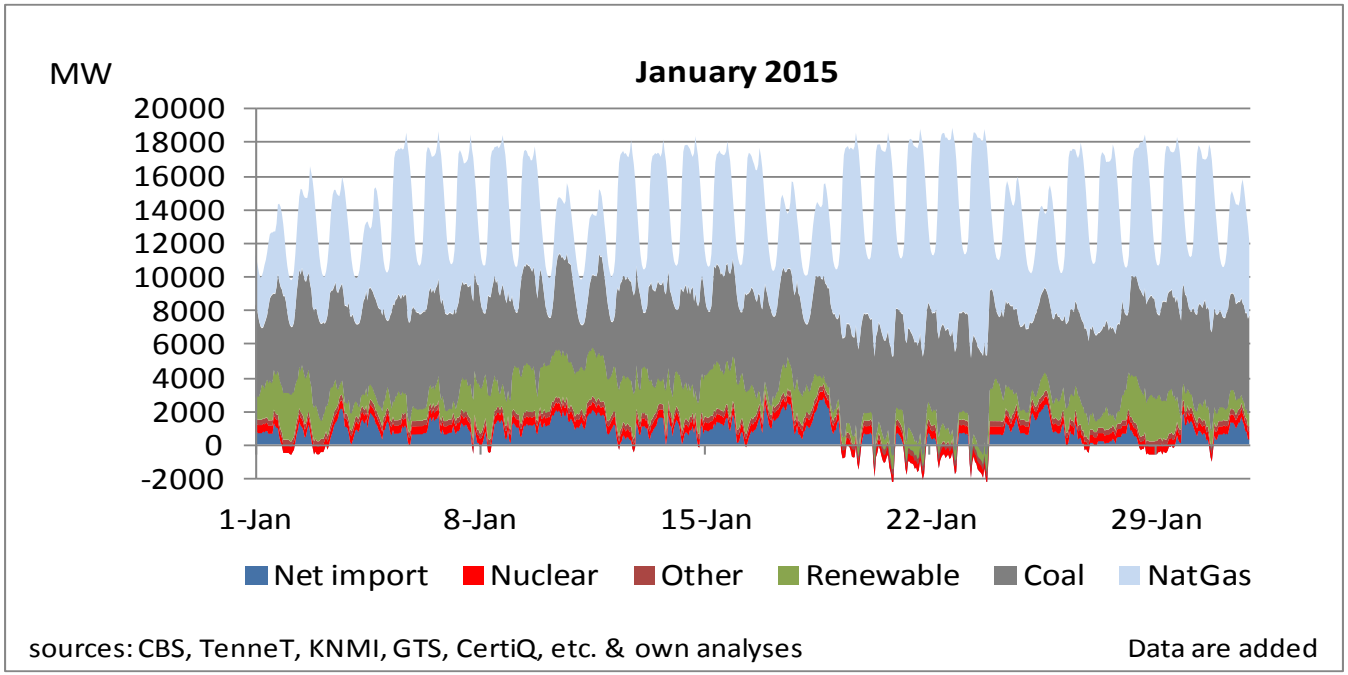
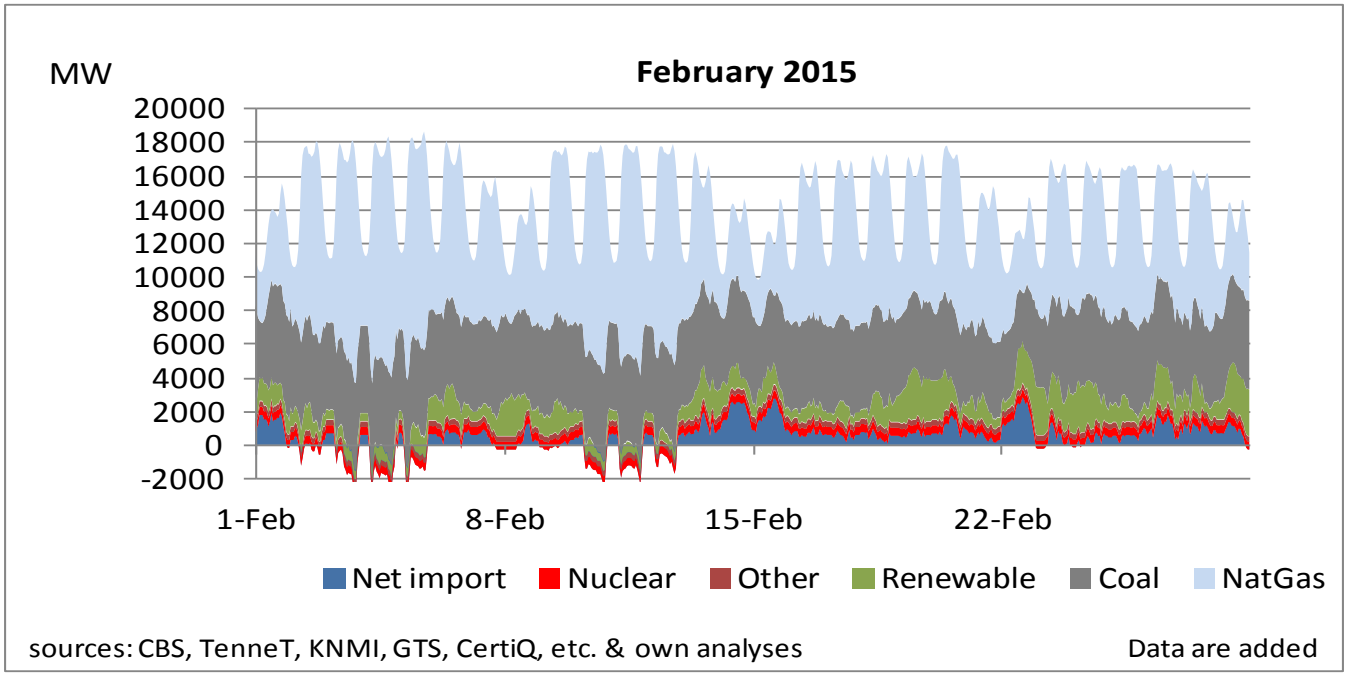


In the week of 20-24 January, power generation peaked, due to the net exports that occurred. The majority of the additional power generation has been generated by gas-fired installations.

Power Generation February 2015



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

Power Generation March 2015

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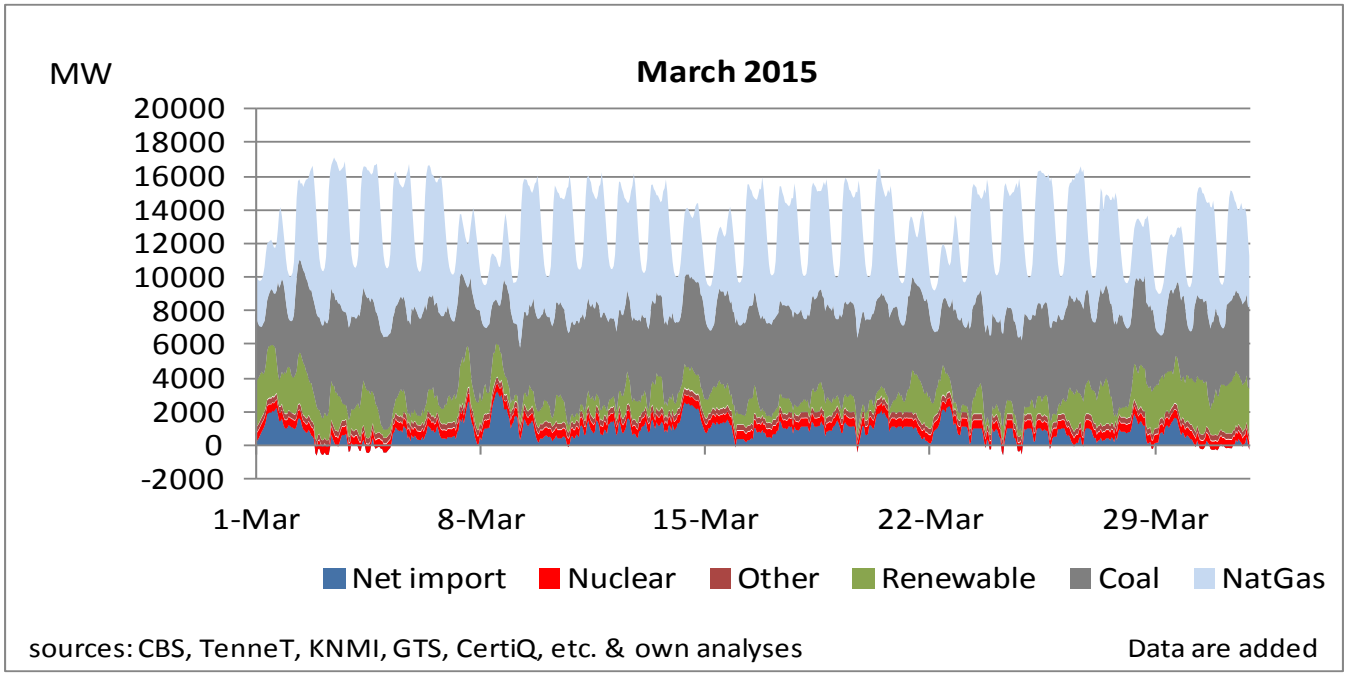

Relatively low imports of power occurred in March. On several Saturdays, some net exports were recorded.

Power Generation
April 2015

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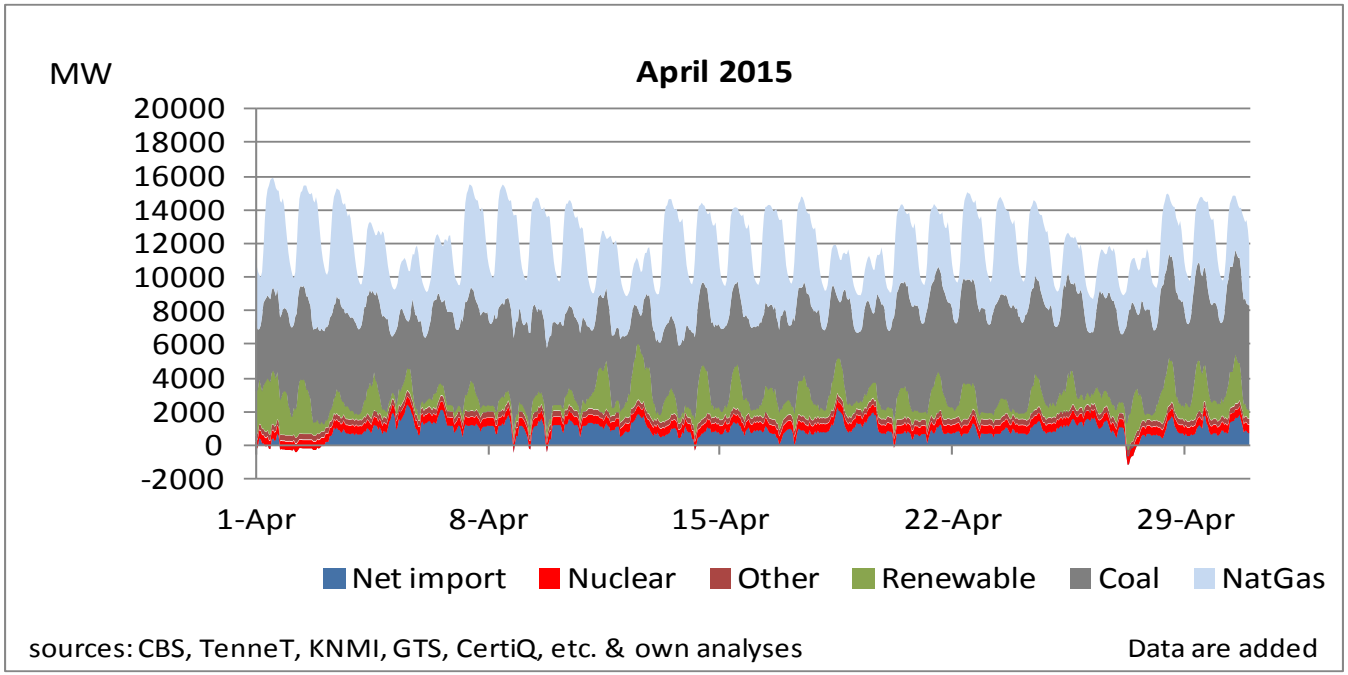
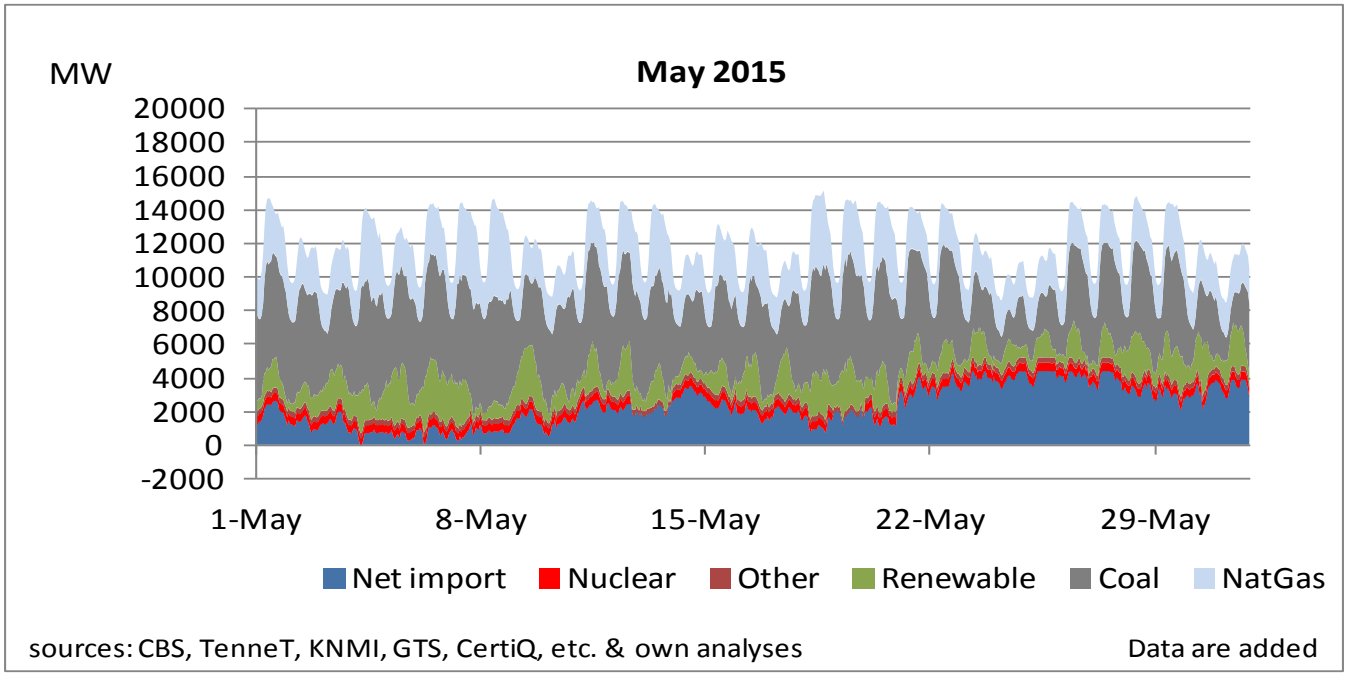


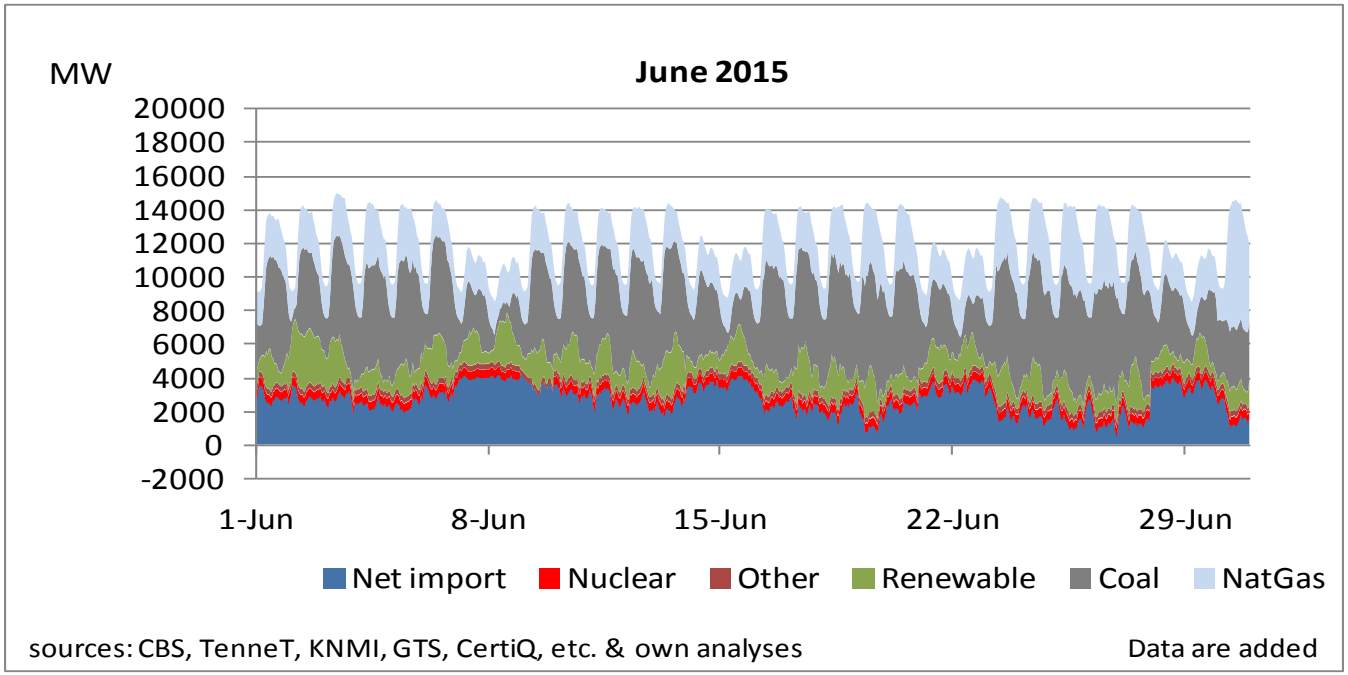
Relatively low imports of power occurred in April. On several occasions, mainly on Saturdays, net exports were recorded. April showed several days with high coal-fired generation, while gas-fired generation was low.

Power Generation May 2015



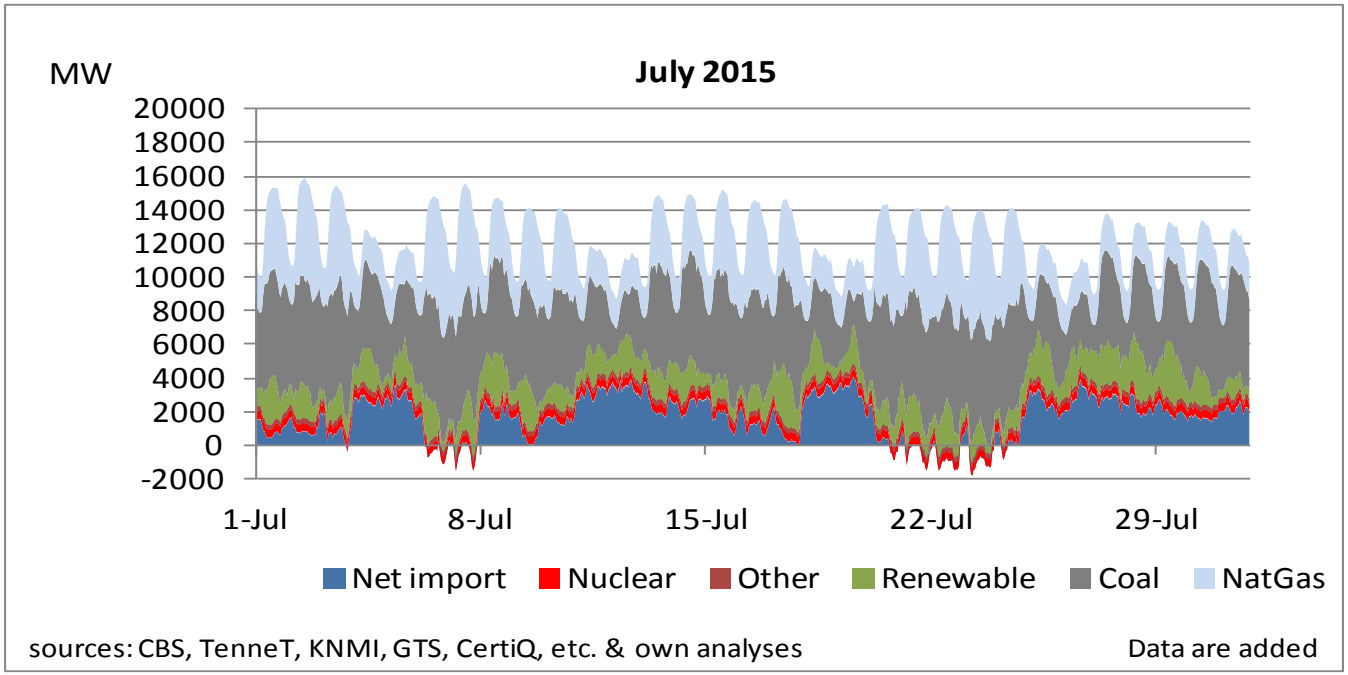
In May, high net imports and high coal utilization squeezed gas-fired power generation.

Power Generation
June 2015



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

Power Generation July2015



In July, imports were more moderate than in June; consequently, although coal utilization remained high, more gas-fired power generation was registered than in June.

Power Generation September 2015

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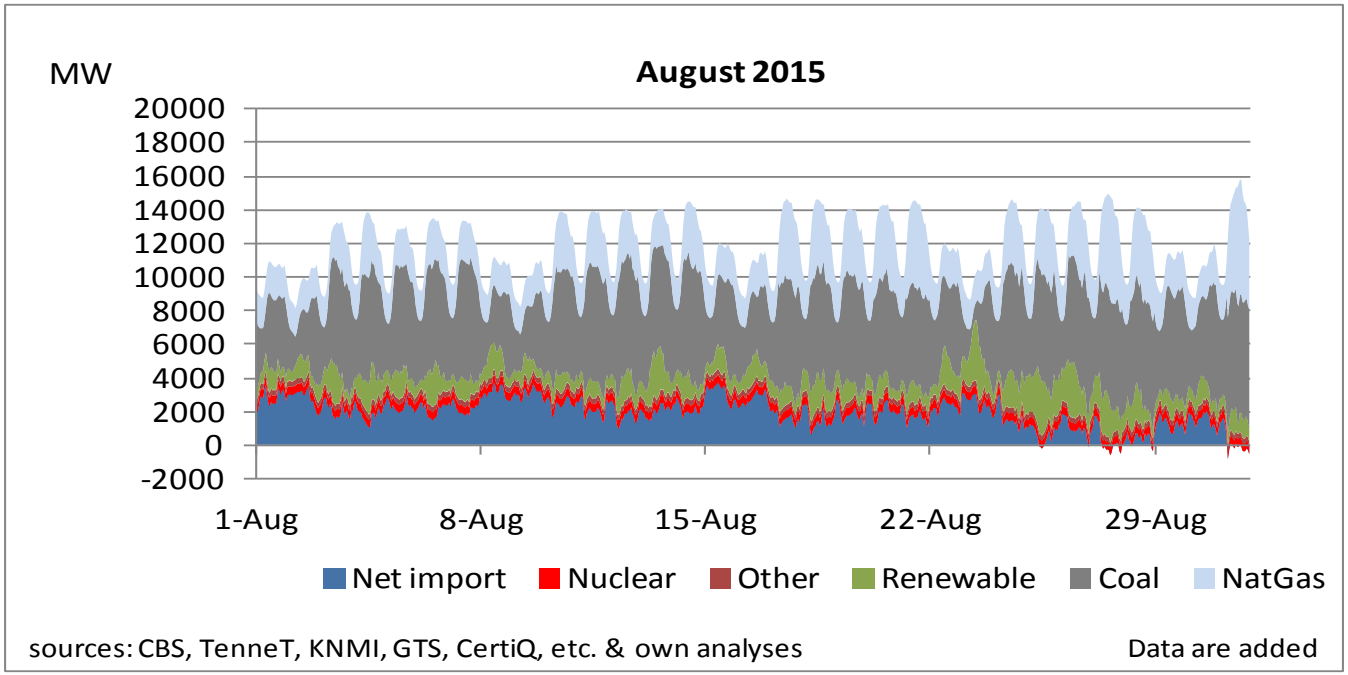

In September, there were a lot of power imports and consequently, not much gas-fired power generation was used.

Power Generation September 2015

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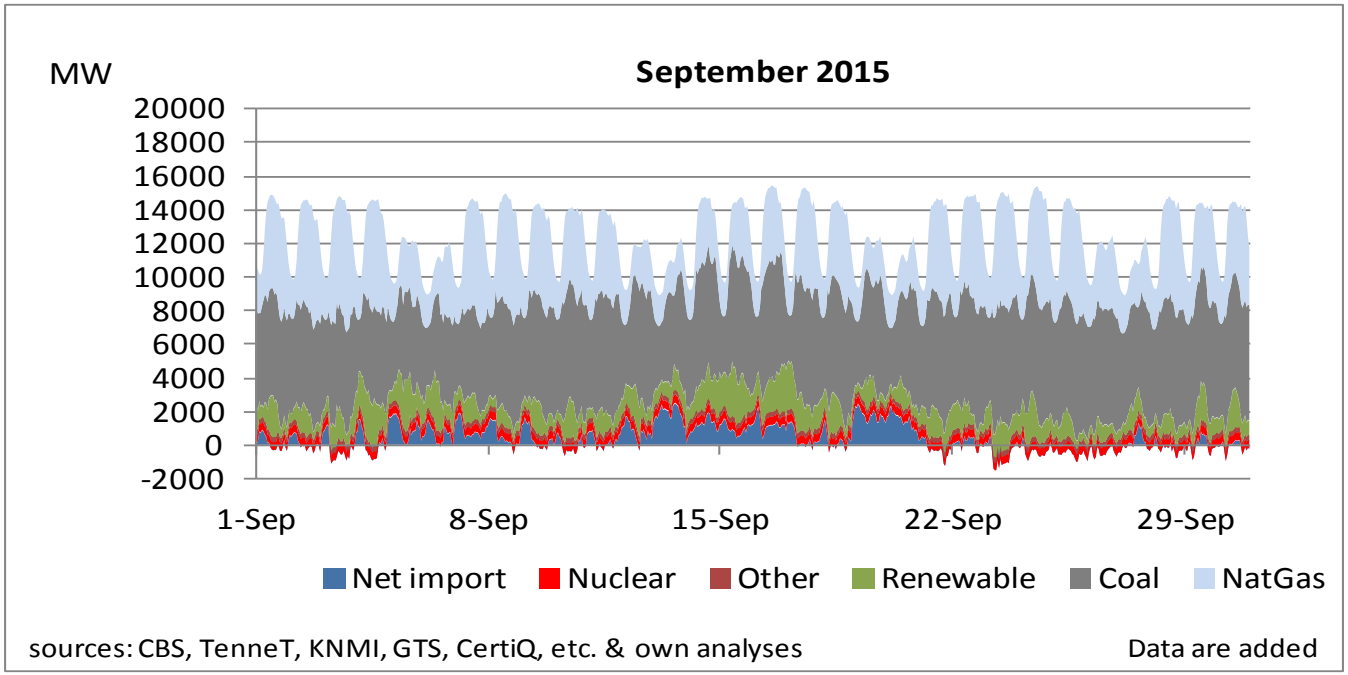

In September, power imports, depicted as negative values, were low. The majority of the power is produced by the coal fired power stations.

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

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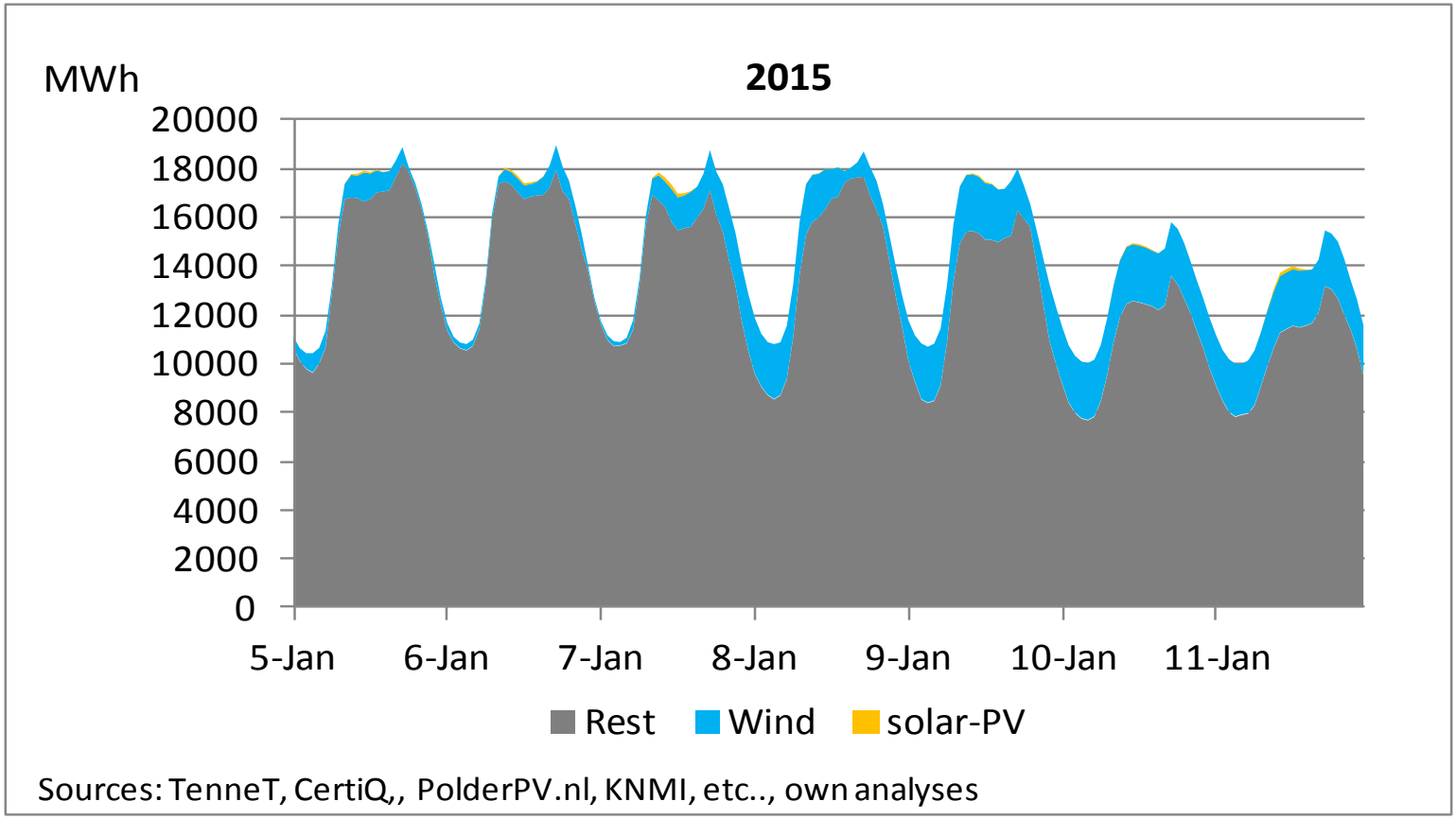

Sources: TenneT, CertiQ,, PolderPV.nl, KNMI, etc.., own analyses

Hourly Solar-PV and Wind Generation 2015

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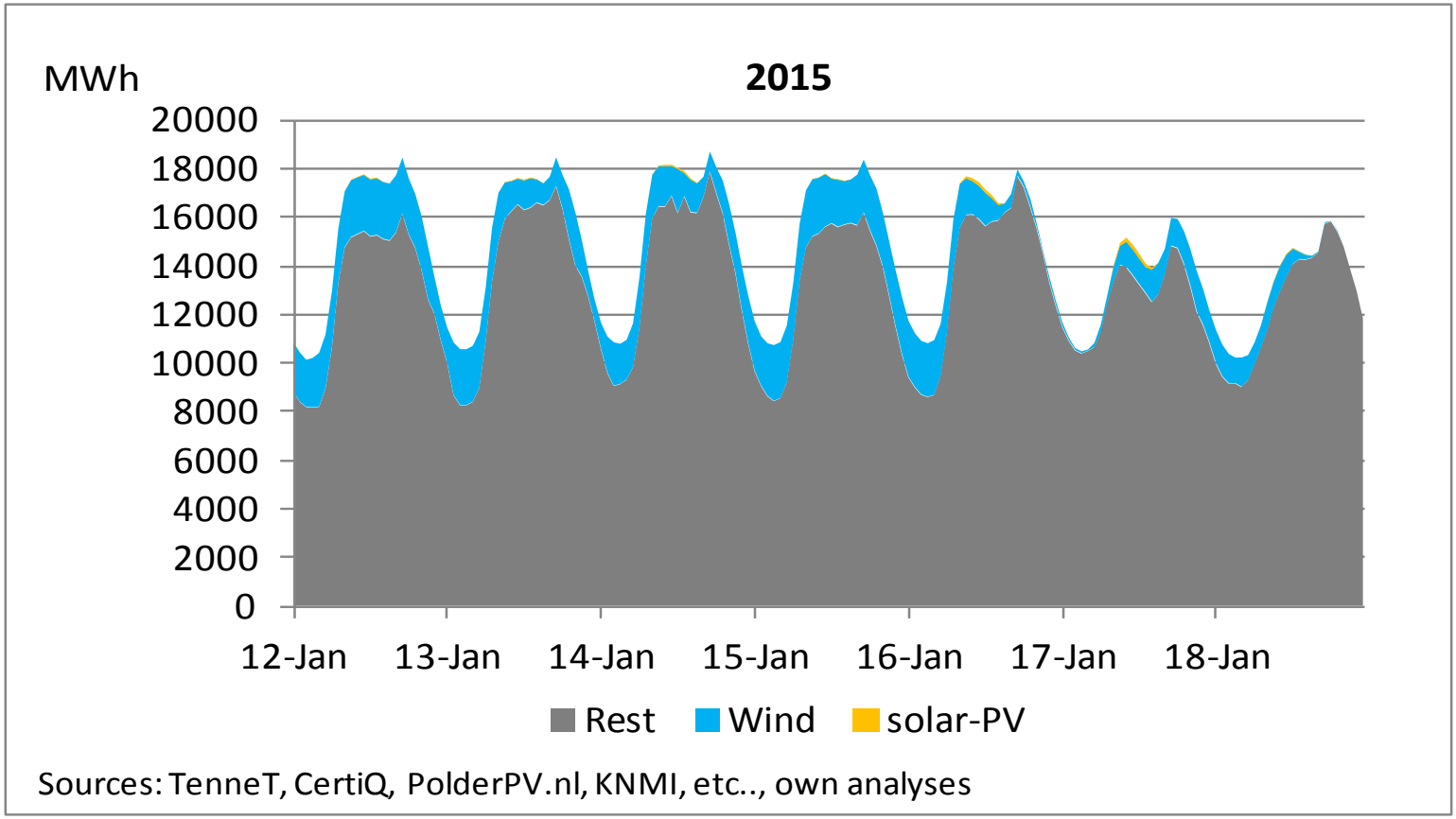

Sources: TenneT, CertiQ, PolderPV.nl, KNMI, etc.., own analyses

Hourly Solar-PV and Wind Generation 2015

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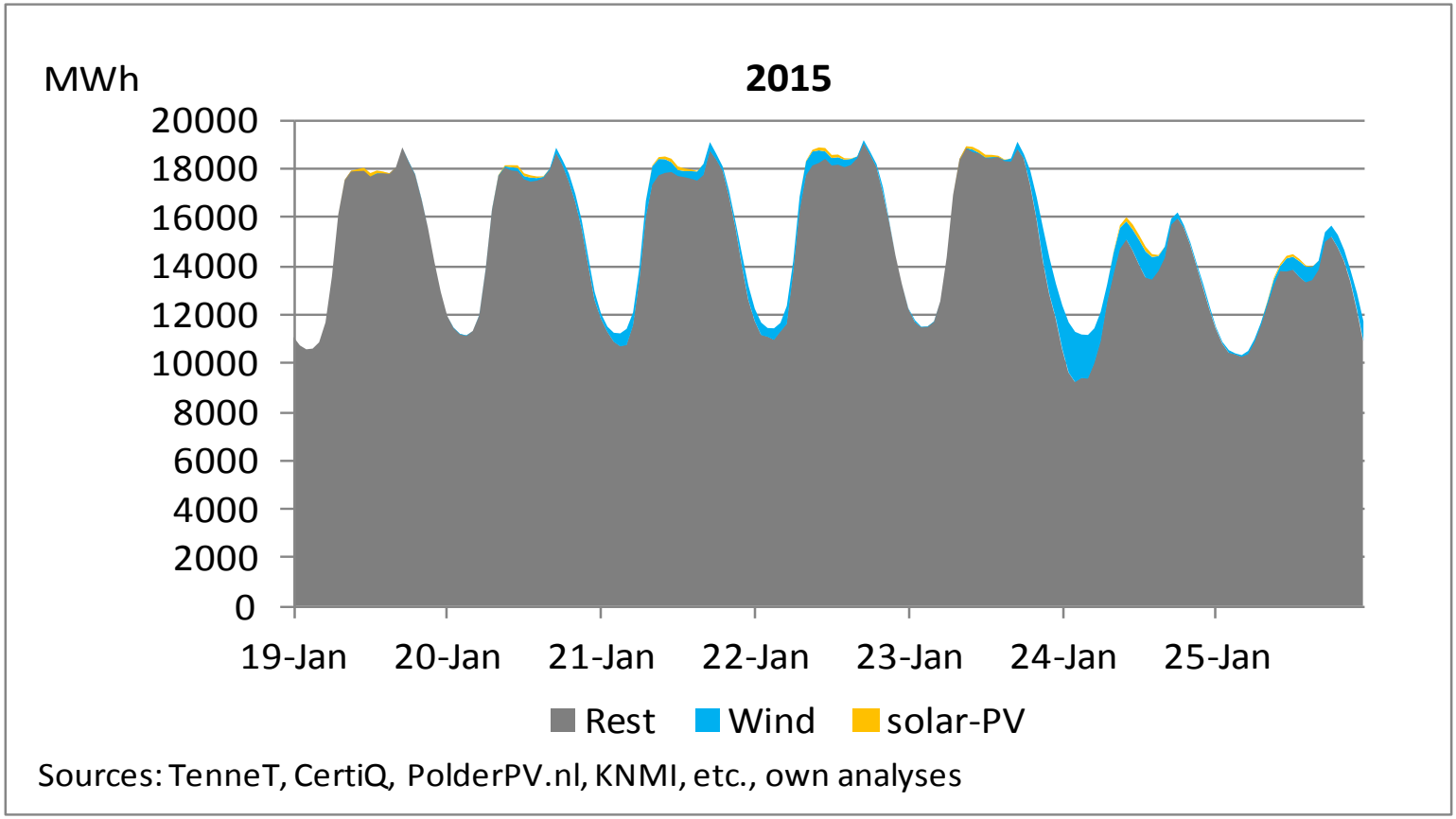

Sources: TenneT, CertiQ, PolderPV.nl, KNMI, etc., own analyses

Hourly Solar-PV and Wind Generation 2015

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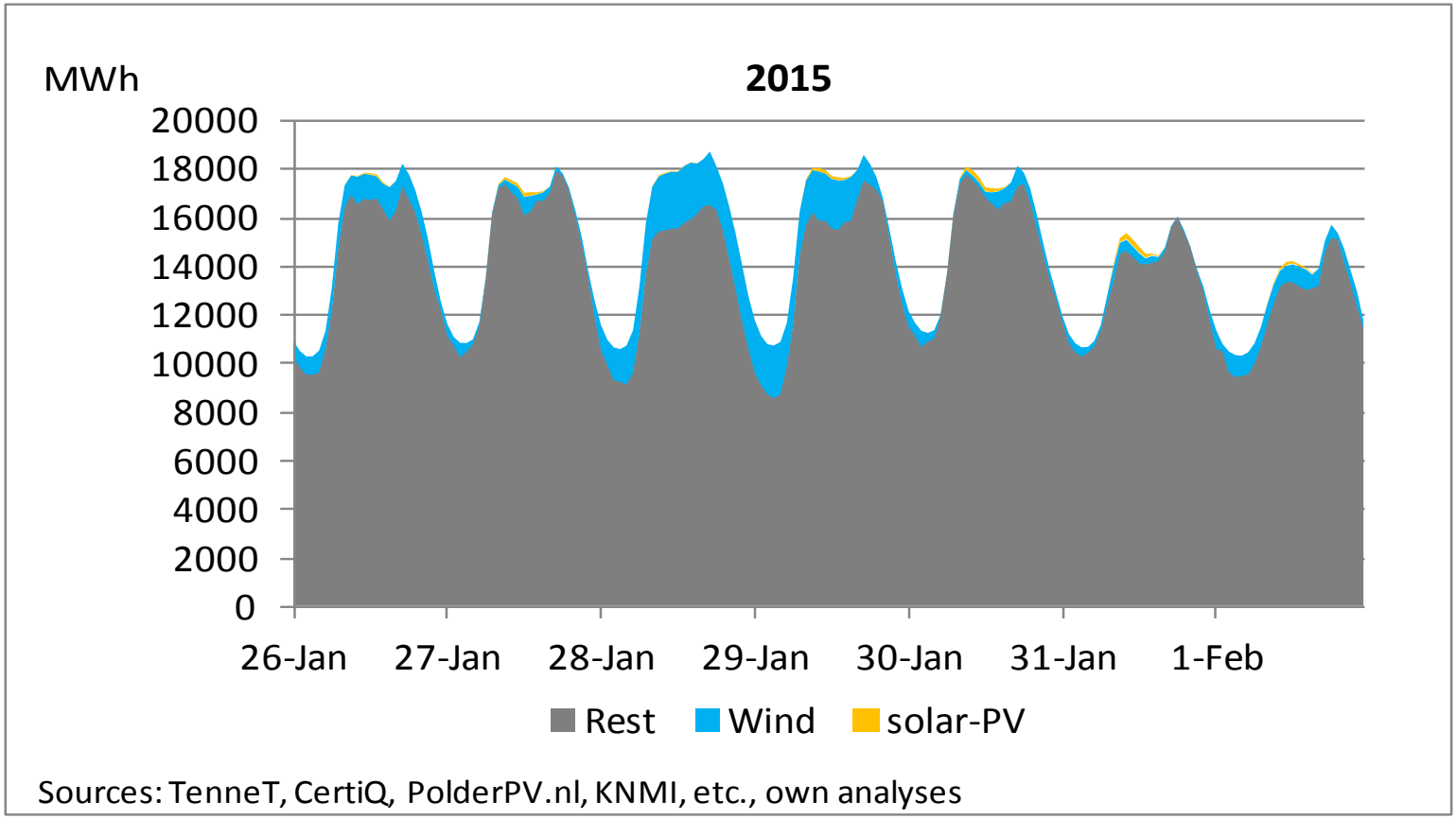

Sources: TenneT, CertiQ, PolderPV.nl, KNMI, etc., own analyses

Hourly Solar-PV and Wind Generation 2015

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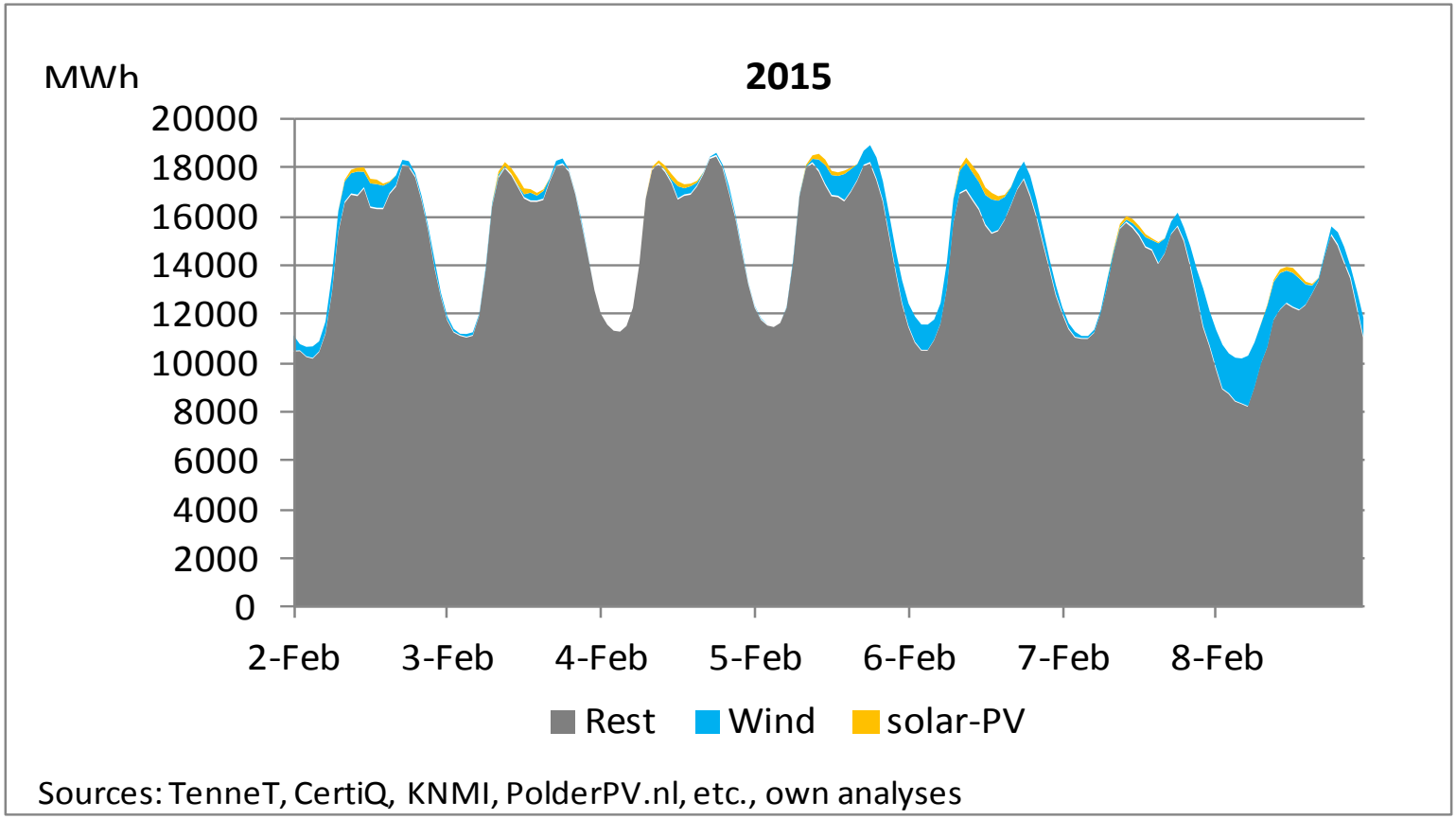

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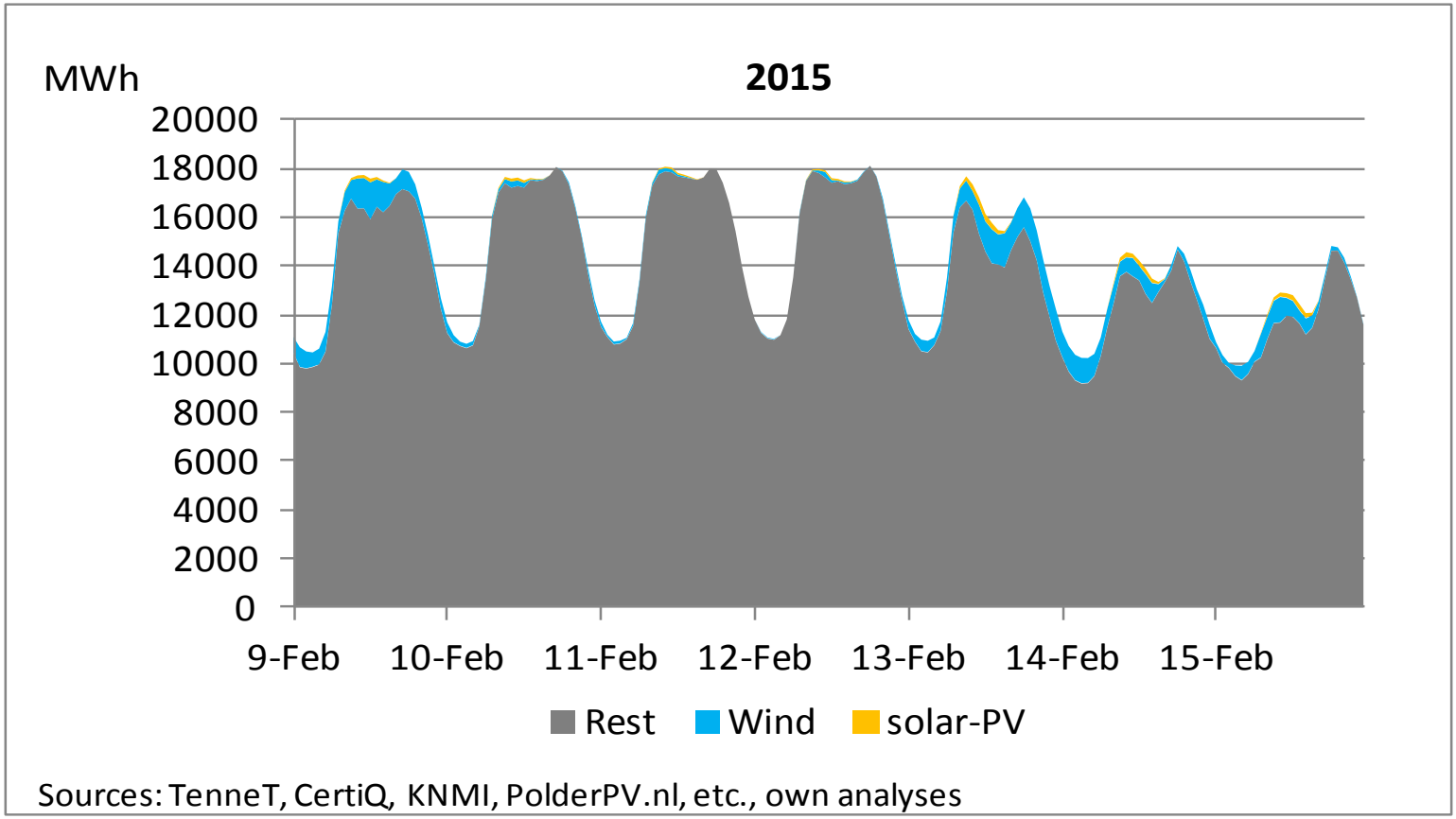

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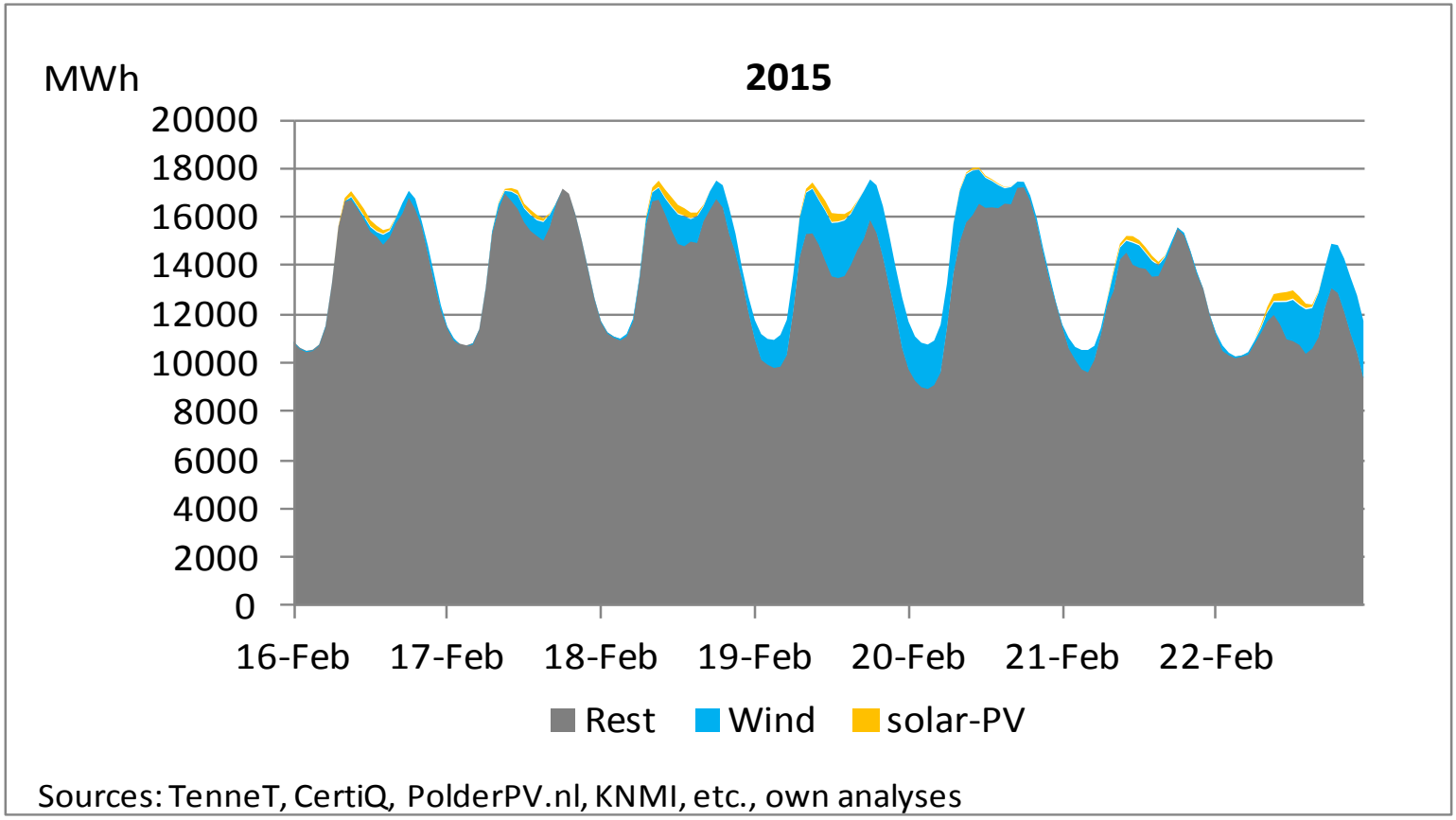

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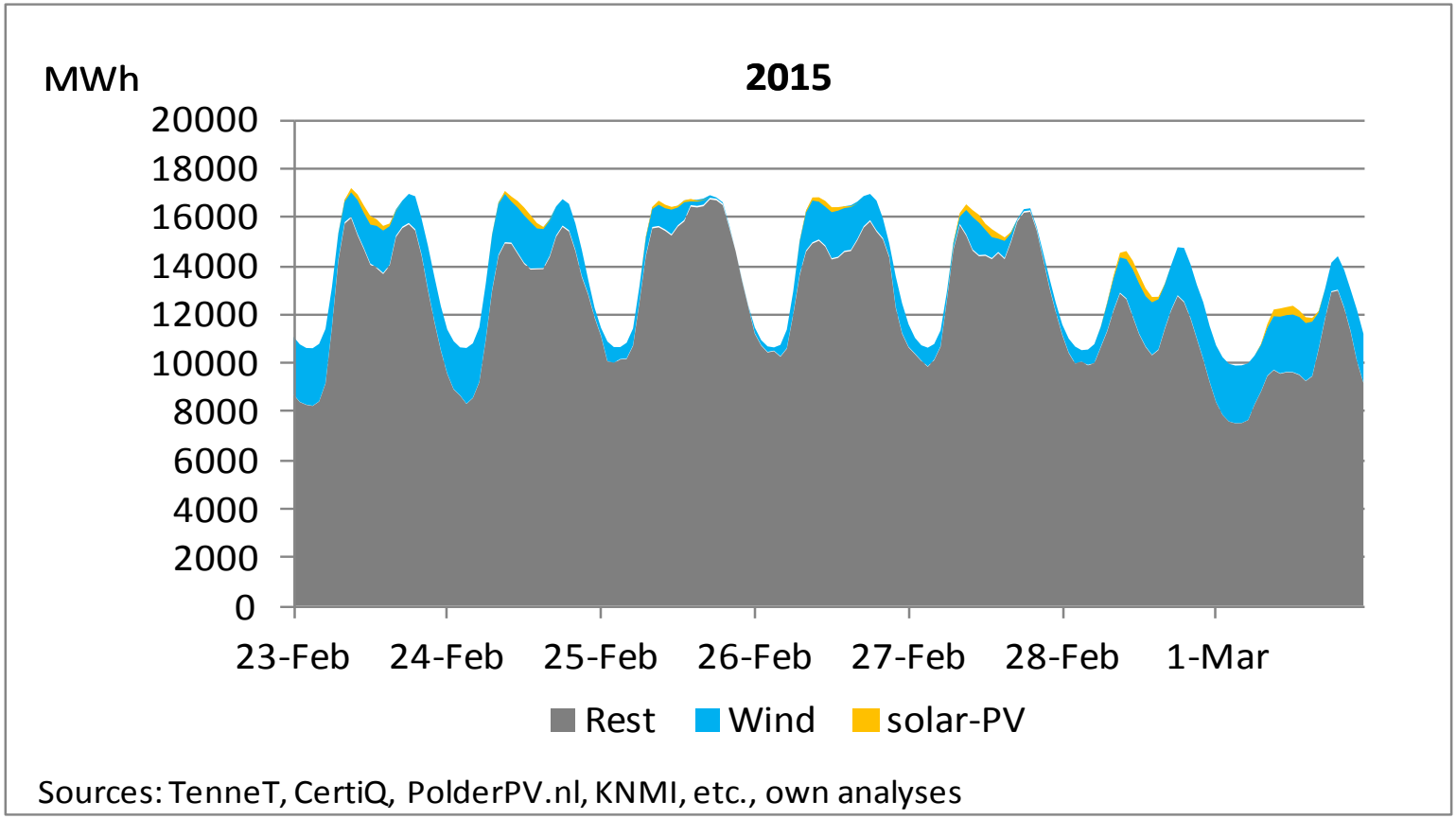

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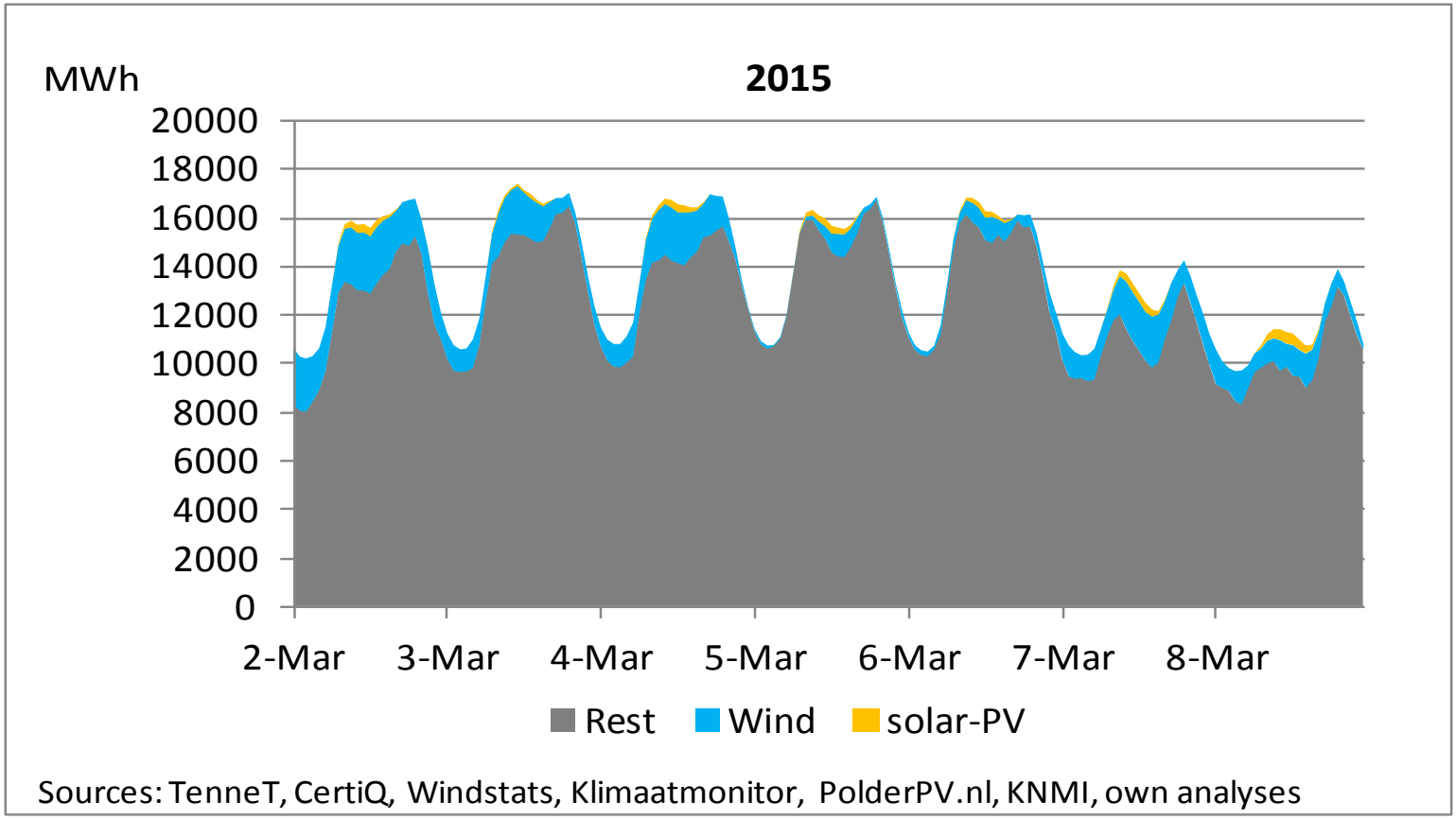

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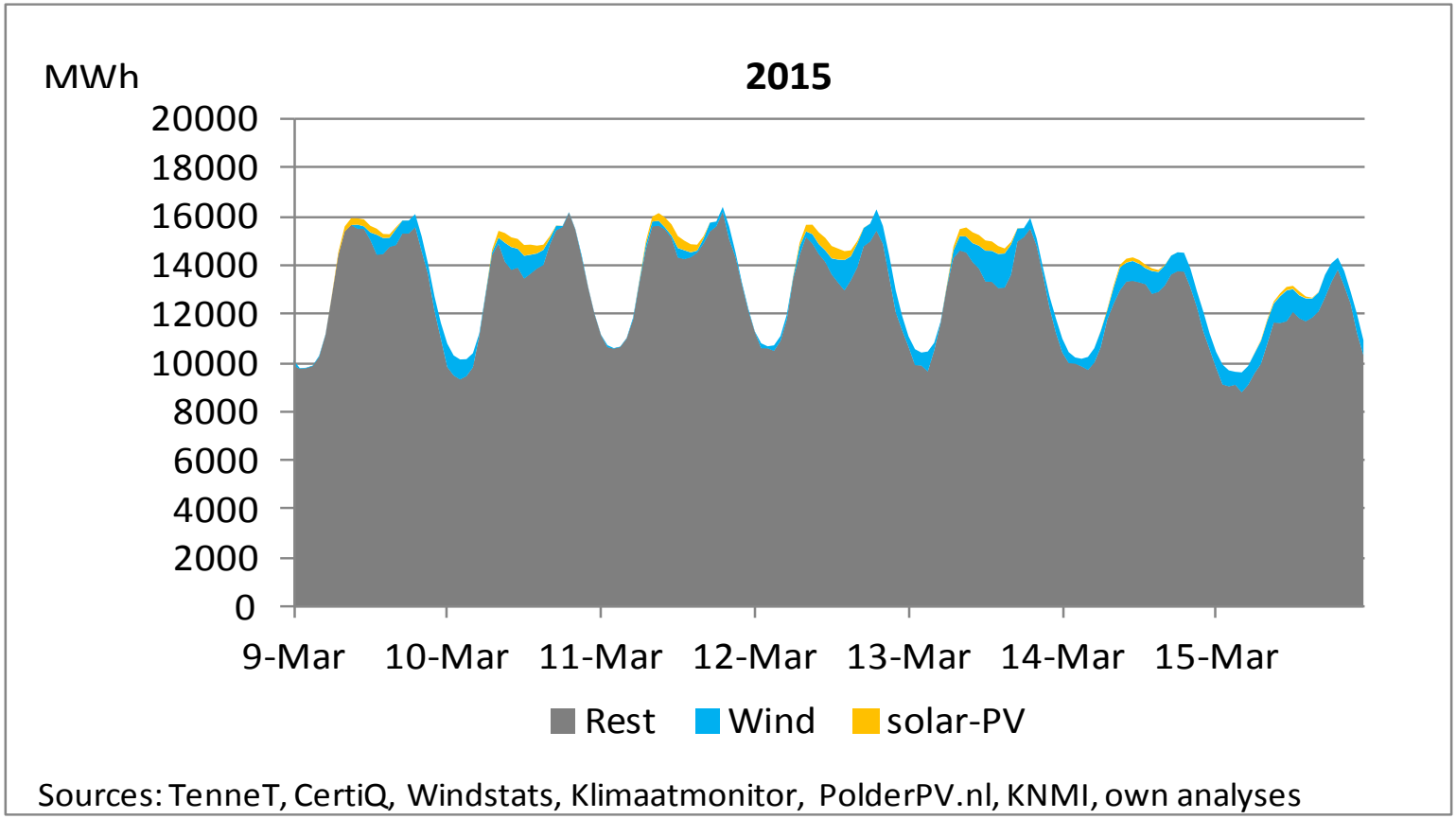

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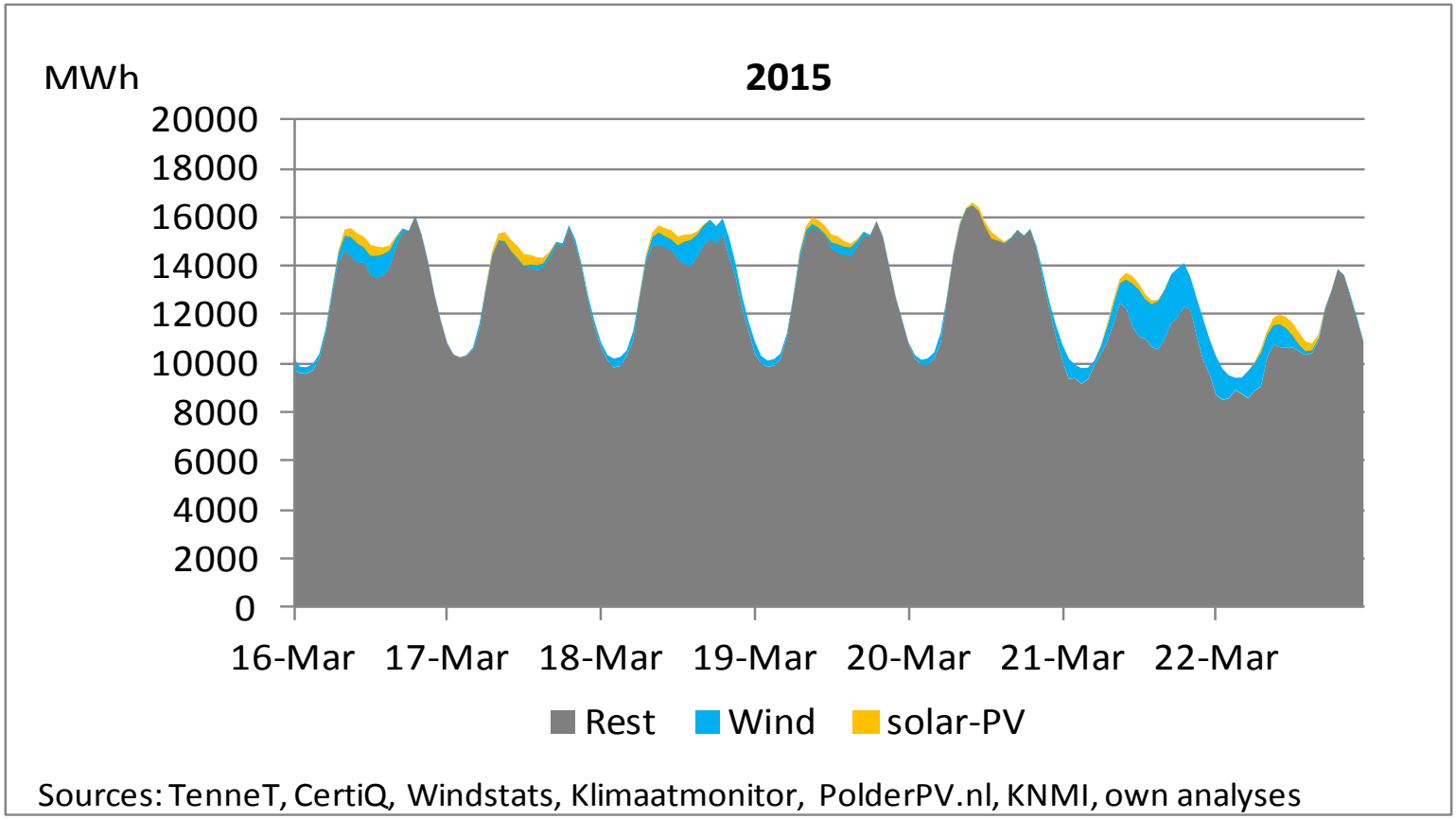

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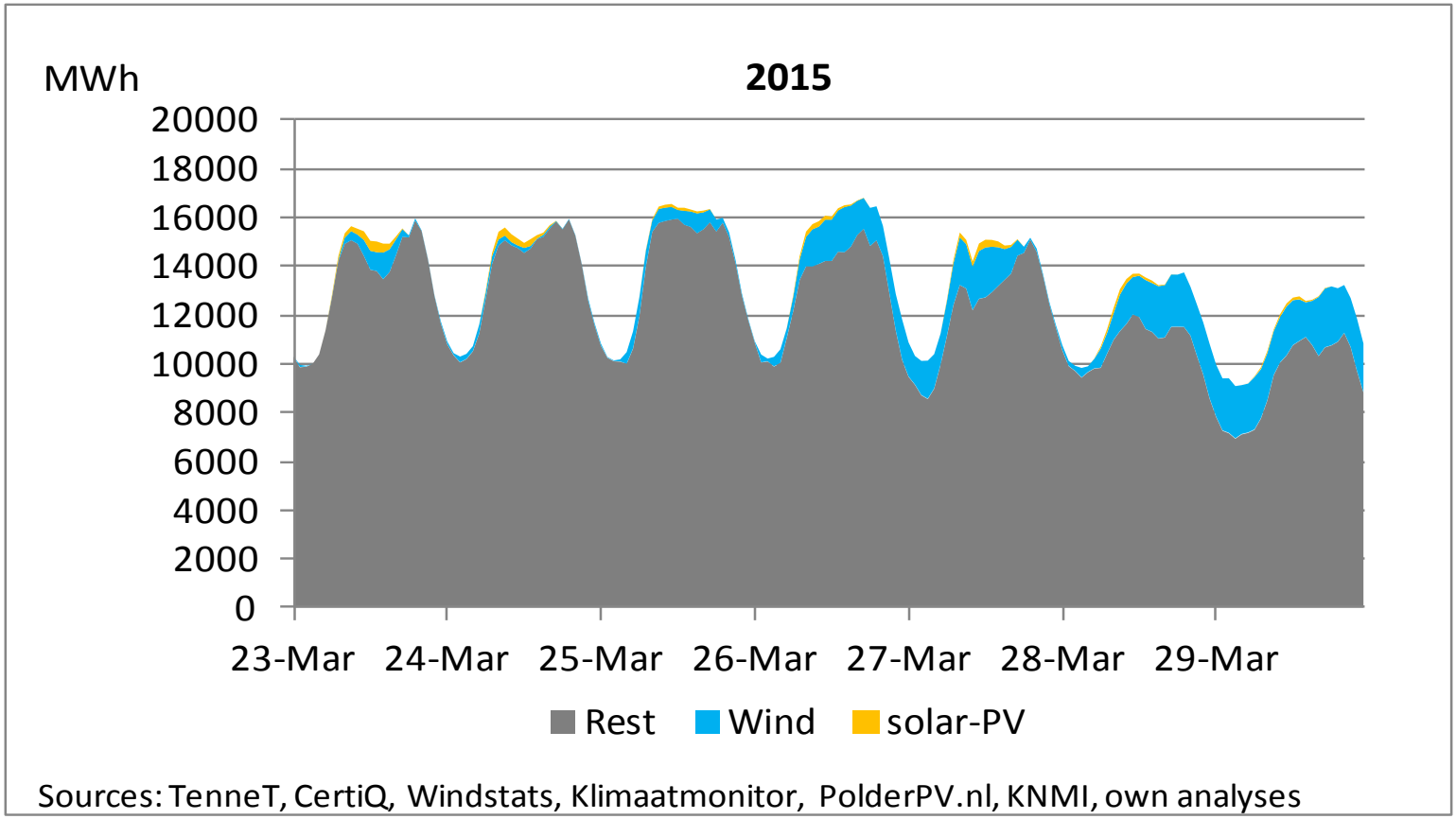

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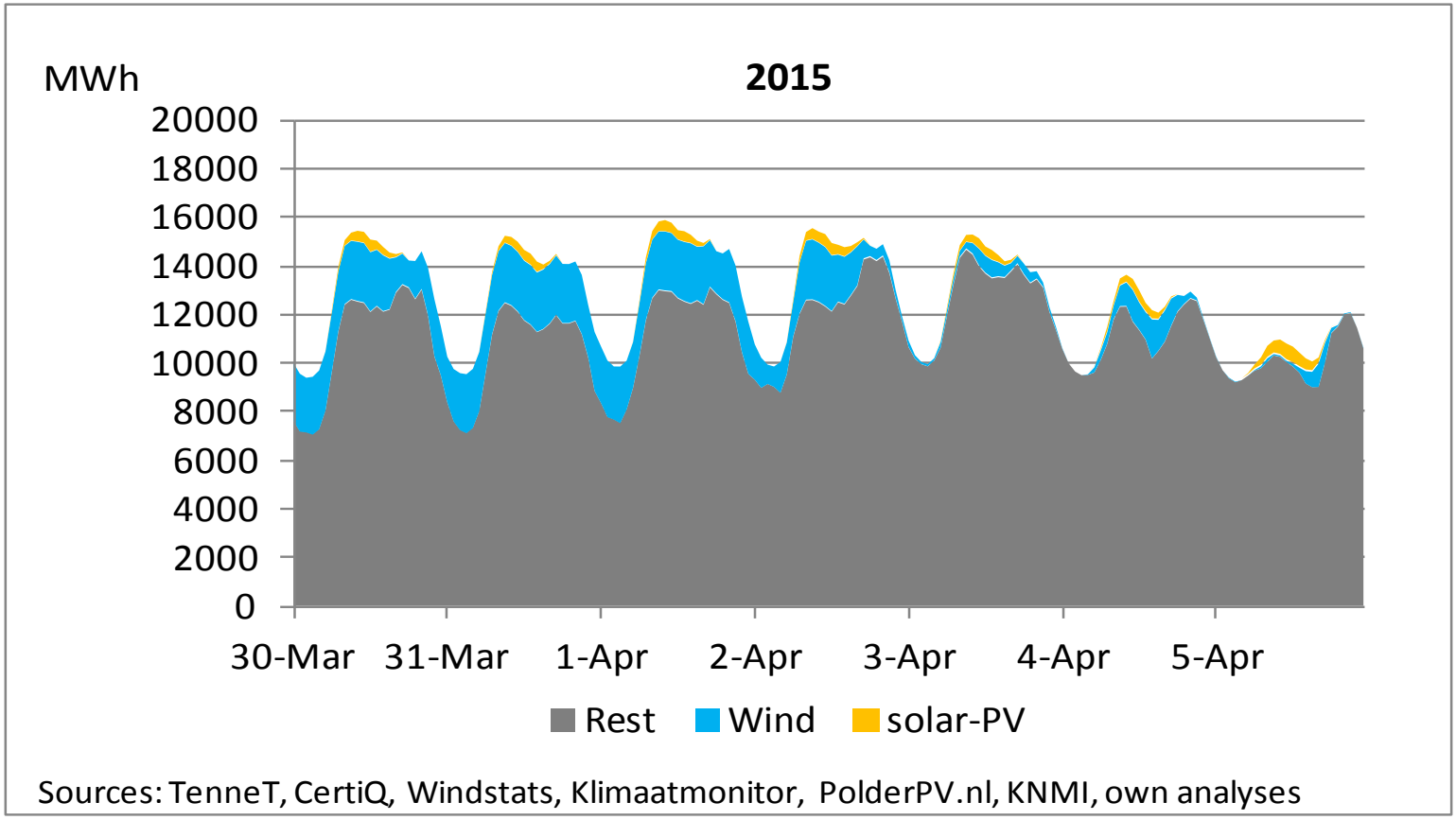

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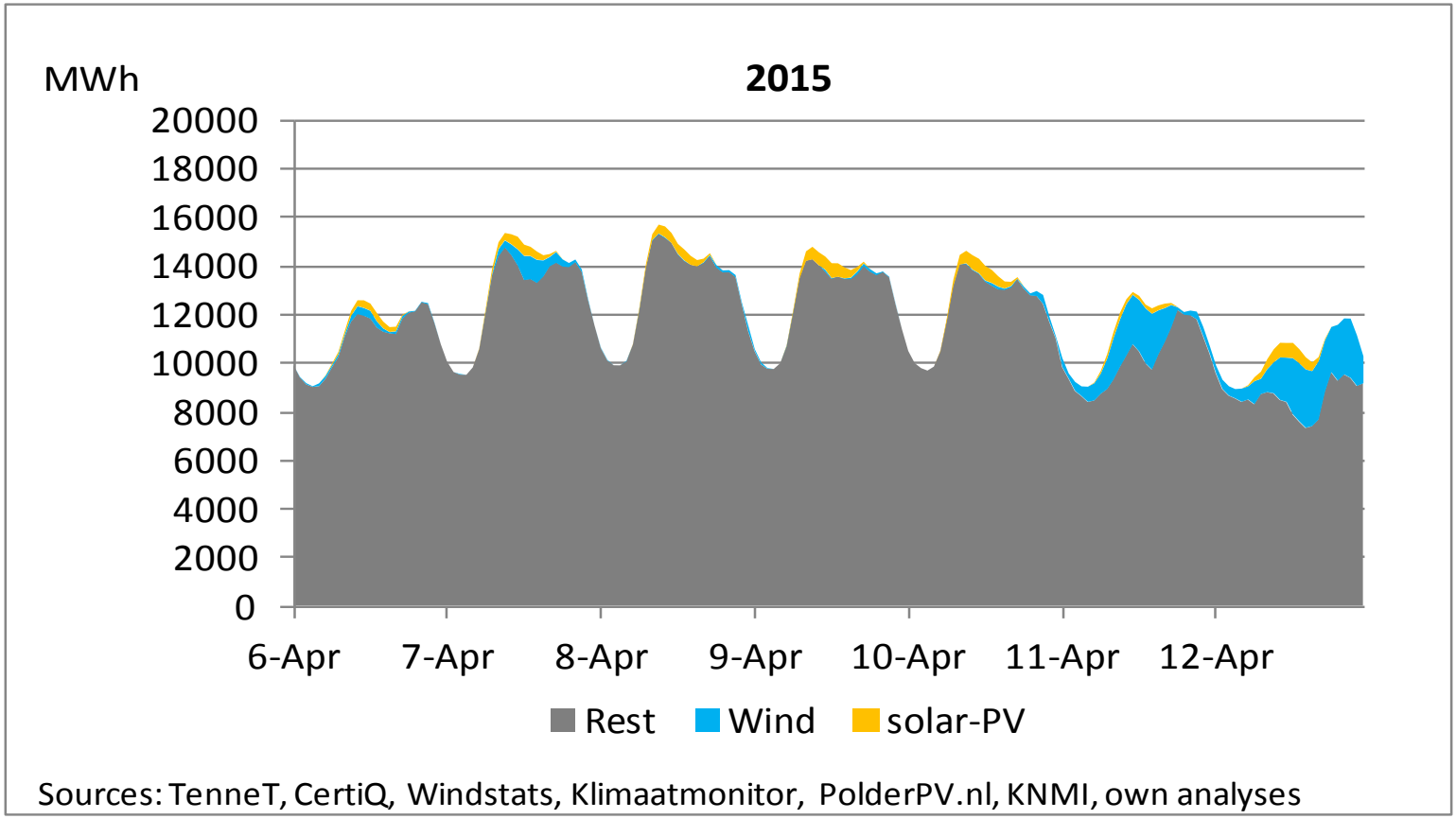

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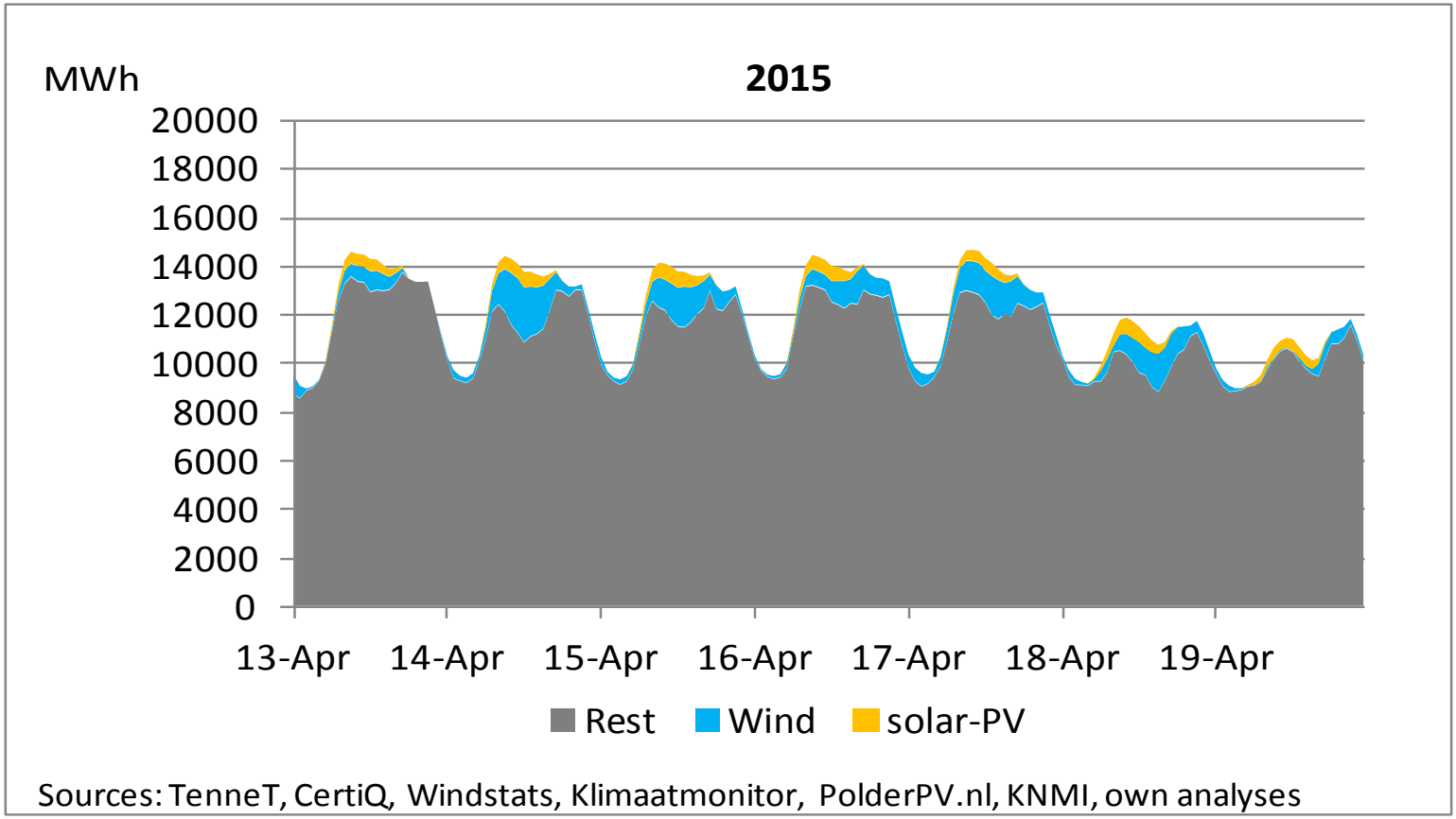

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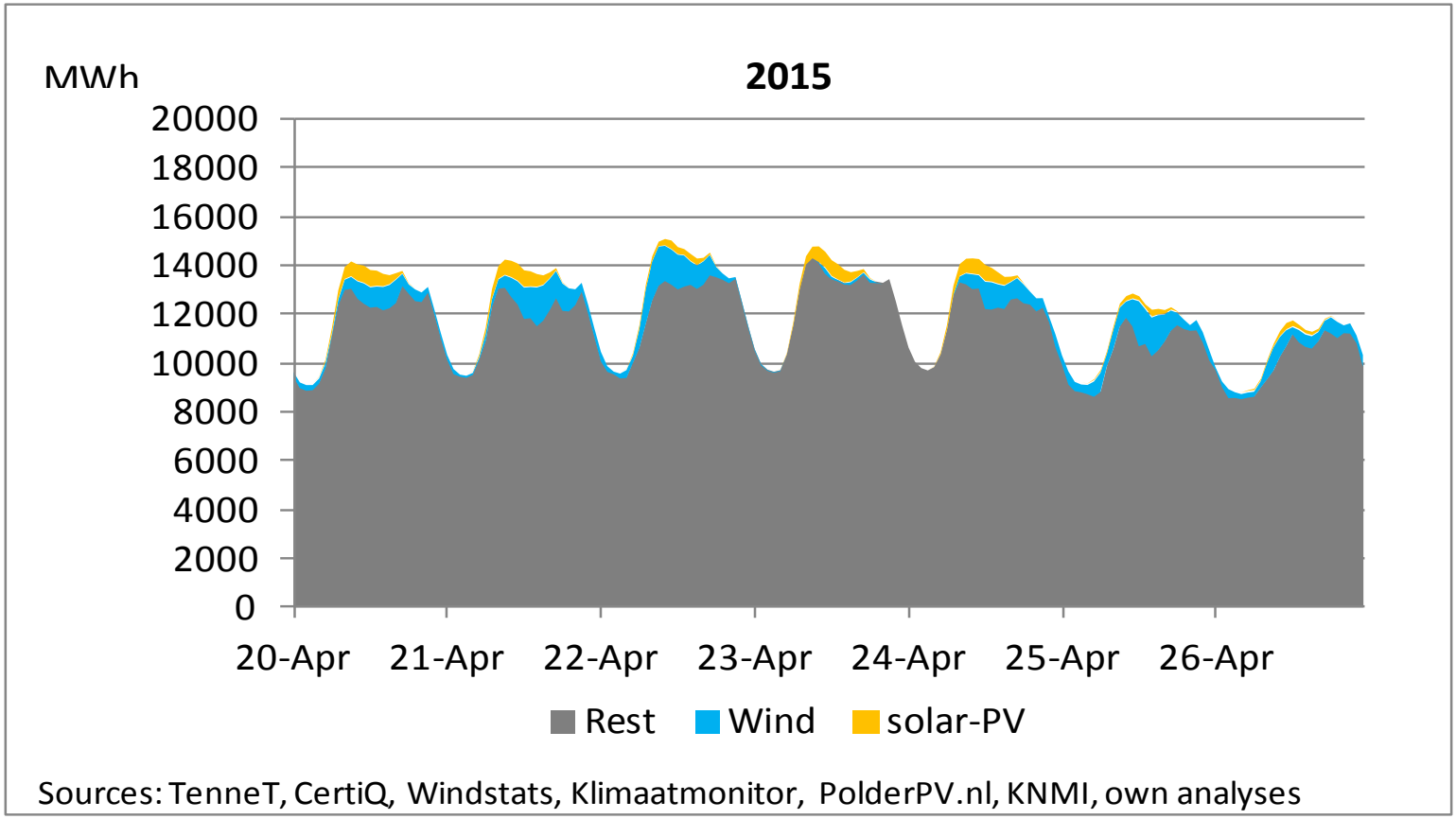

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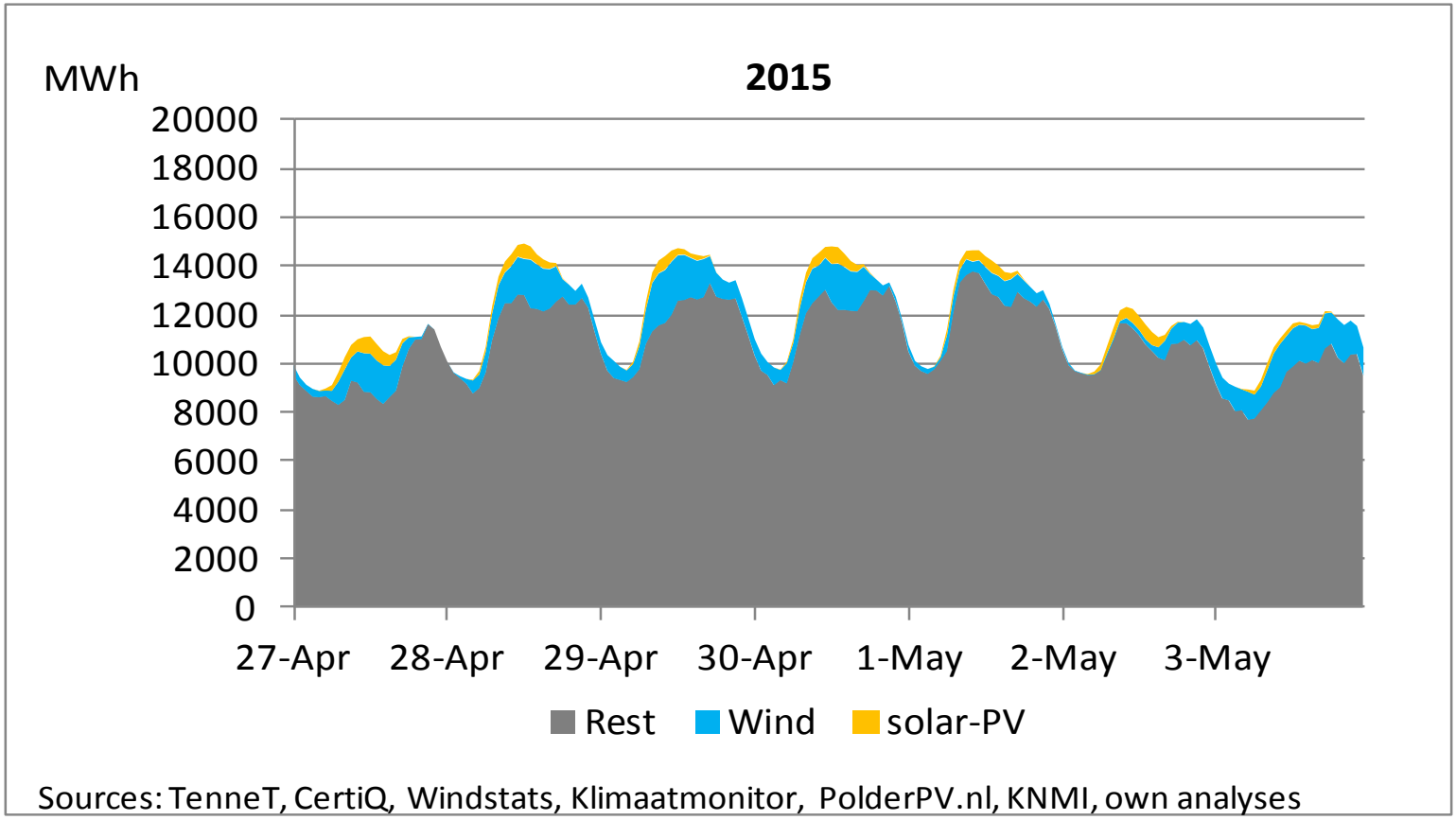

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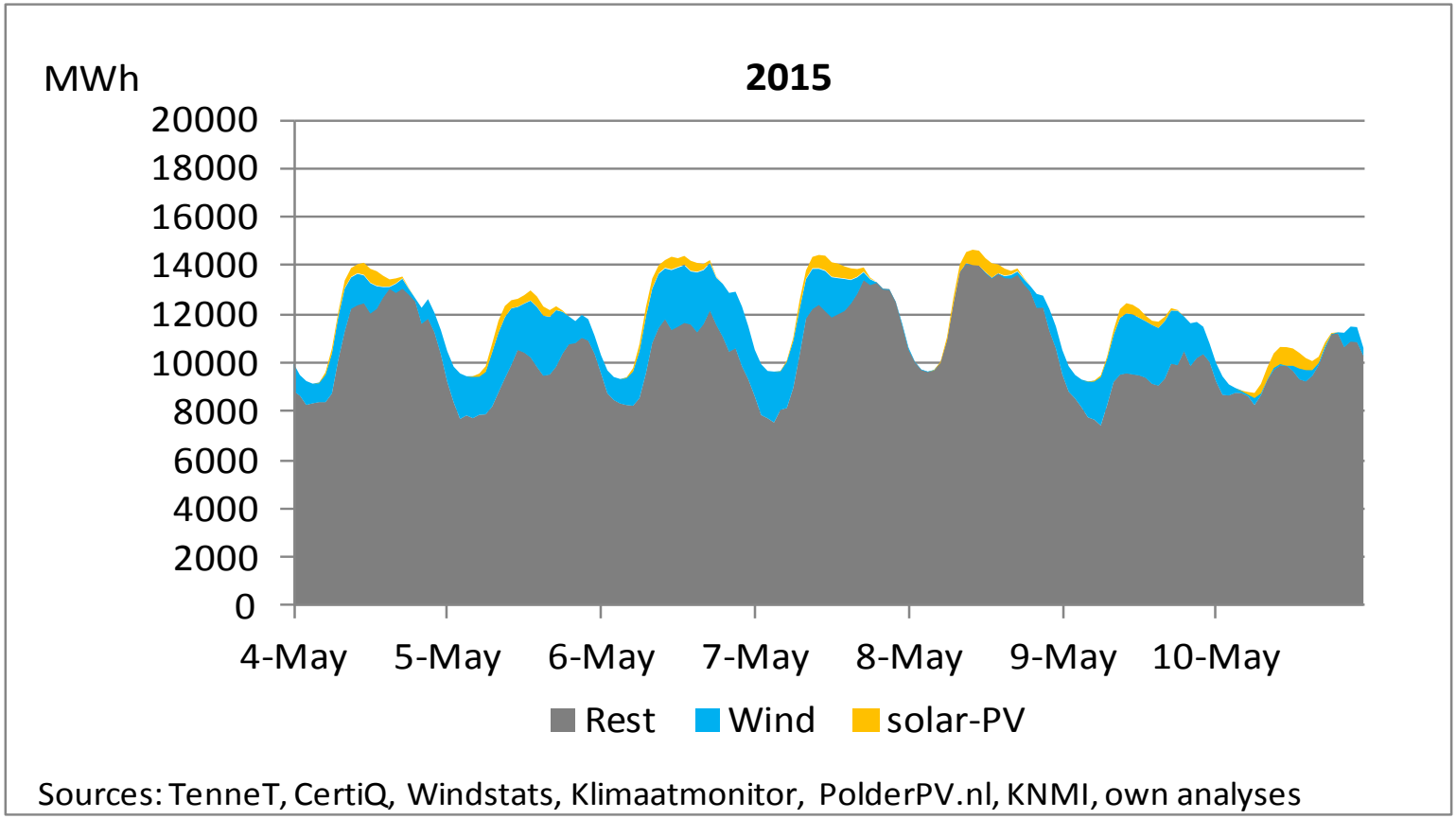

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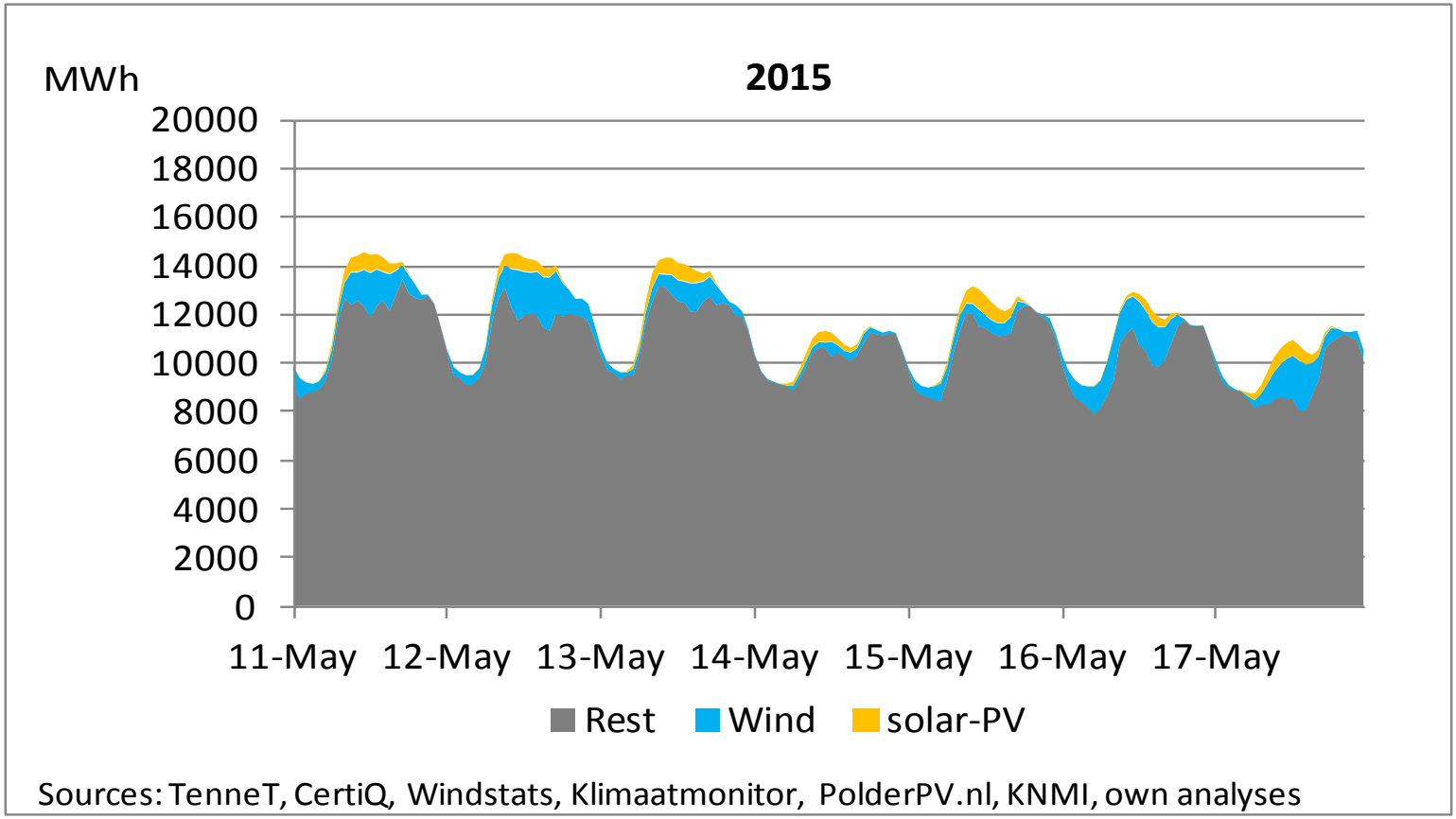

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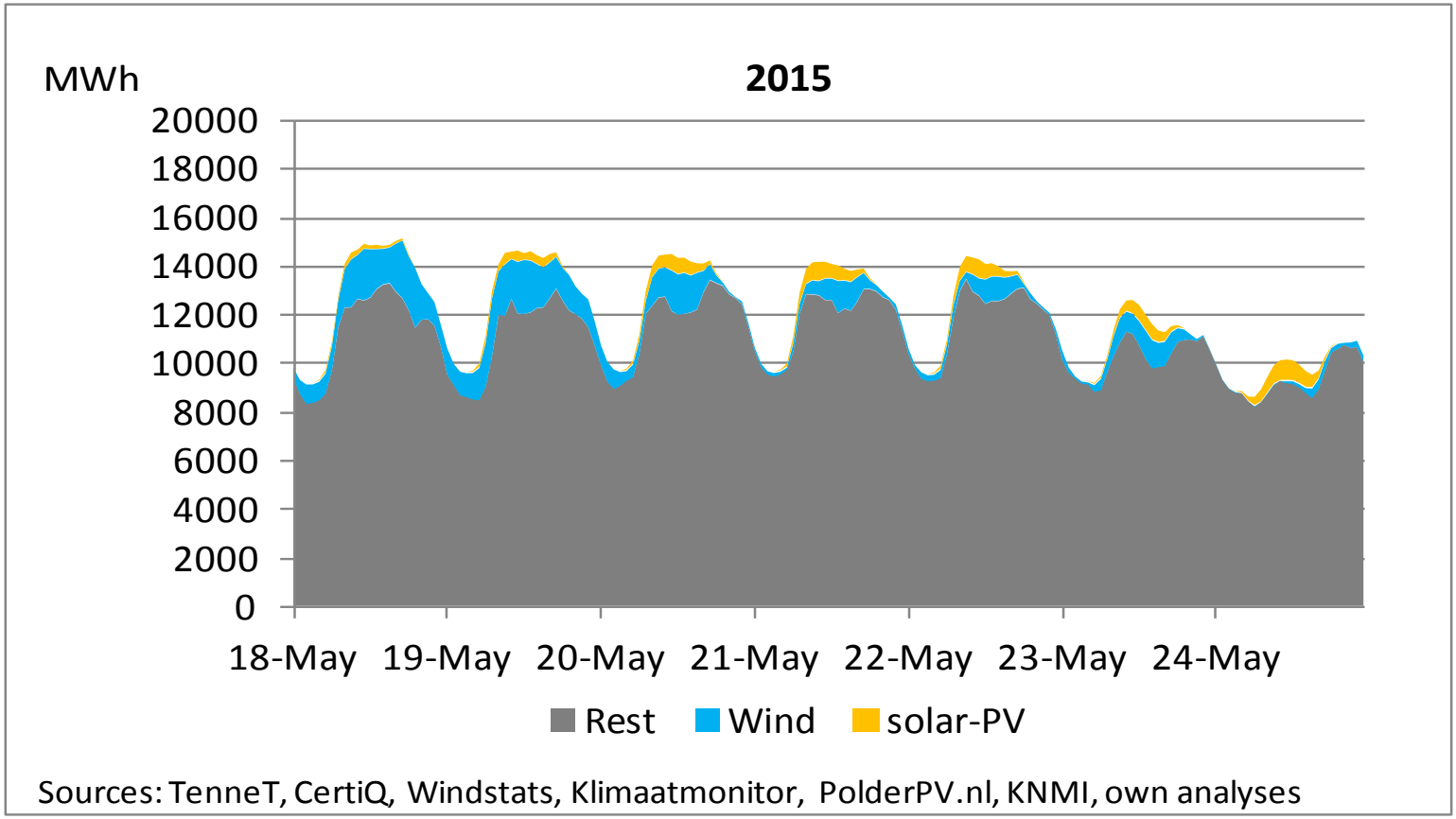

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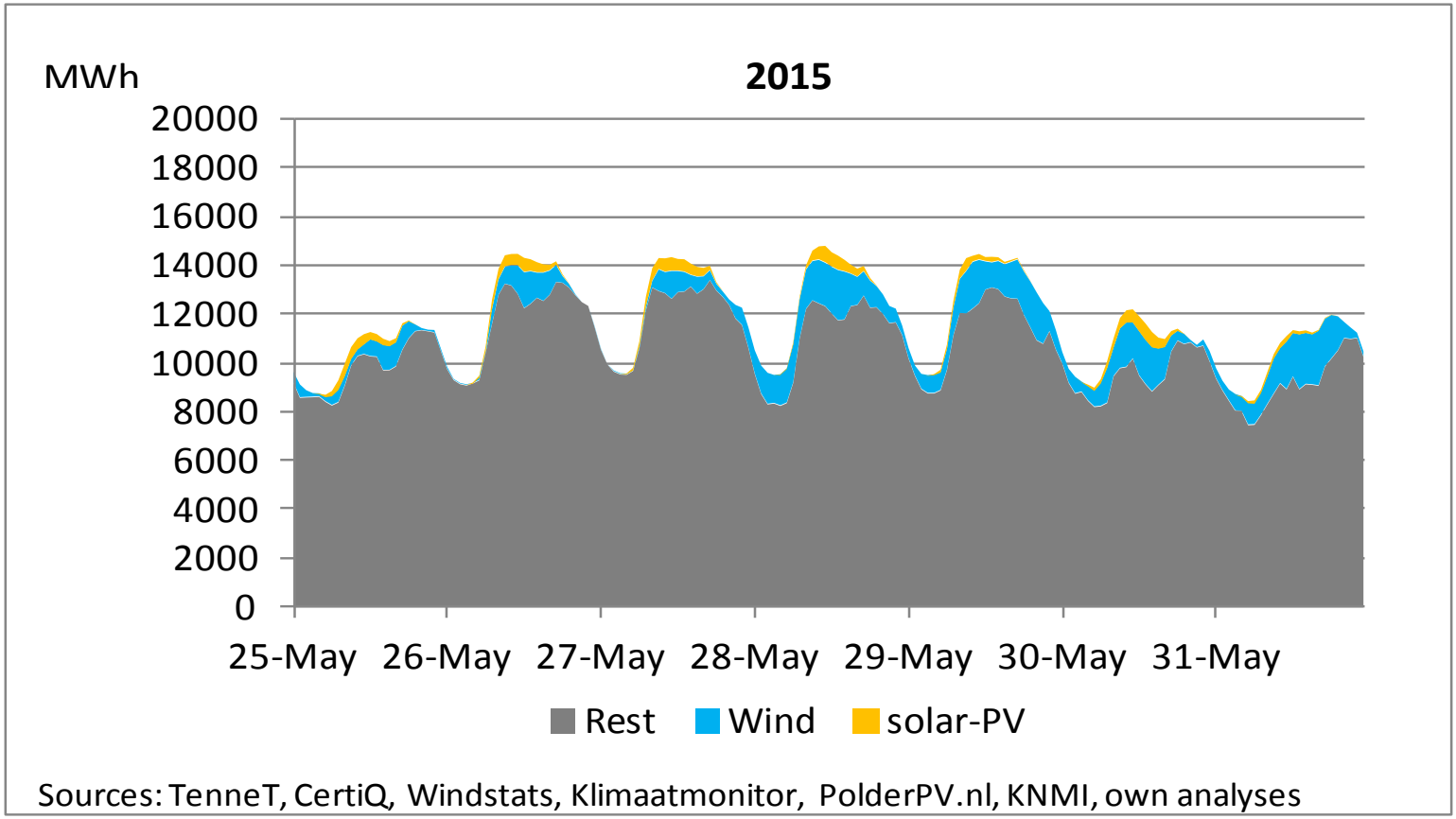

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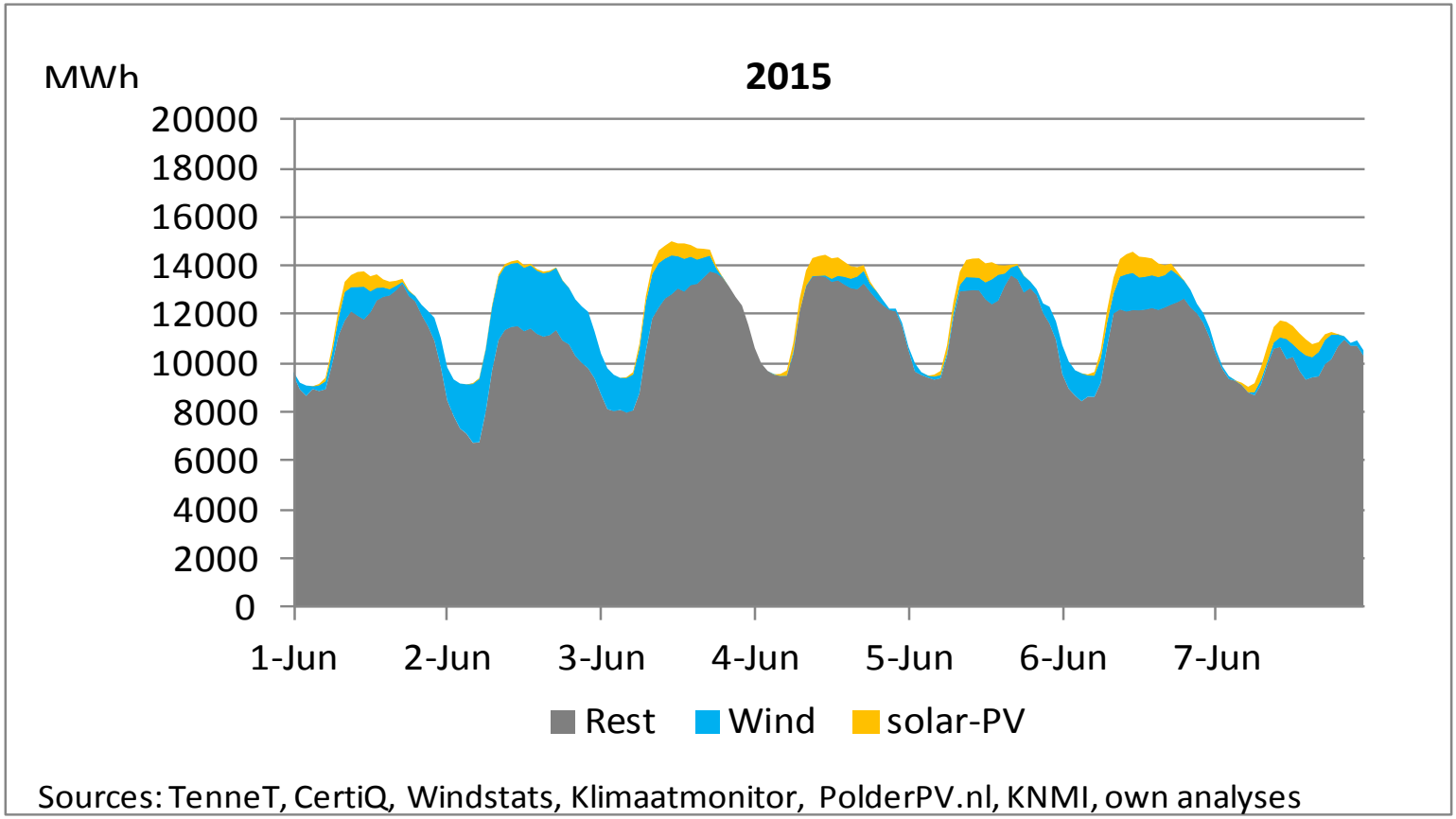

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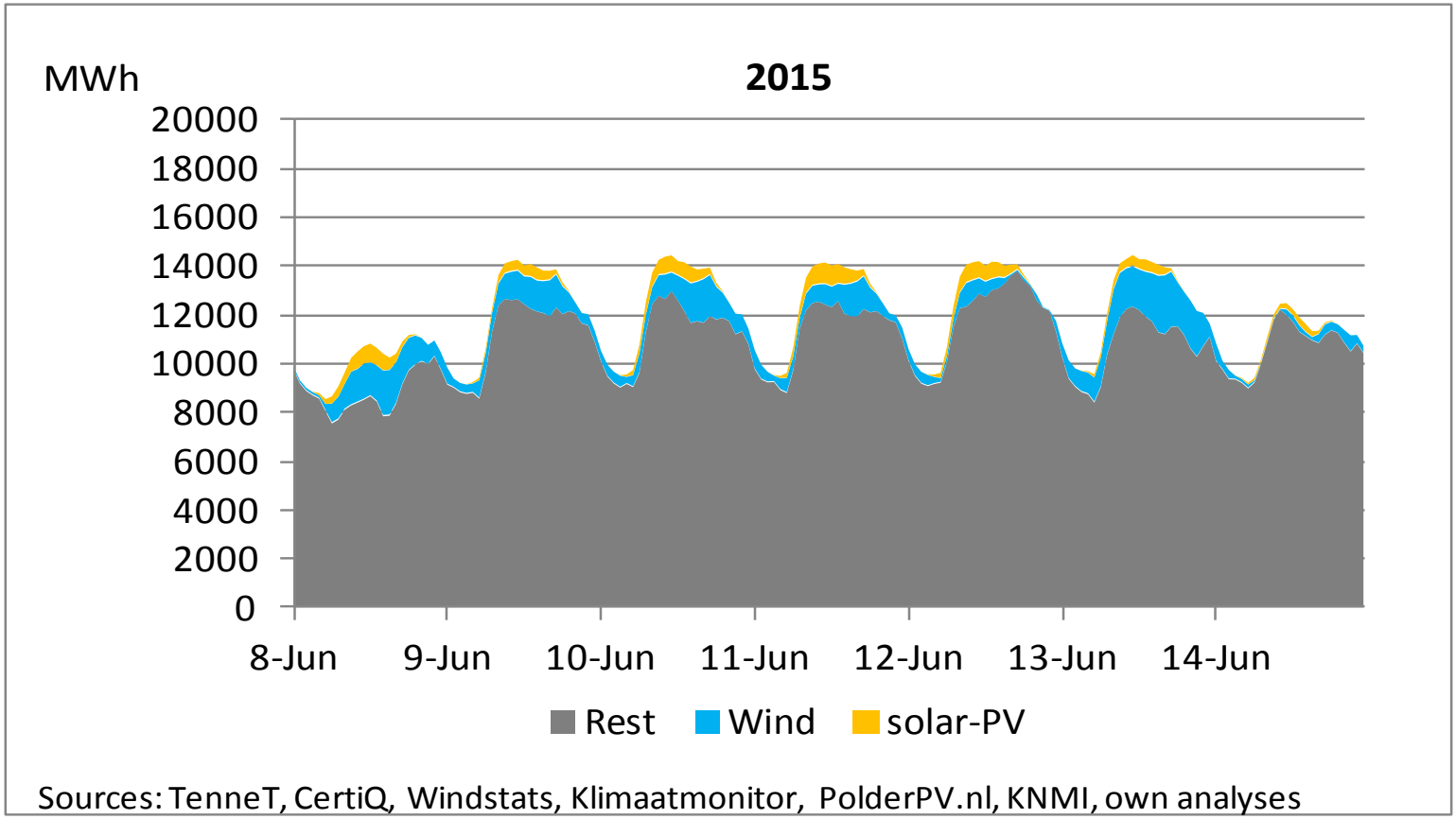

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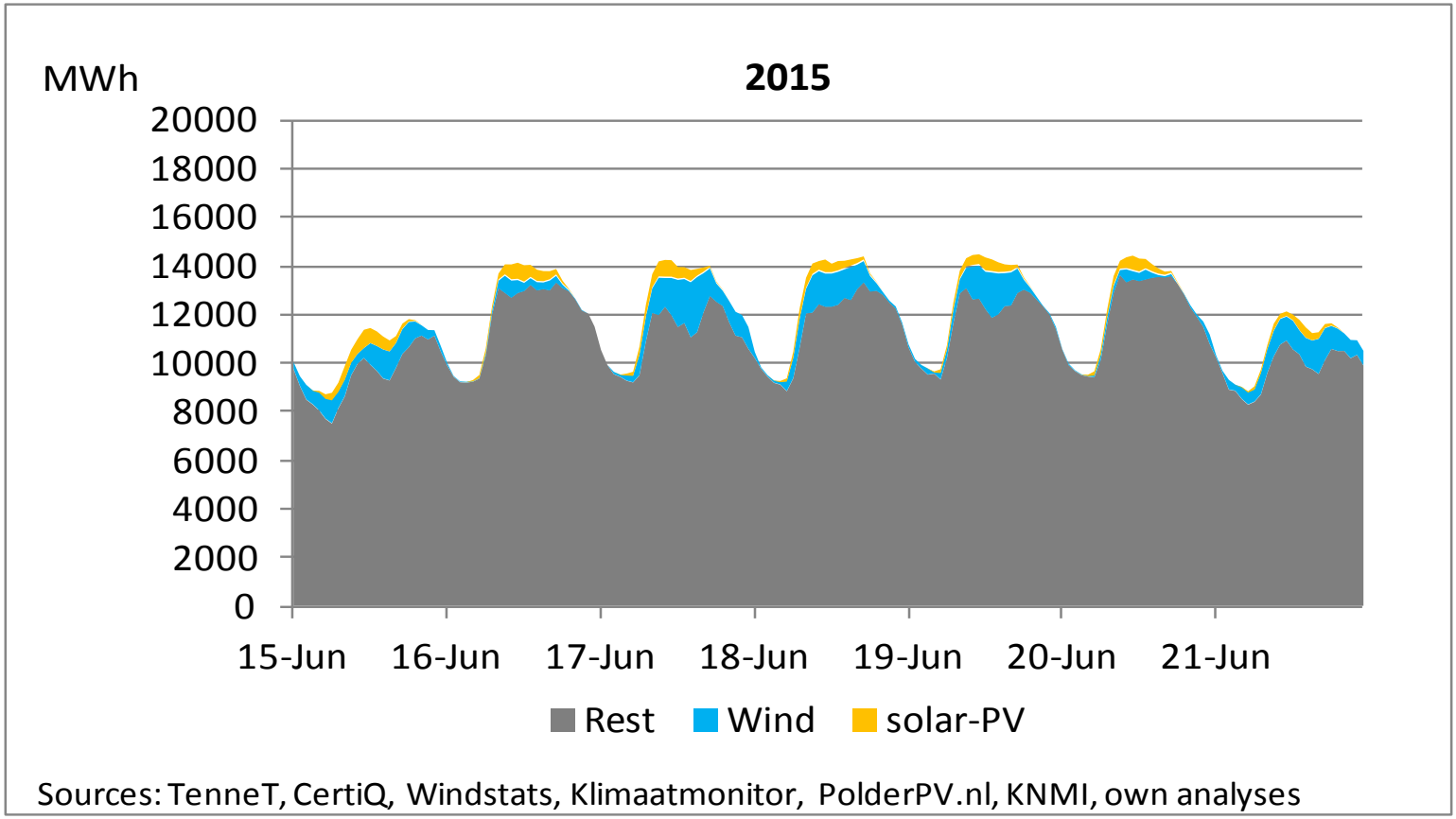

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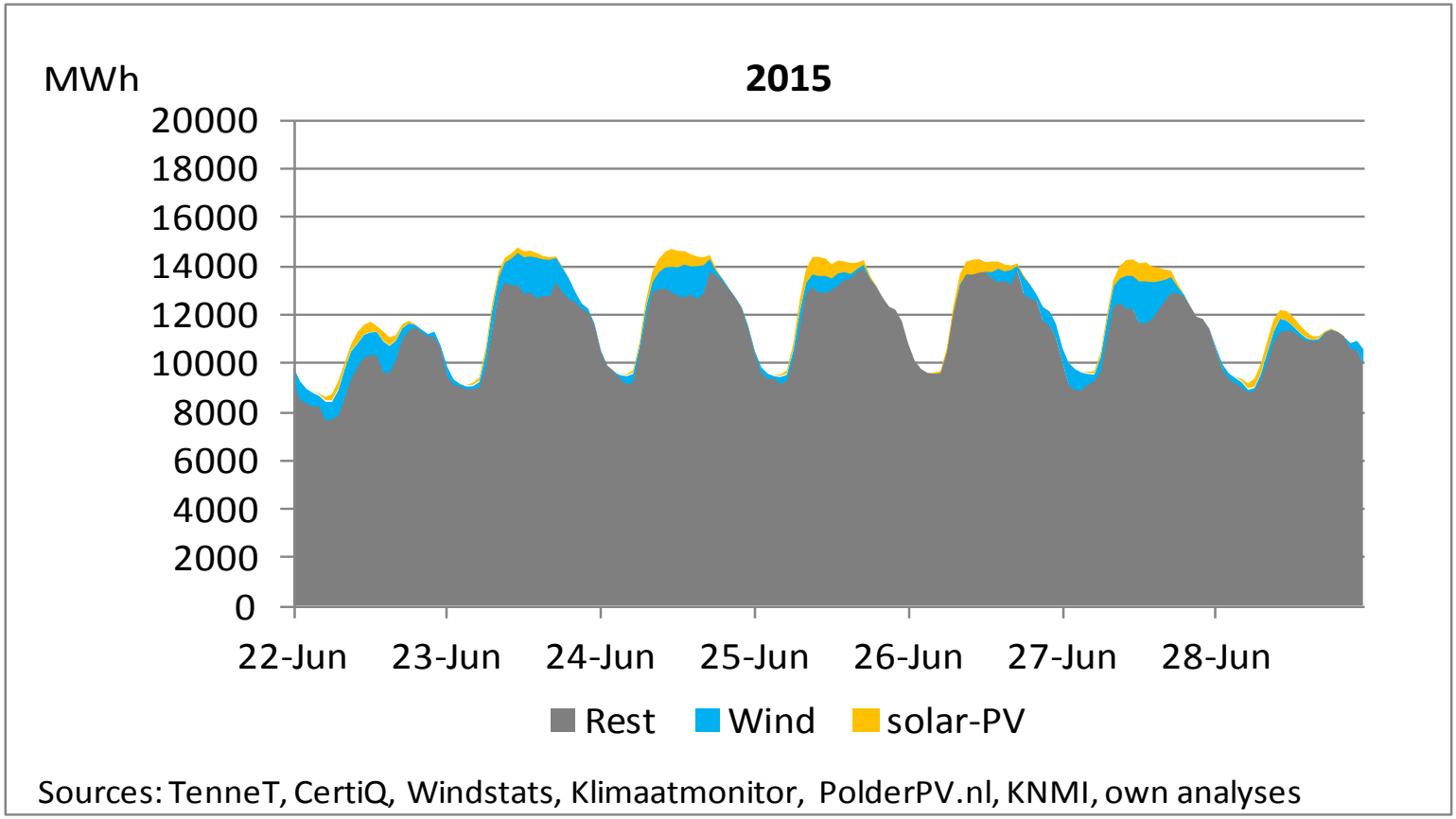

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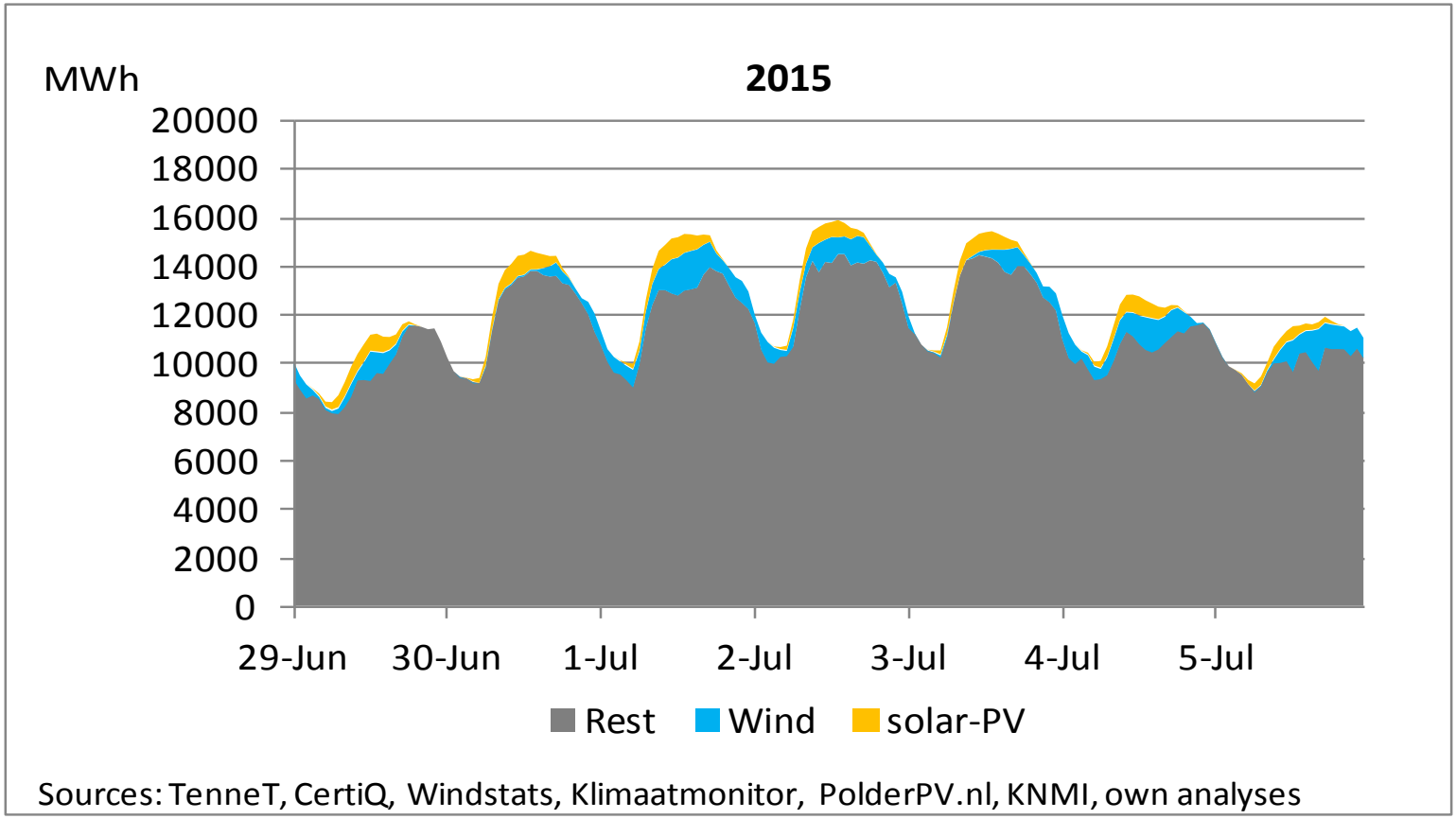

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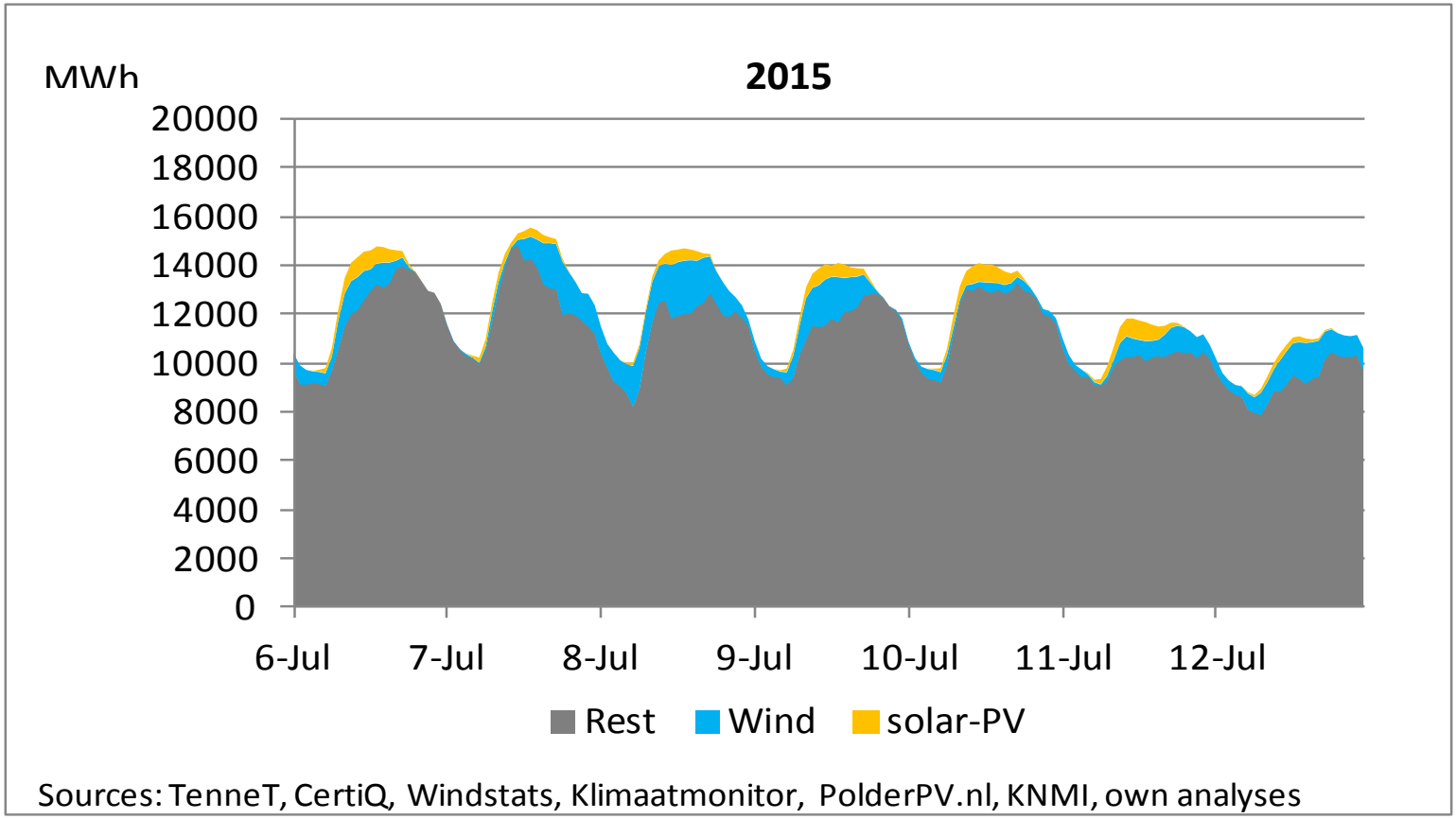

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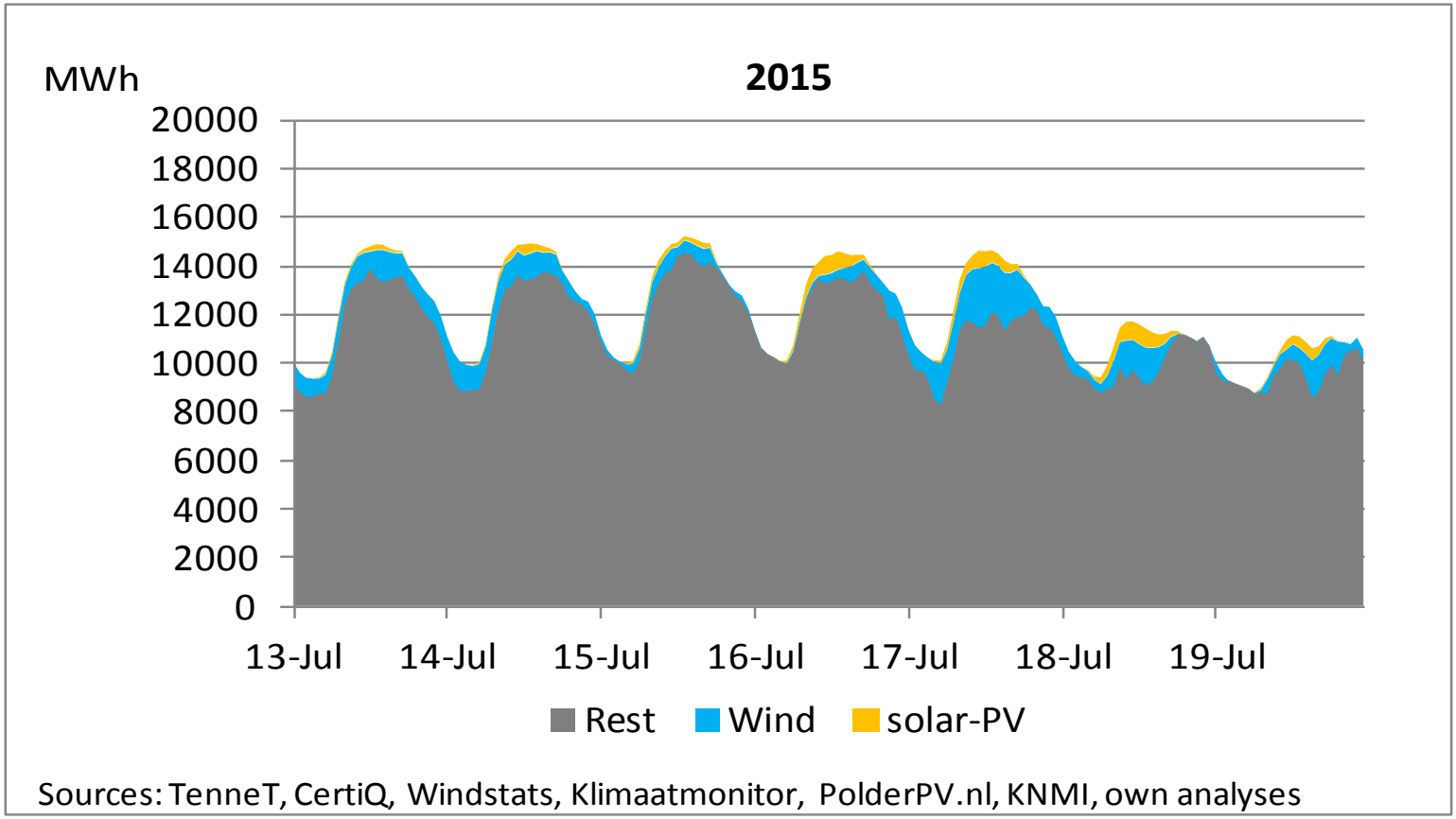

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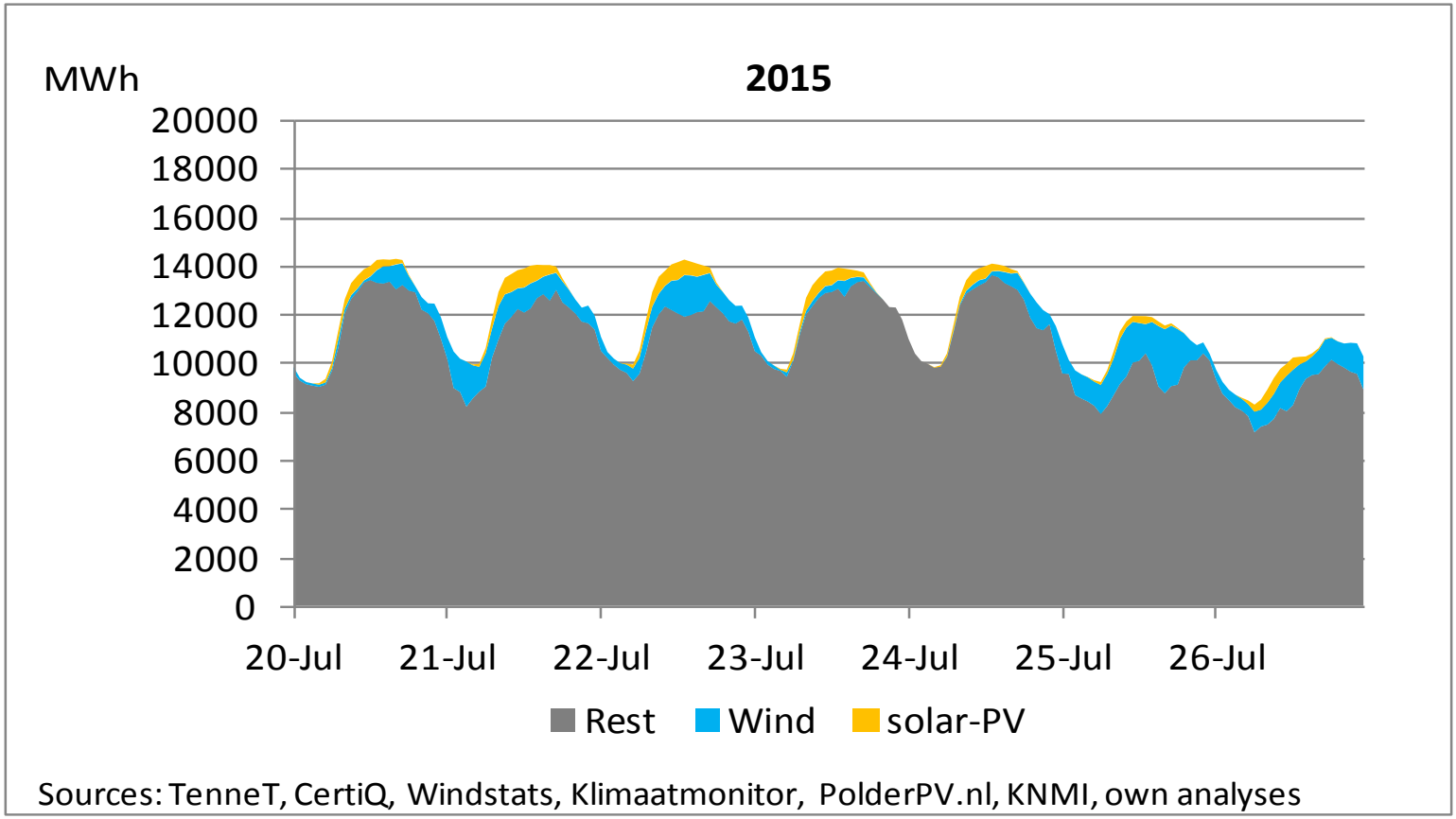

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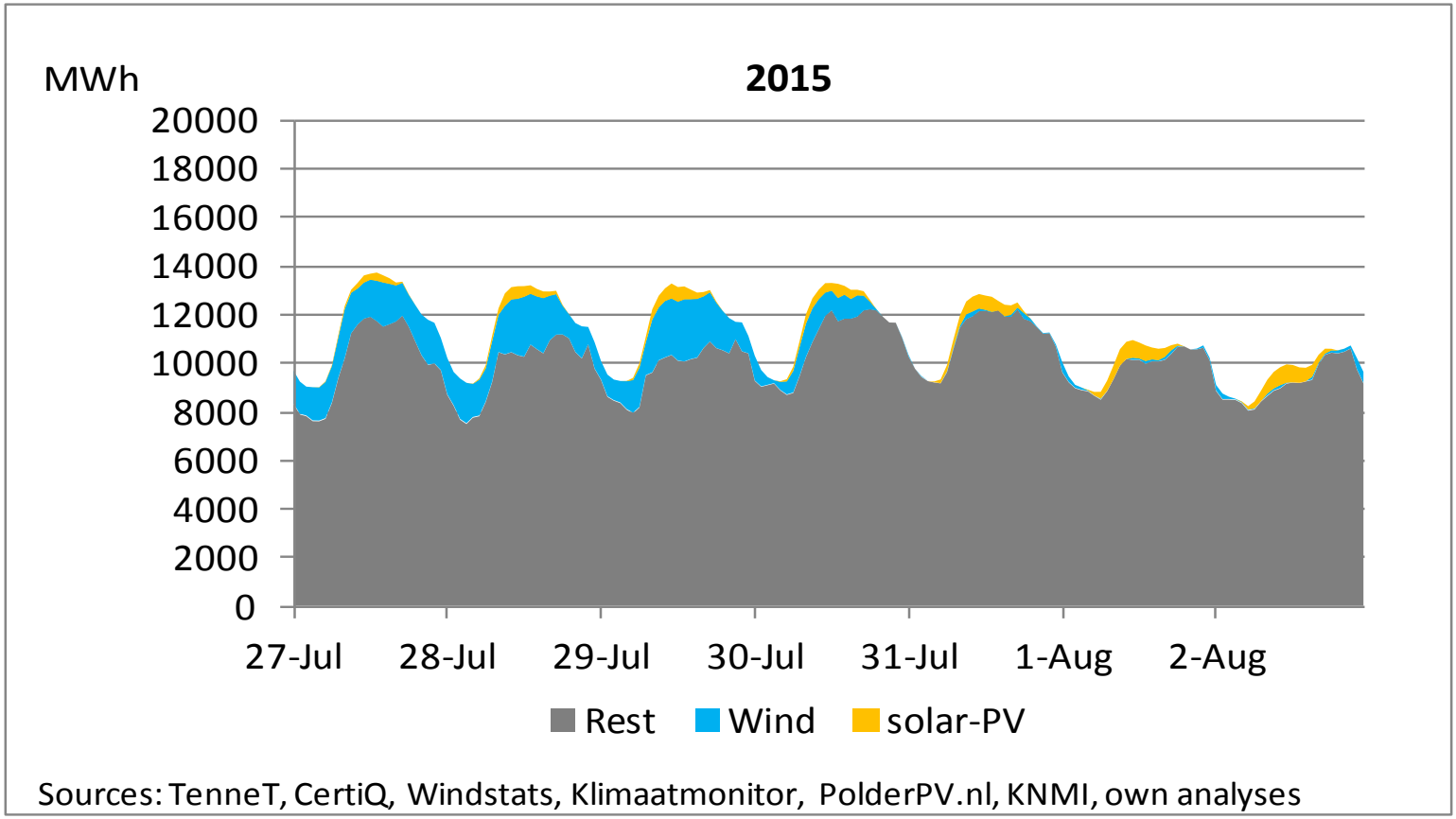

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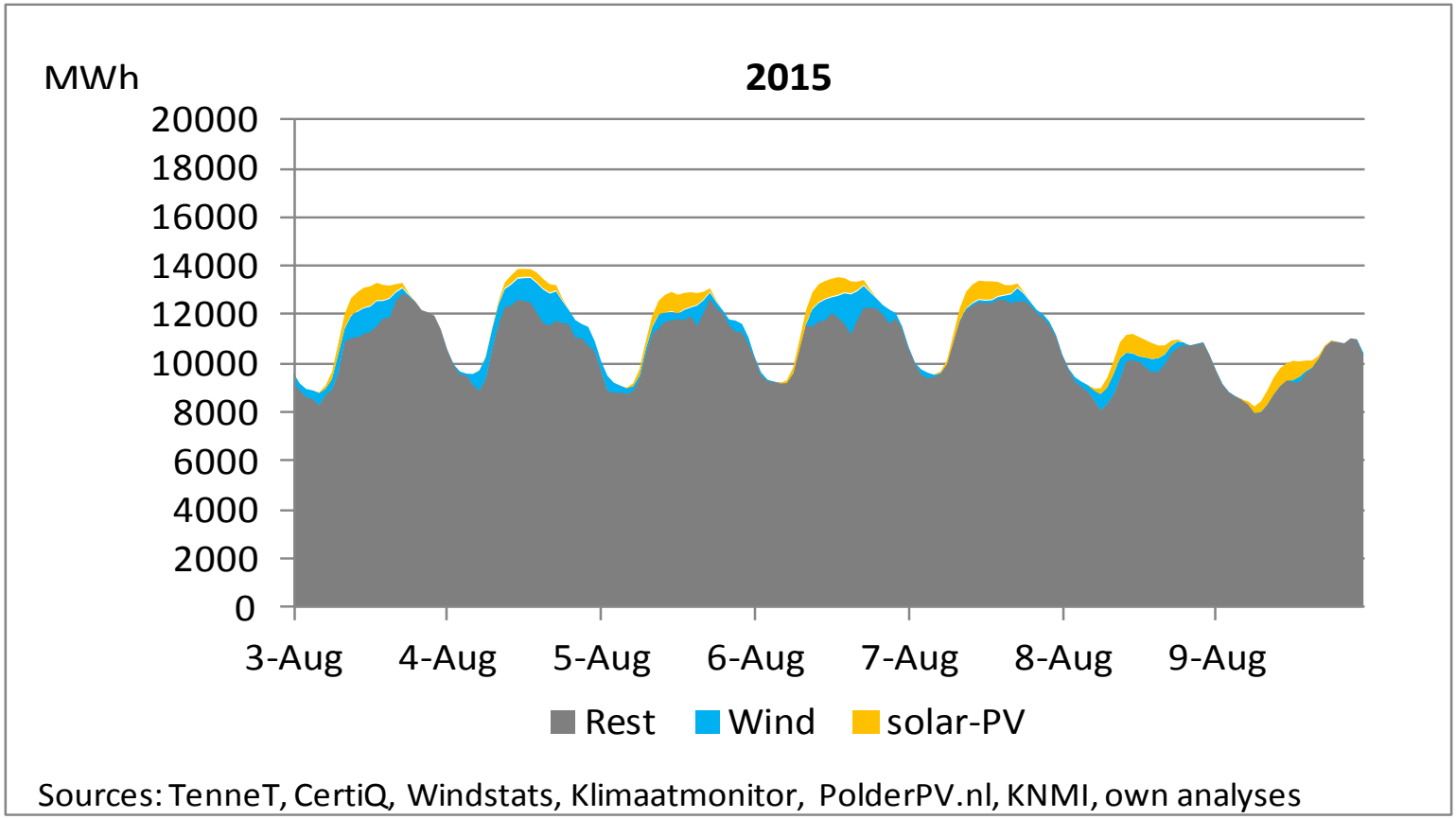

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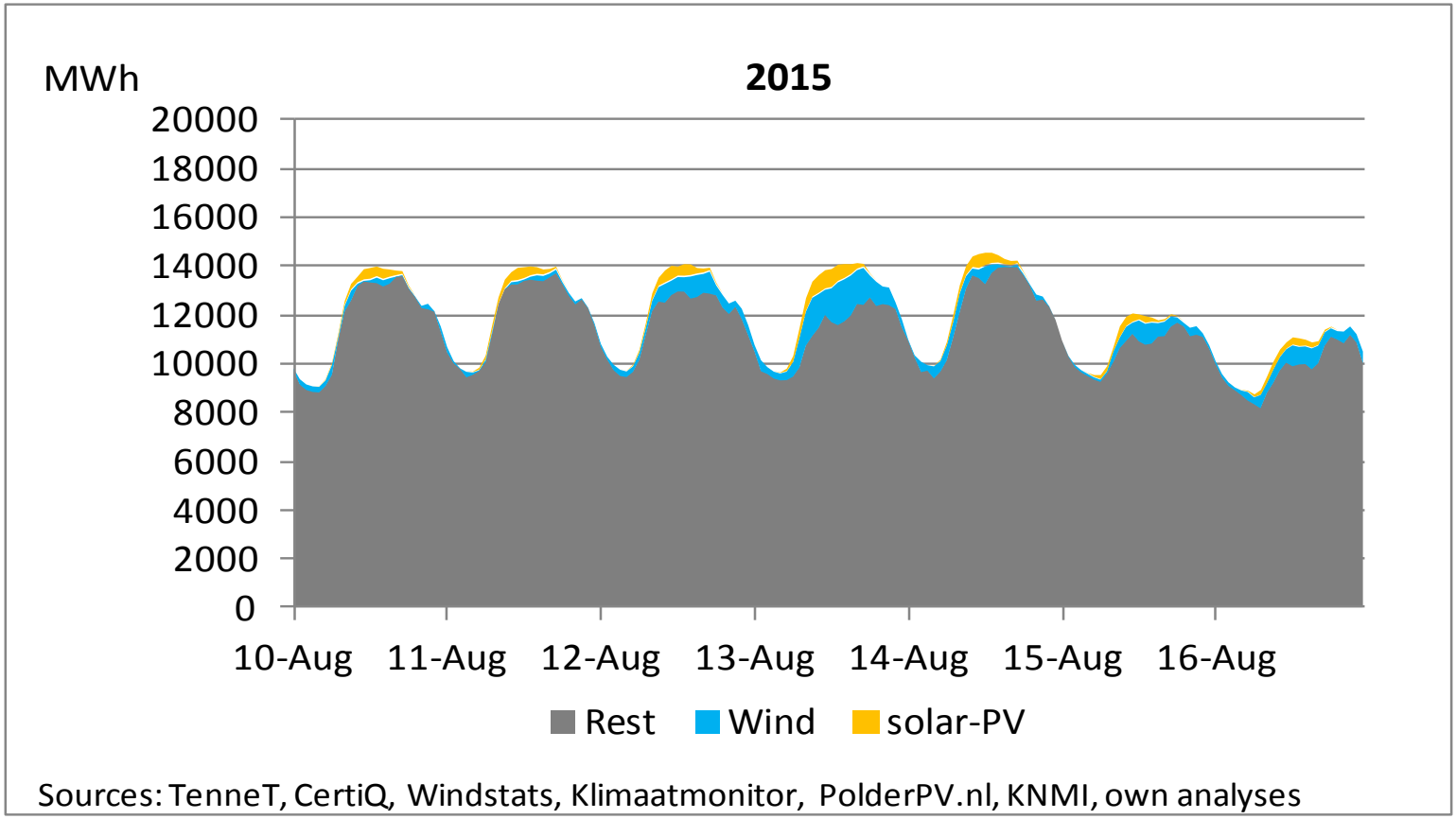

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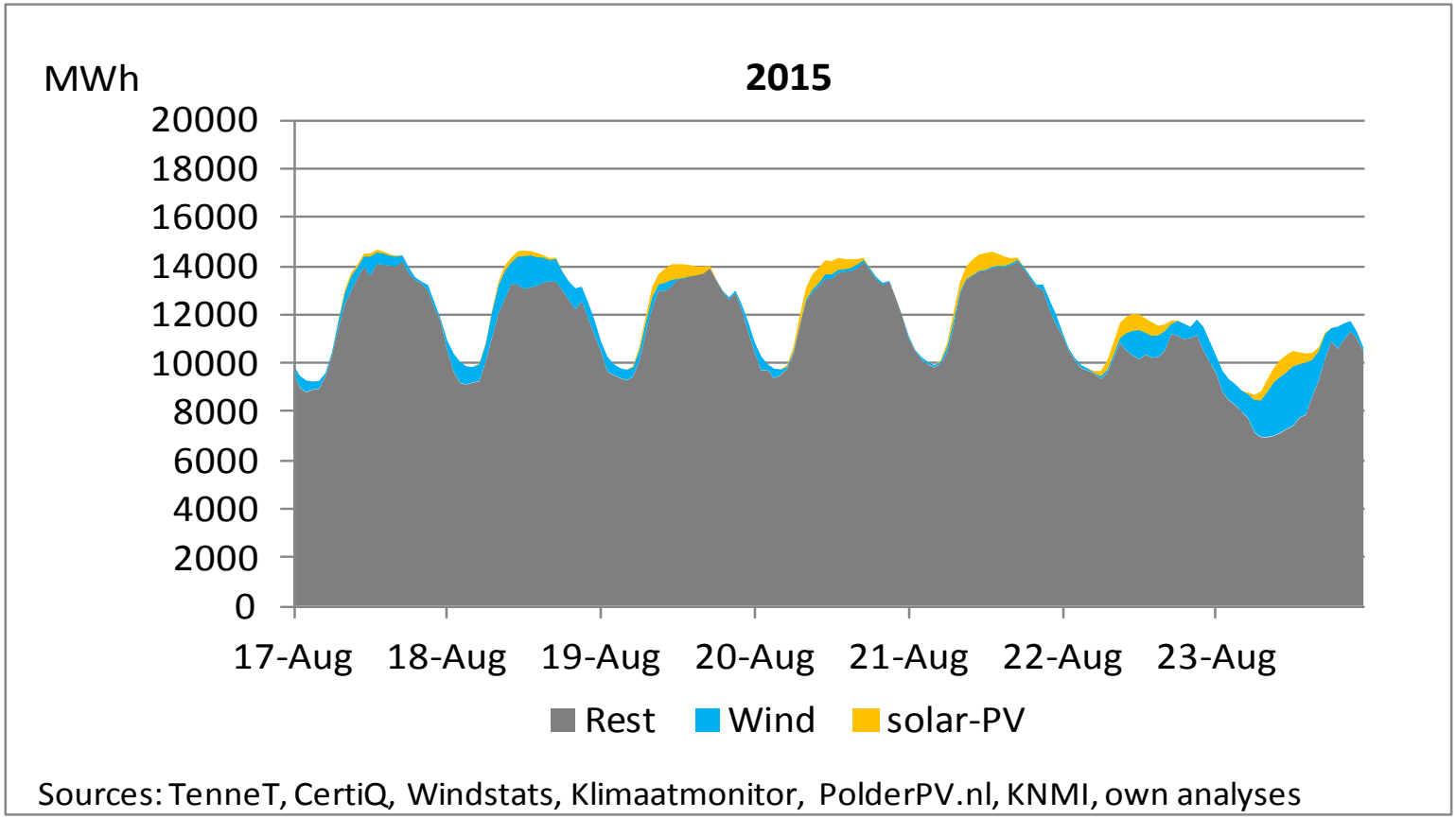

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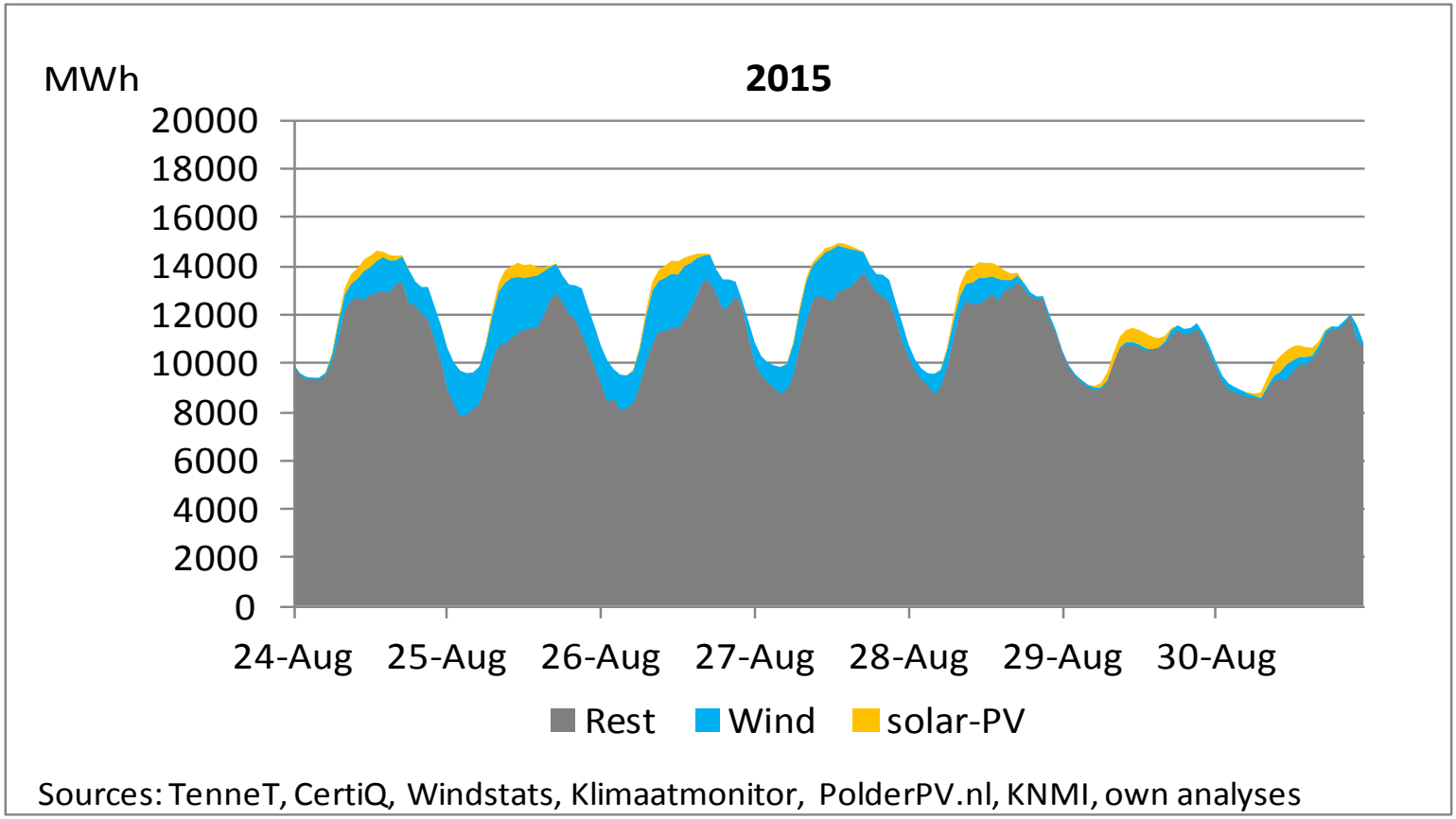

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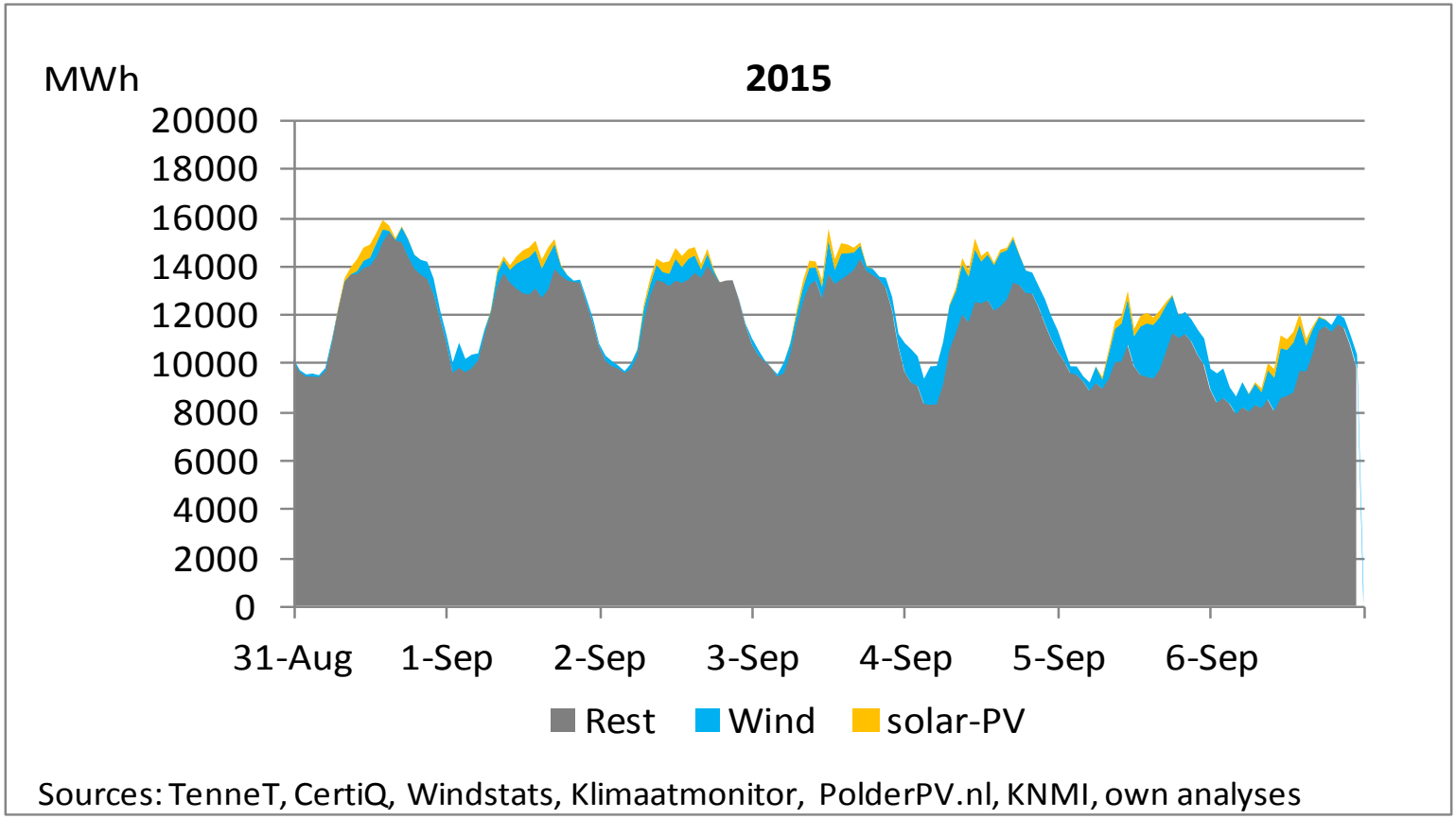

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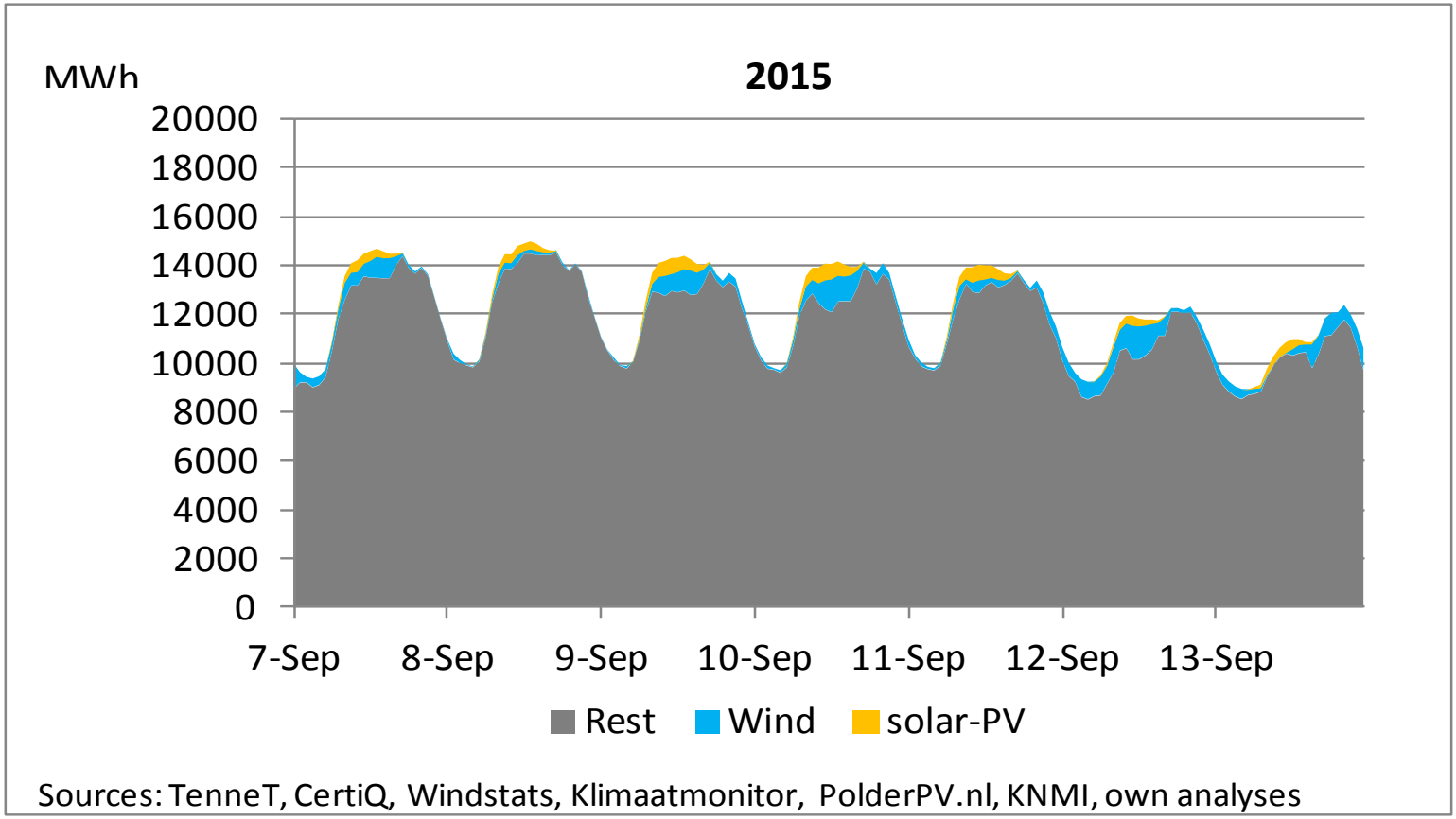

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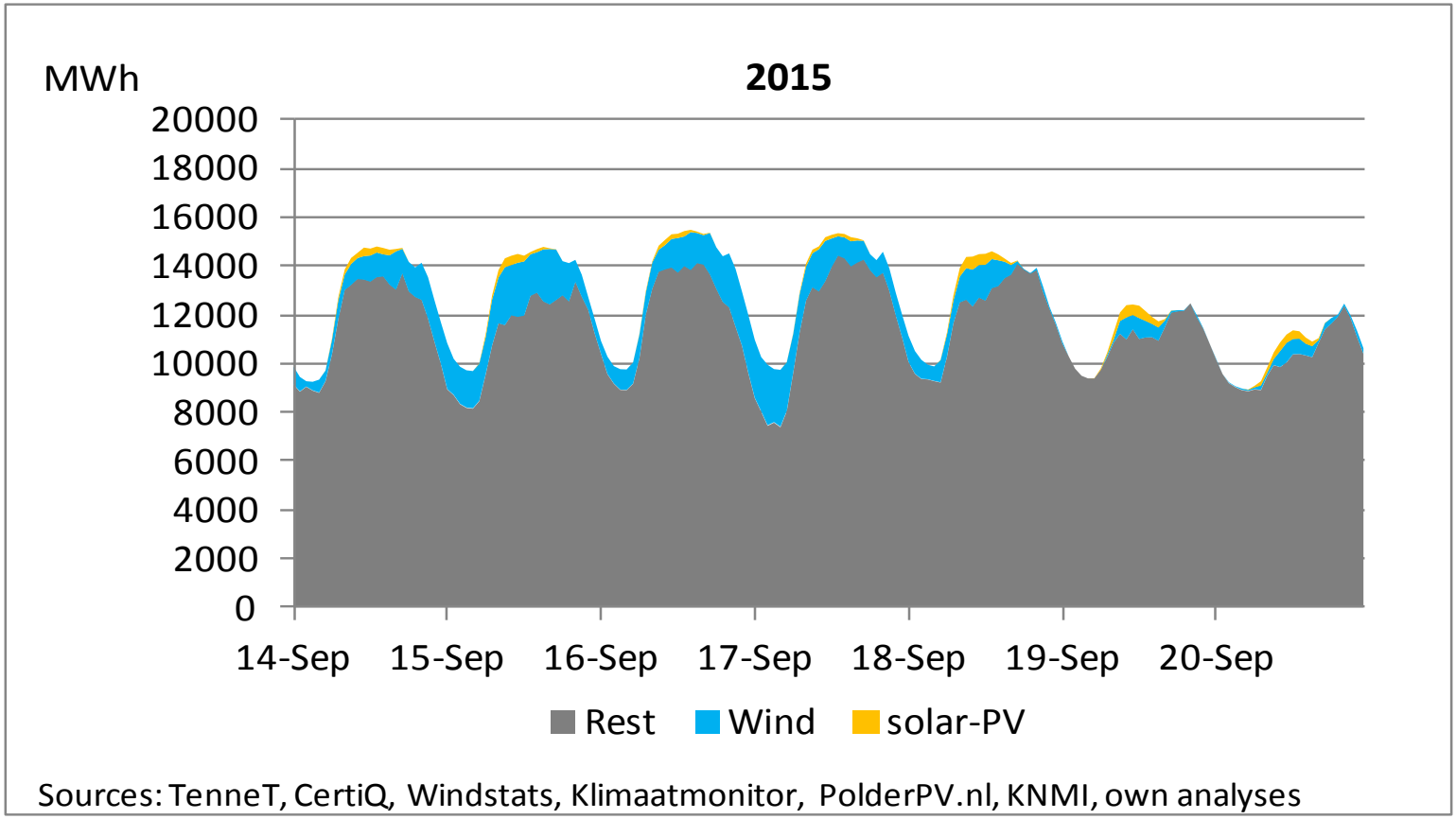

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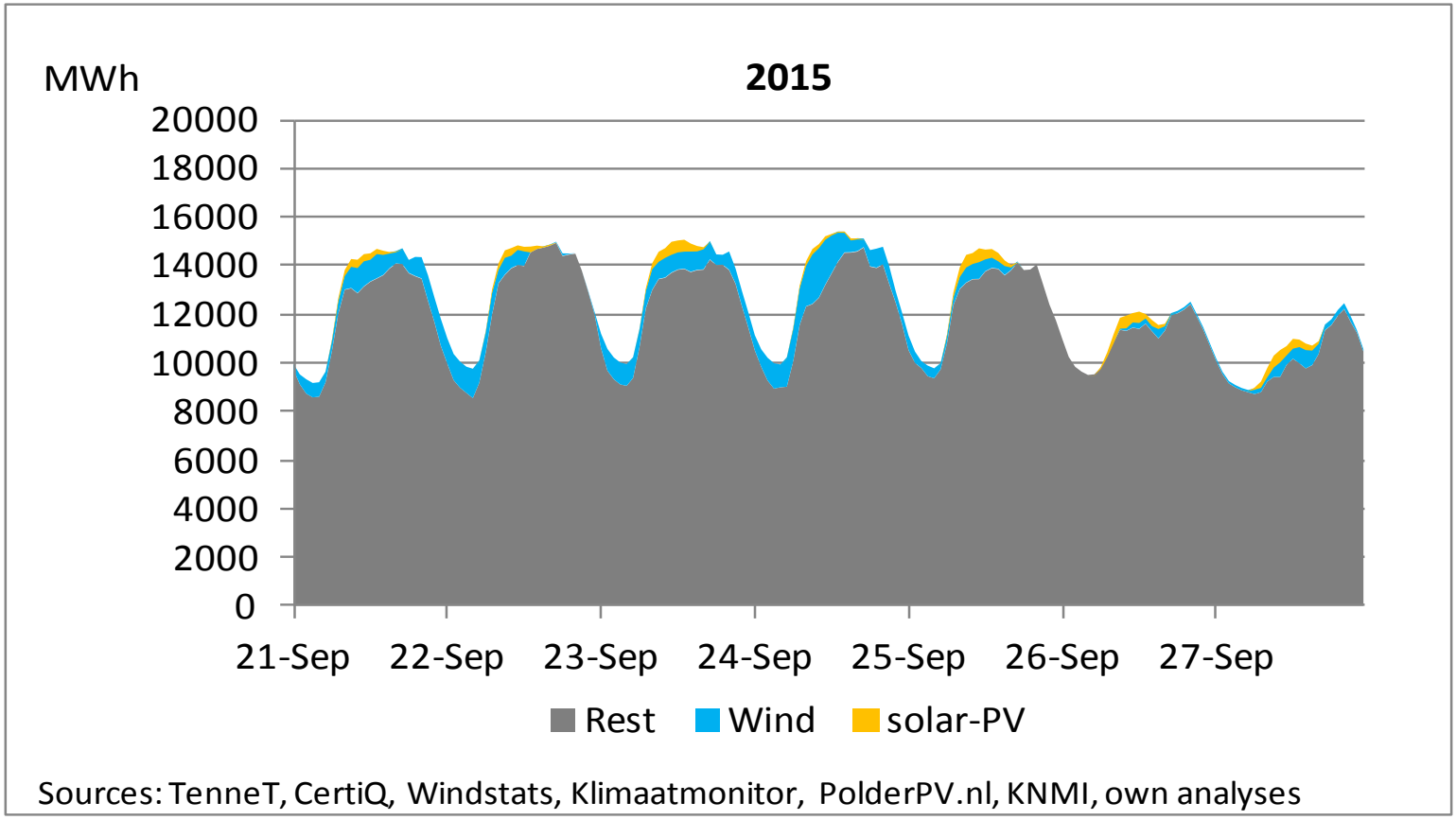

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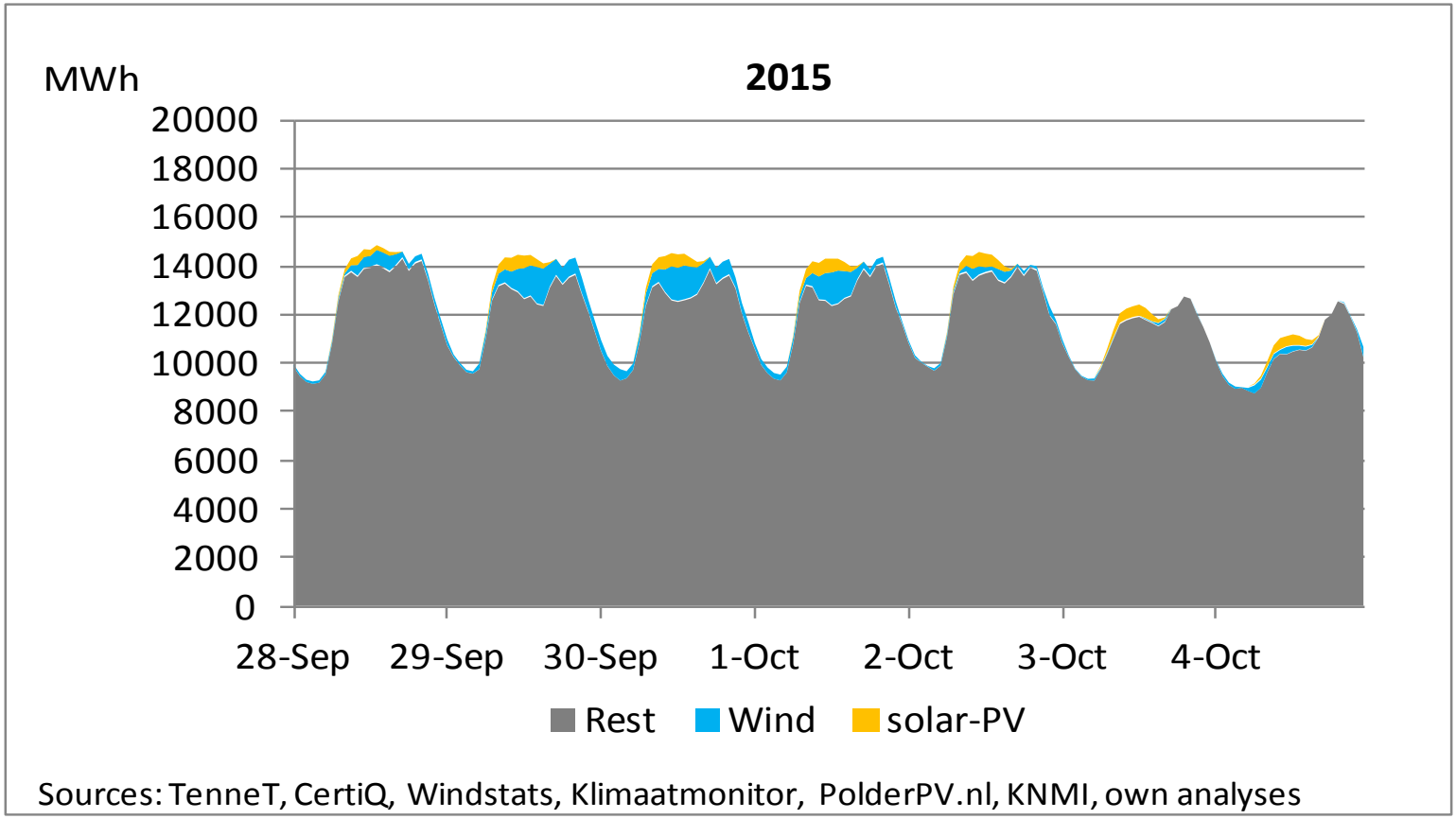
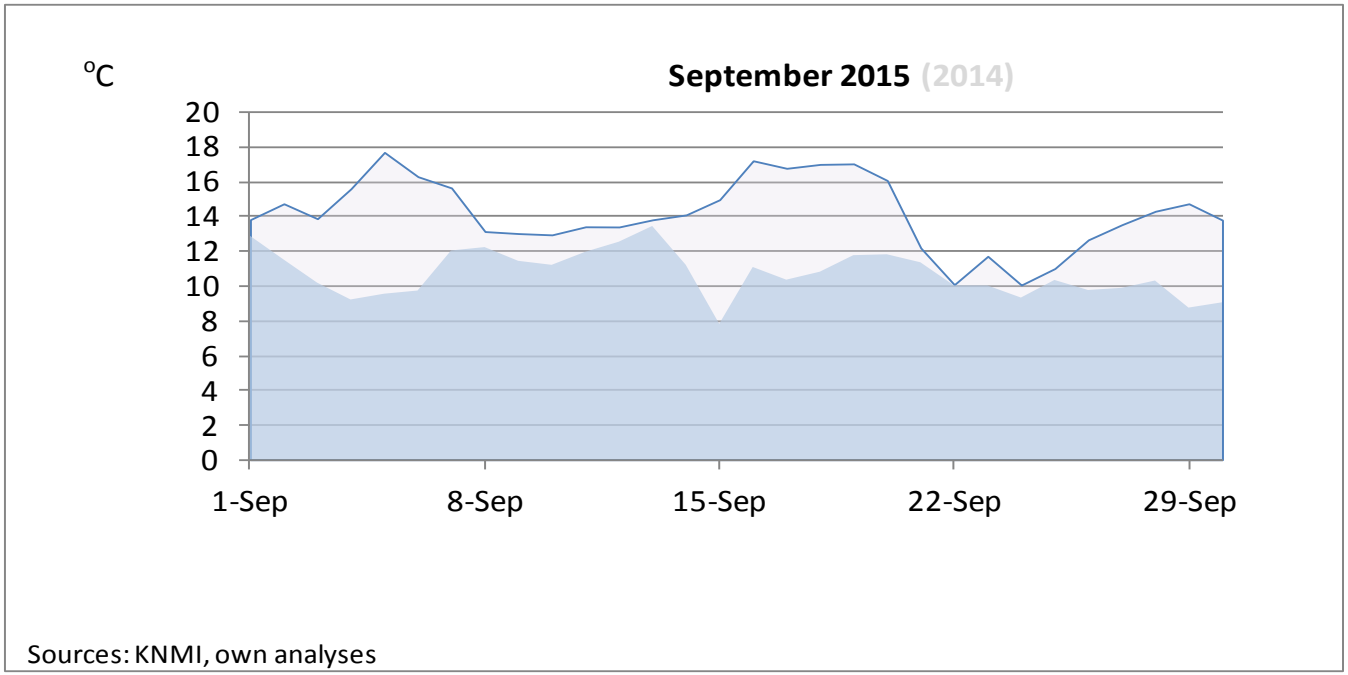


Sources: TenneT, CertiQ, Windstats, Klimaatmonitor, PolderPV.nl, KNMI, own analyses

MISCELLANEOUS

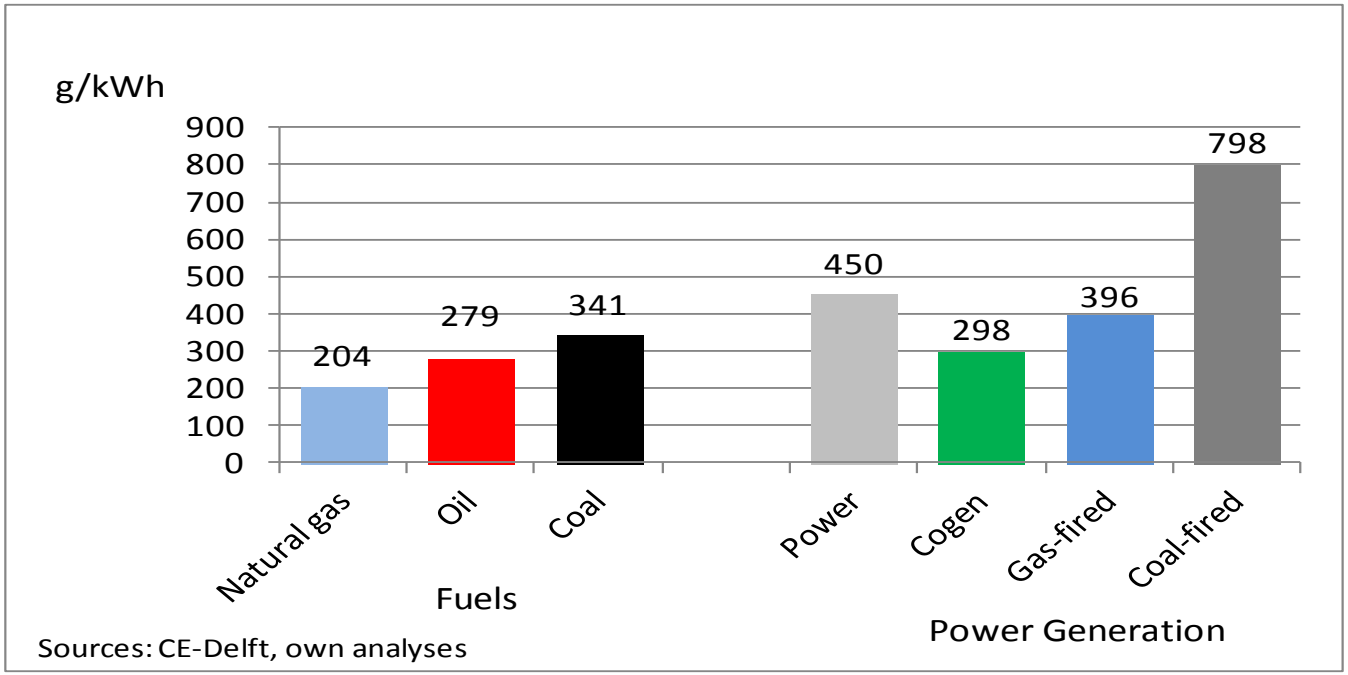
Effective Temperature September 2015



Sources: KNMI, own analyses

In Septembers 2015, the average daily effective temperature (temperature including wind shield factor) was relatively low: 10.7 °C. For comparison, the effective temperature of September 2014 are presented at the background.

Fuel Specific CO2 Emissions



Characteristic CO2 emissions used in this presentation.

Epilogue

b.m.visser@pl.hanze.nl

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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.