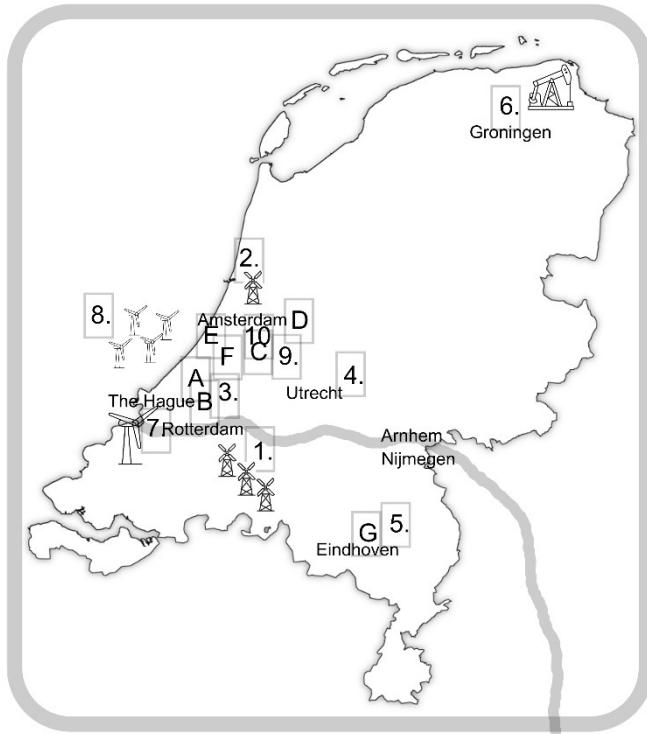


The Netherlands: "God created the world; the Dutch created the Netherlands"



1. 18th-century windmills ([Kinderdijk](#), via Rotterdam).

About 10 km southeast of Rotterdam, the UNESCO World Heritage Site in the Alblasserwaard region comprises 19 windmills and 3 pumping stations to drain water from a lower polder to a reservoir to a higher polder via scoop wheels and then on to the River Lek at low tide. Take the Line 20 ferry from Rotterdam (every 30 minutes).

2. Traditional windmills ([De Zaandse Schans](#), via Amsterdam).

About 20 km northwest of Amsterdam, 7 working sixteenth-century windmills are dotted along the River Zaan, employed to ground oil, spices, and pigments, saw wood, and pump water. The mills are an easy boat ride from the town of Zaandam with regular trains from Amsterdam.

3. First practical telescope demonstration ([The Binnenhof](#), The Hague).

Seat of the Dutch government, the first practical demonstration of the telescope was from atop a tower of the Binnenhof in 1608. Two years later in Padua, Galileo confirmed Copernicus's paradigm-changing heliocentric solar system with his own two-lens telescope, starting with the discovery of four of Jupiter's moons that clearly didn't orbit the earth. The Binnenhof is beside the [Mauritshuis](#) art museum, site of Vermeer's Girl with the Pearl Earring.

4. Sonnenborgh Observatory ([Zocherpark](#), Utrecht).

Now a museum, astrophysicists at the Sonnenborgh Observatory created the first detailed photometric solar spectrum atlas, listing spectral lines from the ultraviolet to the infrared (333.2 nm to 887.1 nm), consisting of 120 meters of pages.

5. Strip S ([Veemstraat, Eindhoven](#)). In 2022, a combination vertical-axis wind turbine (VAWT) system with Venturi funnels was installed on the top floor of an apartment building in the former Philips Strijp-S industrial area of Eindhoven. The 4-turbine array along with almost 300 complimentary bifacial solar panels supply a minimum of 140 MWh/year to power the building's communal lighting and elevators, selling excess generated power back to the grid. A "vertical forest" also adorns the exterior of a nearby apartment building that promotes biodiversity as part of the area's regeneration.

6. Natural Gas Fields ([Groningen](#)). The largest natural gas store in Europe has provided up to 30% of European gas since extraction began there in 1963. The 60-year-old site annually generates billions of euros for the Dutch government, but subsoil faults and earthquakes have prompted remedial action since a compromised dike, canal, or lock could be catastrophic to the nearby low-lying regions.

7. Haliade-X Wind Turbine ([Port of Rotterdam](#)). In 2019, GE introduced its Haliade-X prototype wind turbine to the Port of Rotterdam, the world's most powerful at the time, generating 12 MW via a 220-m rotor. Each 107-m blade is longer than a football field! The port of Rotterdam has been fully automated since 2015 as thousands of cargo containers are automatically directed to their destinations by built-in identification transponders.

8. Hollandse Kust Zuid Wind Farm ([offshore, north of The Hague](#)). Higher construction and installation costs make offshore wind power uncompetitive without subsidies, although costs continue to fall with increased uptake and scaling. The first unsubsidized offshore wind farm has a capacity of 750 MW and is slated to provide 2% of Dutch electrical needs.

9. Largest Charge Storage Site ([Johan Cruijff Arena](#)). Refashioned Nissan Leaf lithium-ion batteries help power the Johan Cruijff Arena in Amsterdam (home of Ajax football club). Such "second-life" battery systems are ideal when a battery loses 20% of its rated capacity, transitioning from transport to stationary storage for industrial or off-grid use to recoup some of the original costs.

10. The Great Bubble Barrier ([Westerdok](#)). An innovative device that emits air bubbles through a perforated tube, fixed diagonally across a canal bed to redirect floating and submerged plastic into a bank-side container, stopping plastic waste from reaching the open seas. The 24/7 system lets fish, wildlife, and boats pass, but blocks waste from escaping. The bubbles also aid the aquatic environment by increasing oxygen levels in the canal water. Both [The Great Bubble Barrier](#) and [The Ocean Cleanup](#) were developed in the Netherlands to counter increasing plastic waste.

Other interesting science education sites: A [Hofwijk](#) (Christaan Huygens's summer home and observatory, Voorburg), B [Escher in the Palace](#) (The Hague), C [The Rijksmuseum](#) (numerous windmill paintings, Amsterdam), D [NEMO Science Museum](#) (Amsterdam), E [Boerhaave Museum](#) (Leiden), F [Cruquius Museum](#) (between Haarlem and Hoofddorp), G [The Philips Museum](#) (Eindhoven)



The Truth About Energy: Our fossil-fuel addiction and the transition to renewables

[Cambridge University Press John K. White](#)

E21↑NS

Many trade books on energy are light on technical details, while textbooks are full of equations, theory, and problem sets. *The Truth About Energy* aims to bridge the gap, giving the reader a comprehensive scientific grounding in energy technology without the complex mathematical or theoretical detail. Everyday power generation is explained with historical examples, taking the reader through each of the watershed energy technologies since the start of the Industrial Revolution — wood, coal, oil, natural gas, hydro, and nuclear — as well as modern renewables such as biomass, photovoltaics, concentrated solar power, wind, wave, and geothermal.

CONTENTS

1. Wood to Coal: A Short History of the Industrial Revolution

Harnessing steam for lifting and locomotion, the energy pioneers (Newcomen, Watt, Trevithick, Stephenson, Rumford, Joule, Carnot), fuel to burn (wood, peat, biomass, coal), the first global industrial economy, the heat engine and power

2. Oil and Gas: Twentieth Century Prosperity

Colonel Drake and Titusville, John D. Rockefeller and Standard Oil, the internal combustion engine and the auto industry, the quest for more, the Saudi connection, hydrocarbons and the dark sides to oil, the global oil economy, modern extraction (offshore, fracking, oil sands, M. King Hubbert and Peak Oil

3. The Nuclear World: Atoms for Peace

Fission reactions and the bomb, atoms for peace, half-lives and waste management, nuclear dangers (Mayak, Windscale, Three Mile Island, Chernobyl, Fukushima), can nuclear coexist with green industry to reduce carbon emissions?, fusion and the future

4. Old to New: The Sun and all its glory

Solar basics, a short history of solar power, it's a silicon world, the photovoltaic solar cell (silicon wafers, thin-film, third-gen), utility-scale solar power (PV and CSP), Germany's revolutionary renewables economy and beyond

5. The Old becomes New Again: More Sustainable Energy

Wind (onshore/offshore), geothermal (the hot earth rises), hydro (dams, tidal, wave), the grid (old to new), virtual power plants, batteries (Zn-Mn, PbA, NiMH, Li-ion, .)

6. Driving the Revolution Revolution: From Volta to Tesla and back

Electric cars, the revolution revolution, autonomous driving, energy storage (more than just batteries), a whole new way of thinking, an even smarter grid (V2G)

7. Rethink, Rebuild, Rewire

Energy efficiency and conservation in the home (kilowatt hours and costs), taking it to the street, local green solutions (the traditional three Rs and other energy-saving tips), calculating our carbon footprint to promote simple sustainability (less is more), rooftop solar and off-grid setup, get involved

SOME QUESTIONS ANSWERED

What type of radiation is heat? • Why was James Watt's steam engine unique? • Is all coal the same? • Where was the first commercial electric-generating station and who built it? • How is petroleum separated into components and what is the difference between petrol/gasoline and diesel? • How rich were John D. Rockefeller, Henry Ford, and J. Paul Getty? • What is the difference between conventional and unconventional oil? • How much oil is in controlled by OPEC and what is "peak" oil? • What is the difference between natural, enriched, weapons-grade, and depleted uranium? • Should be worried about Chernobyl and Fukushima? • Where does all the nuclear waste go? • Why does the temperature in a tokamak need to be 10 times that of the sun's core? • Who made the first functional solar cell? • What is the difference between a solar cell and a light-emitting diode (LED)? • What is the difference between a PV and a CSP solar installation? • Where is the world's largest solar farm? • Where are the world's largest onshore and offshore wind farms? • When and where was the first geothermal power plant? • Is hydroelectric power green? • Why did Nikola Tesla originally use AC current? • Which company was the first to use computer batteries for cars? • What is VPP and V2G? • Can we power a house from a car? • Why is lithium salt ("white petroleum") in such demand? • Will cutting down on plastic reduce petroleum use? • Can we make a difference to global warming from more conservation in the home?