This analyses contains information of various sources and own analyses, including estimates. Readers are encouraged to add and improve the quality of the information provided.
The Entrance database on Renewable Energy is regularly improved by the creation and/or refinement of (sub)models

Recent improvements:

From August 2019 onwards, more data from ENTSO-E are used to estimate flows in the Dutch electricity system. From September 2019 onwards, day-ahead natural gas and power prices are added.
The fraction renewable energy has been calculated using EU/IPCC regulations. In November, the Netherlands produced on average 8.3% of its final energy consumption in the form of renewables. The 11.4% is an estimate for the average renewable energy in 2020 by PBL in its KEV report of November 2019.
In November 2019, the fraction renewable energy was 8.5%, compared to 7.9% last year.

In November:

- Solar PV generation was 0.65 PJ, 30% more than last year.
- Onshore wind generation was 2.1 PJ, 15% less than last year.
- Offshore wind generation was 1.1 PJ, 15% less than last year.
- Gross final energy demand was 196 PJ, equal to last year.
- Energy related CO2 emissions were 14.4 Mton, 1% more than last year.
- The percentage renewable power was 17%, up from 16% last year.
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SELECTED ENERGY DATA FROM NOVEMBER 2019
Renewable Energy is produced in various forms. The most important contributors are biomass (biogas, waste, wood and bio-oil) and wind energy. In November 2019, calculated according to the EU/IPCC rules, 8.5% of the gross final energy consumption in the Netherlands was renewable energy.
Contribution of various sources of renewable energy y-o-y.
Renewable energy appears in various forms. Solar energy has a clear maximum in summer, while in winter, wind is usually stronger. Since biomass is preferentially used for space heating, its consumption in winter is higher than in summer as well.
Energy is used for many various purposes. The most important energy applications in November have been natural gas for industry and oil for various forms of transport. The ‘gross final energy demand’, the nominator in the equation for the calculation of the fraction renewable energy, does not contain feedstock and shipping.
In November 2019, the national energy related CO2-eq. emissions, calculated using the official methods, are estimated at 14.4 Mton, about 1% more than in November 2018. Non-energy (human created) CO2-eq. emissions, mainly agricultural, are estimated at 2.3 Mton.
The capacity in this figure is the so-called name-plate capacity. In practice, not all capacity is available for the market due to planned and unplanned maintenance and mothballing.
In November 2019, power consumption, including transmission losses, has been estimated at 10.8 TWh, equal to November last year.
The daily CO2 emission per kWh produced varies due to variations in the power mix. In November 2019, the average CO2 emissions from power generation, including renewables and cogeneration, are estimated at 411 g/kWh, up from 371 g/kWh in October 2019.
SELECTED MONTHLY PROFILES

(using daily data)
The daily contributions of renewable energy, according to the classification by CBS. In November the average daily gross final energy demand was 1810 GWh per day. One GWh is one million kWh. An average production of 1 GWh/day requires 55 onshore wind turbines of 3 MW each.
Daily energy consumption shows a typical weekday-weekend pattern. Gas demand is mainly dependent of ambient temperature.
Conventional power generation is affected by wind and solar production, variations in electricity demand, maintenance (mainly coal and nuclear) and the balance between power imports and exports.

In this figure, co-firing of biomass in coal-fired power stations has been excluded.
November 2019 was rather sunny, while the average wind speed was relatively low. The average utilization rate of onshore wind turbines was 23% and for offshore wind, it was 46%. For solar PV, average utilization rate was 4%.

1 GWh is sufficient to provide power for a year for 300 households.
In November, the percentage of renewable power varied between 11% and 33%, with an average of 18%. The average percentage of renewable energy was 8.3%. These percentages have been calculated using the formal EU/IPCC methodology.
In November, gas was a marginally attractive source for electricity production. With a gas price of 15 €/MWh and a CO2-price of 25 €/ton, power can be produced at marginal costs for about 40 €/MWh.
SELECTED MONTHLY ENERGY DATA
The gross final consumption of energy is a quantity used to calculate the percentage of renewable energy. This quantity excludes the energy consumed in the energy sector (mainly due to the generation of electricity); in international shipping; in feedstock; and the energy used for (international) aviation above 6.18% of the total.
Gas consumption in November, excluding gas-to-power, was slightly higher than last year.
Dutch natural gas production is structurally in decline, due to the gradual closure of the Groningen gas field and lower production of the so-called small fields.
Dutch power demand in November, including transmission losses, has been estimated 1% higher than in November last year.
In November 2019, onshore wind production was 2.1 PJ, 13% less than last year. Offshore wind production was 1.1 PJ, 16% less than last year. The average utilization of wind capacity was 23% for onshore and 46% for offshore.
In November 2019, Solar PV reached 0.7 PJ. This is 28% more than in November last year. In November 2019, there was not much sunshine. The increase is entirely due to the significant increase in Solar PV capacity in the Netherlands.

In November, the average utilization rate of solar PV capacity was 4%.
In November 2019, coal-fired power generation has been estimated to be much lower than in November 2018, due to low natural gas costs and more biomass co-firing.
In November 2019, gas-fired power generation (including CCGT’s and Cogen) was similar to last year.
This figure depicts the amount of LNG injected into the gas grid. This year, LNG imports by the Netherlands are at a much higher level than in previous years. The figure excludes the usage of LNG as transport fuel.

1 PJ is equal to about 30 million m3 gas.
In November 2019, renewable energy production was 7% higher than last year.
In November, the percentage of renewable energy was 8.5%, compared to 7.9% in November last year. The increase was entirely caused by more renewable energy production, since gross final energy consumption was stable.
Dutch CO₂ Emissions 2019 (and 2018)

CO₂ emissions in November 2019 were 3% higher than in November 2018.
ENERGY DEMAND IN A NUTSHELL
Dutch government has allocated Energy Demand in four categories. These categories (and this figure) do not take into account energy demand for international shipping, aviation and feedstock. (1 GWh is equal to the average daily energy production of 55 onshore wind turbines of 3 MW each)
The primary energy requirement for Low Temperature Heat, mainly buildings and green houses, varies with ambient temperature.
The primary energy requirement for High Temperature Heat (mainly industry) varies with the economic activity in the Netherlands.
The primary energy requirement for Transportation (excluding international shipping and aviation) varies with the economic activity in the Netherlands. Fuel purchases abroad, e.g. because of lower taxes, are not included in this figure.
The primary energy requirement for the Dutch power sector varies with power demand, the import/export balance and the production of renewable power. The figure excludes the primary energy demand associated with power imports.
This figure presents the daily CO₂ emissions of each of the four energy demand sectors. The figure does not take into account the CO₂ emissions by international shipping and aviation and from the energy for feedstock. (1 kton CO₂ is equal to the average daily CO₂ emission of 95,000 households, each using 1400 m³ gas and 3000 kWh electricity annually.)
The CO$_2$ emissions from low temperature heat, mainly buildings and green houses, vary with ambient air temperature. November was a relatively cold month and hence, energy demand from buildings was relatively high. The figure excludes the CO$_2$ emissions due to the production of electricity used for low temperature heating.
Dutch CO₂ emissions High-Temperature heat

CO₂ emissions from high temperature heat, mainly industry, vary mainly with the economic activity in the Netherlands.
This figure presents the formal CO$_2$ emissions from Transportation (thus excluding international shipping and aviation). These emissions vary primarily with the economic activity in the Netherlands. CO$_2$ emissions from fuel that is bought abroad, are, according to international conventions, not included in this figure.
CO₂ emissions from the power sector vary with power demand, the fraction of coal used for power generation, the amount of renewable power produced, and the level of power exports and imports.
SELECTED HOURLY ENERGY DATA
Gas supplies are related to ambient temperatures. When gas storages are being filled, this is represented by negative values. Gas supplies in this figure are used both for Dutch consumption and for exports.
Domestic gas demand in November peaked at 85 GW. In this graph, the term “industry” is defined as the 400 direct connections to the high pressure Gasunie grid including Zebra. The term “distribution” includes households, offices, commercials and small and medium size industries that are connected to the gas distribution grids.
In November 2019, Dutch gas imports were 160 PJ while Dutch gas exports were 140 PJ.
In November 2019, power imports (mainly from Germany and Norway) were 4.7 PJ, while the power exports (mainly to Belgium and UK) were 6.5 PJ. This graph presents the actual power flows, i.e. both intended (traded) and unintended.
November 2019 was characterized by a varying production of wind energy; the average utilization rate of the wind turbines was 23% onshore and 46% offshore. The installed wind power capacity was about 4500 MW in total.
November was very sunny; the utilization rate of solar PV installed was 4%. At the beginning of November, the installed solar power capacity in the Netherlands is estimated at 6150 MW. Solar power capacity in NL increases approximately by 200 MW per month (equal to one solar panel every 5 seconds).
This graph shows the combined renewable electricity production by offshore wind, onshore wind and solar PV.
The following set of graphs presents for each month in 2019 the hourly contributions of various energy sources to total power consumption in The Netherlands.
June 2019

MW

Net import Nuclear Other Renewables Coal NatGas

Data are added

1-jun 8-jun 15-jun 22-jun 29-jun

Entrance

Energy Academy Europe
Dutch power supplies October 2019

- Net import
- Nuclear
- Other
- Renewables
- Coal
- NatGas

Data are added
Dutch power supplies November 2019

Data are added
The following set of slides presents for each week in 2019 the hourly contributions of wind and solar PV to the total power consumption in The Netherlands.
Electricity in The Netherlands 2019

Graph showing electricity generation in megawatts (MW) from different sources: Rest, solar-PV, Wind-onshore, Wind-offshore. The graph covers the period from 1 January to 7 January with data for each day. The highest generation is seen on Saturday and Sunday, with a peak during the week on Tuesday and Wednesday. The lowest generation is seen on Monday and Thursday. The data shows a significant contribution from solar-PV and Wind-onshore sources.
Electricity in The Netherlands 2019
Electricity in The Netherlands 2019

The graph illustrates the electricity production in The Netherlands for the month of January 2019, with data points for the weekdays from 15th to 21st January. The production is categorized into different sources: Rest, solar-PV, Wind-onshore, and Wind-offshore. The graph shows fluctuations in production throughout the week, with certain days having higher production than others.
Electricity in The Netherlands 2019
Electricity in The Netherlands 2019

2019

MW

22000
20000
18000
16000
14000
12000
10000
8000
6000
4000
2000
0

Tuesday
Wednesday
Thursday
Friday
Saturday
Sunday
Monday
12-feb
13-feb
14-feb
15-feb
16-feb
17-feb
18-feb

Entrance

Rest
solar-PV
Wind-onshore
Wind-offshore
Electricity in The Netherlands 2019

Graph showing electricity generation by source (Rest, solar-PV, Wind-onshore, Wind-offshore) from 19-feb to 25-feb 2019.
Electricity in The Netherlands 2019

![Graph showing electricity production in The Netherlands in 2019, with data categories for Rest, solar-PV, Wind-onshore, and Wind-offshore.]
Electricity in The Netherlands 2019
Electricity in The Netherlands 2019

![Graph showing electricity production by source in The Netherlands in 2019. The graph displays daily production from Monday to Sunday, with separate lines for Rest, solar-PV, Wind-onshore, and Wind-offshore.]
Electricity in The Netherlands 2019

[Graph showing electricity production by type over a week in 2019, with labels for Rest, solar-PV, Wind-onshore, and Wind-offshore.]
Electricity in The Netherlands 2019

![Graph showing electricity generation by day and source]

- **Rest**
- **solar-PV**
- **Wind-onshore**
- **Wind-offshore**
Electricity in The Netherlands 2019
Electricity in The Netherlands 2019

![Graph showing electricity generation by source in The Netherlands in 2019](image-url)
Electricity in The Netherlands 2019

[Graph showing electricity generation by type over a week in May 2019, with categories such as Rest, solar-PV, Wind-onshore, and Wind-offshore.]
Electricity in The Netherlands 2019

Graph showing electricity generation from various sources over the week of 21-27 May 2019, including Rest, solar-PV, Wind-onshore, and Wind-offshore.
Electricity in The Netherlands 2019
Electricity in The Netherlands 2019

![Graph showing electricity consumption by day and source in The Netherlands in 2019. The graph includes data for different days of the week and various energy sources such as rest, solar-PV, Wind-onshore, and Wind-offshore.](image-url)
Electricity in The Netherlands 2019

![Graph showing electricity generation by source over a week in 2019. The x-axis represents days of the week from June 18 to June 24, and the y-axis represents MW. The graph displays contributions from Rest, solar-PV, Wind-onshore, and Wind-offshore.]
Electricity in The Netherlands 2019

![Graph showing electricity production by days and sources]
Electricity in The Netherlands 2019
Electricity in The Netherlands 2019

2019

MW

Tuesday Wednesday Thursday Friday Saturday Sunday Monday

Entrance

Rest solar-PV Wind-onshore Wind-offshore
Electricity in The Netherlands 2019
Electricity in The Netherlands 2019
Electricity in The Netherlands 2019

2019

MW

22000
20000
18000
16000
14000
12000
10000
8000
6000
4000
2000
0

30-jul 31-jul 1-aug 2-aug 3-aug 4-aug 5-aug

Tuesday Wednesday Thursday Friday Saturday Sunday Monday

Entrance

Rest solar-PV Wind-onshore Wind-offshore
Electricity in The Netherlands 2019

The graph shows the electricity production from different sources over the course of a week in 2019. The sources include Rest, solar-PV, Wind-onshore, and Wind-offshore. The production values are measured in MW (megawatt) and are plotted for each day from Tuesday to Monday.
Electricity in The Netherlands 2019

The diagram shows the electricity generation in The Netherlands from 3 September to 9 September 2019, with different energy sources represented. The sources include Rest, solar-PV, Wind-onshore, and Wind-offshore. The graph indicates the fluctuation in MW (megawatts) across the days, highlighting the contribution of each energy source.
Electricity in The Netherlands 2019
Electricity in The Netherlands 2019

![Graph showing electricity production from different sources across different days and weeks in 2019. The graph includes lines for Rest, solar-PV, Wind-onshore, and Wind-offshore.]
Electricity in The Netherlands 2019
Electricity in The Netherlands 2019

![Graph showing electricity generation sources in The Netherlands in 2019. The graph indicates the power output from Rest, solar-PV, Wind-onshore, and Wind-offshore sources over the course of a week from 22-oct to 28-oct. The power output varies daily and weekly, with higher peaks on certain days.]
Electricity in The Netherlands 2019
Electricity in The Netherlands 2019

![Graph showing electricity production from different sources.

Source: Energy Academy Europe]
MISCELLANEOUS
In November 2019, the average daily effective temperature (temperature, including wind shield factor) was 10.8 °C, one degree lower than in November 2018 (11.7 °C)
Specific CO₂ Emissions used in this presentation
This presentation is based on numerous sources about energy demand, supply, conversion and production in The Netherlands. Unfortunately, these sources do not cover the entire Dutch energy system, nor do these sources provide the insights needed for this presentation. Thus, various approximations and scaling factors have been derived and are used. The author would like to thank students from Hanze University of Applied Sciences in Groningen and various consulted energy experts for their feedback on the methods used and results derived. Currently, the aggregated results of this work (e.g. monthly and annual data) are in good agreement with data from the Dutch National Office of Statistics (CBS) and Eurostat and consequently, it is believed that this presentation gives a fair presentation of the complex reality of the Dutch energy system.

The author invites readers to comment on the data provided 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.

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