

Wholesale electricity markets in Europe

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The development of the European Market

- National monopolies prior 1990s followed by several waves of liberalisation packets
- First Energy Packet in 1996
 - market liberalisation
 - unbundling of accounts
 - third party access
 - regulated network tariffs
- Second Energy Packet in 2003
 - expansion of the first packet and improvements in the internal functionality of the energy market
 - legal unbundling
 - increased consumer choice
 - enhanced regulatory powers
- Third Energy Packet in 2009
 - goal: create a fully operational and competitive internal energy market
 - ownership unbundling
 - establishment of the Agency for the Cooperation of Energy Regulators (ACER)
 - consumer rights strengthening

History of the Czech Market

- 20th century- need for electrification due to labor shortage -> number of small power plants throughout the country
- high rise in access to electricity, de-escalation due to WWII
- 1970s - large coal-power plants and high-voltage transmission lines
- planned economy -> cheap electricity vs. high production costs
 - imbalance -> inefficiency and wasteful consumption
- 1980s nuclear power plants

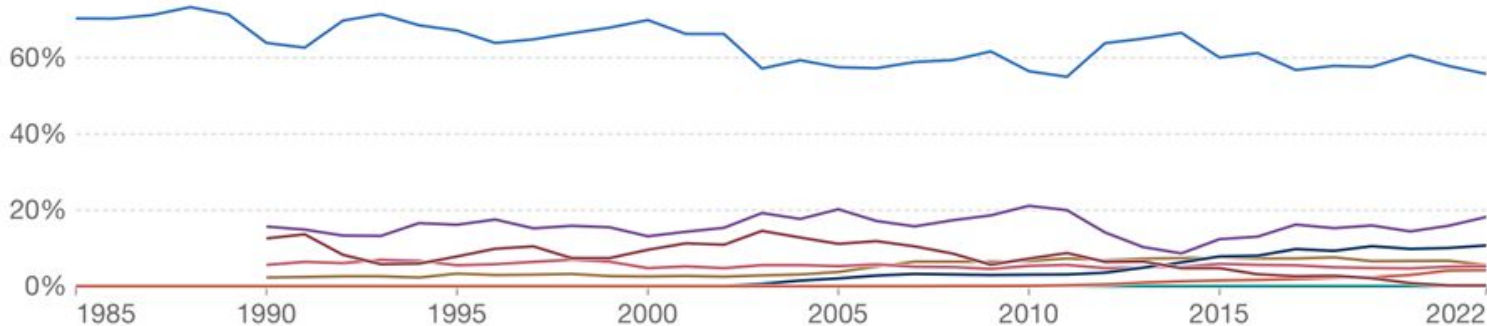
History of the Austrian Market

- access to electricity
 - monarchy: 1900s
 - common folk: 1920s
- 1947 - Österreichische Elektrizitätswirtschafts-AG, today VERBUND
- introduction of hydro power plants
- efforts for nuclear power in the 1970s -> Zwentendorf Referendum of 1978 -> Austria to this day free from nuclear energy or weapons
- further expansion of hydro power - to this day main source of electricity
- late 1990s liberalisation process
- renewable power: wind, sun, biomass

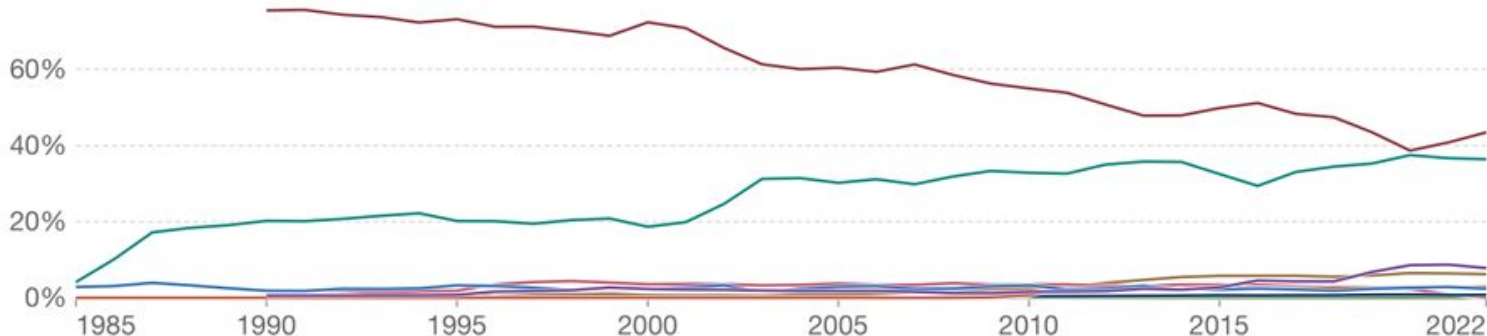
Share of electricity production by source

■ Coal
 ■ Gas
 ■ Hydropower
 ■ Solar
 ■ Wind
 ■ Oil
 ■ Nuclear
 ■ Other renewables
 ■ Bioenergy

Austria

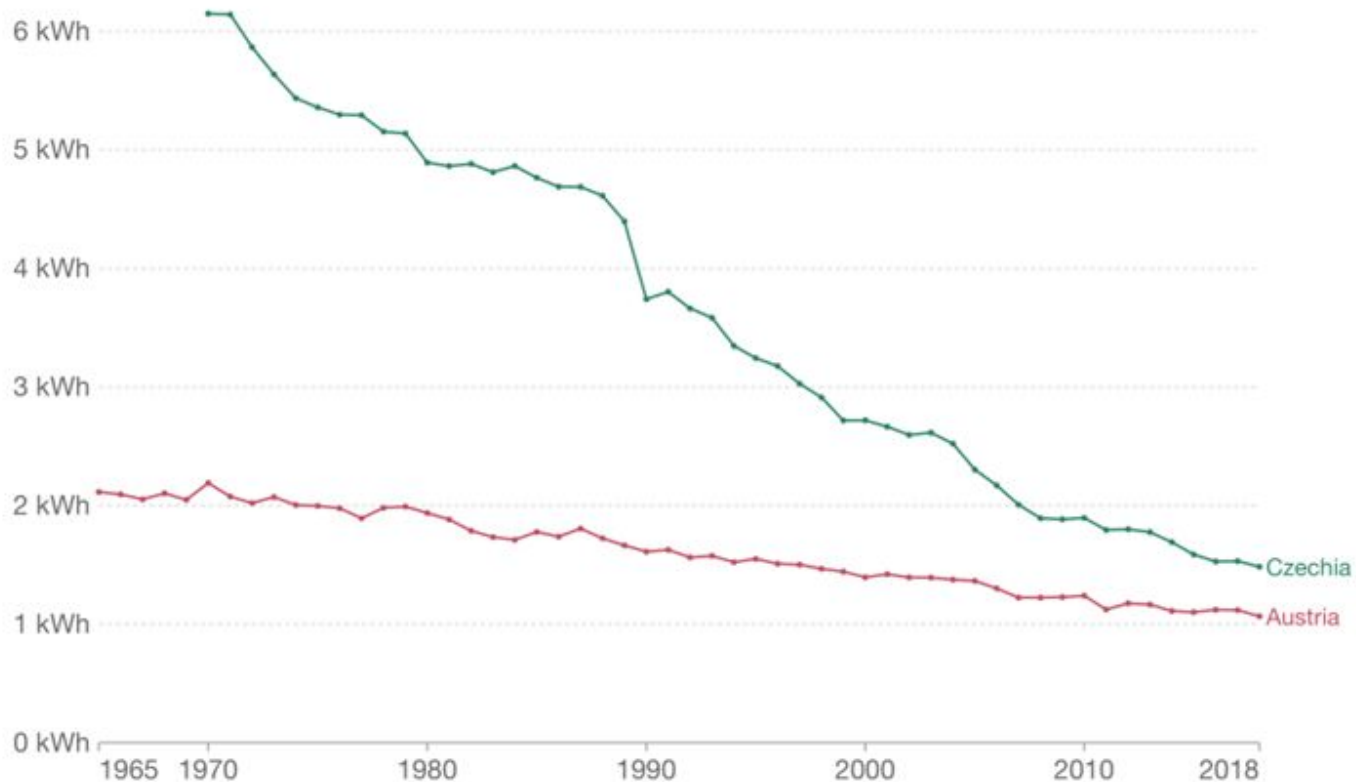


Czechia



Energy intensity

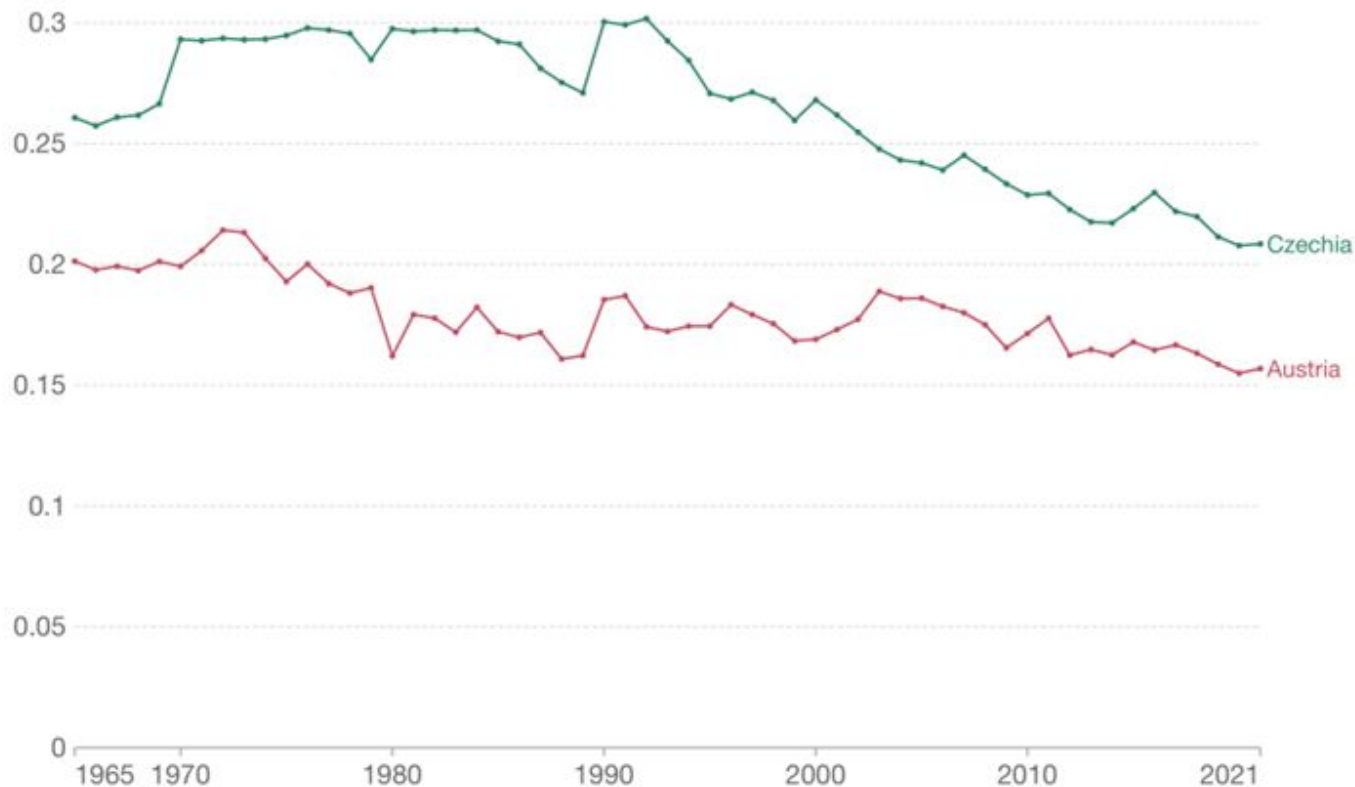
Energy intensity is measured as primary energy consumption per unit of gross domestic product. This is measured in kilowatt-hours per 2011\$ (PPP).



Carbon intensity of energy production

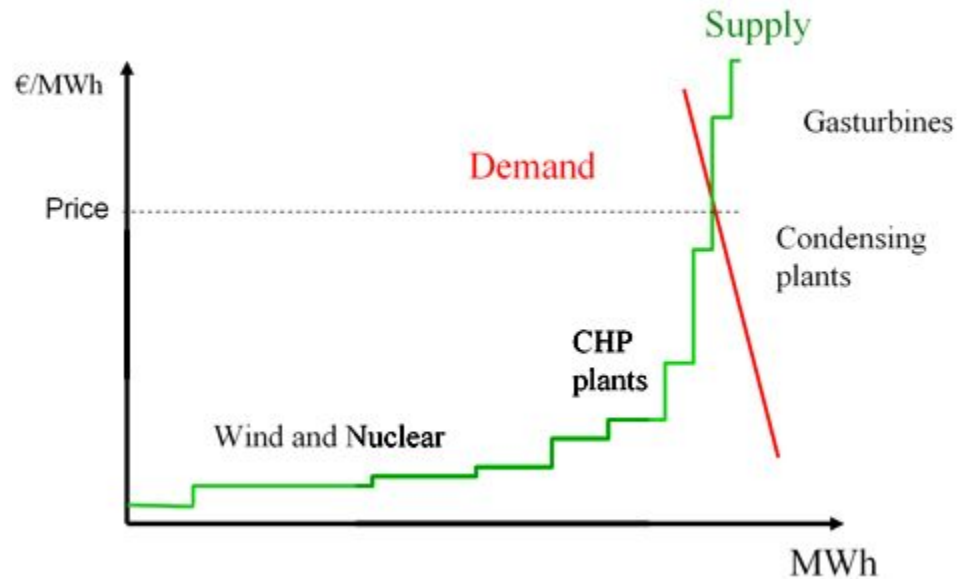


This measures the amount of carbon dioxide emitted per unit of energy production. This is measured in kilograms of CO₂ per kilowatt-hour.



The Market Framework in Europe

- complex network of interlinked exchanges
- energy consumers, providers and grid operators in the EU brought together
- usually based on “pay as cleared approach”
 - auction sets price and volume traded based on the point where demand curve meets supply curve
- exchanges: EPEX SPOT in Western Europe, Nord Pool in Northern Europe, GME in Italy and PXE in Czech Republic



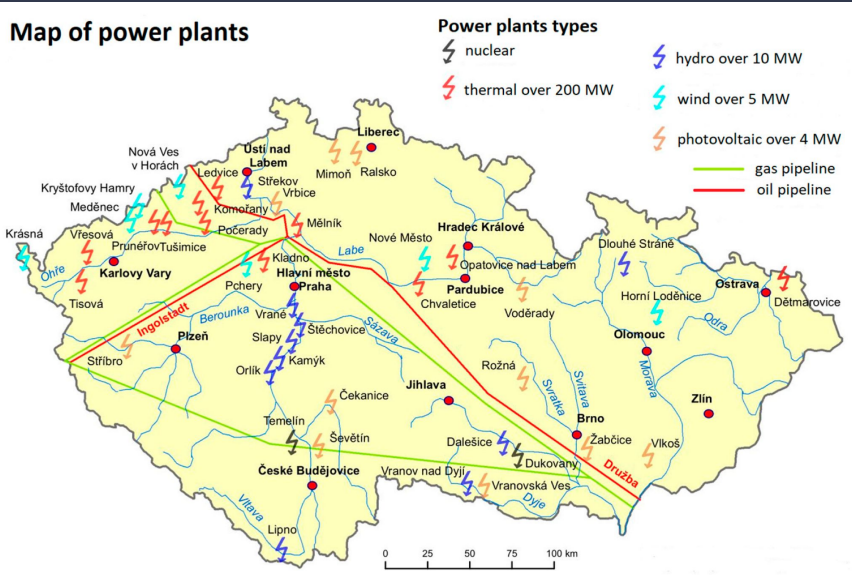
<https://www.wind-energy-the-facts.org/images/5-8.jpg>

Market Types

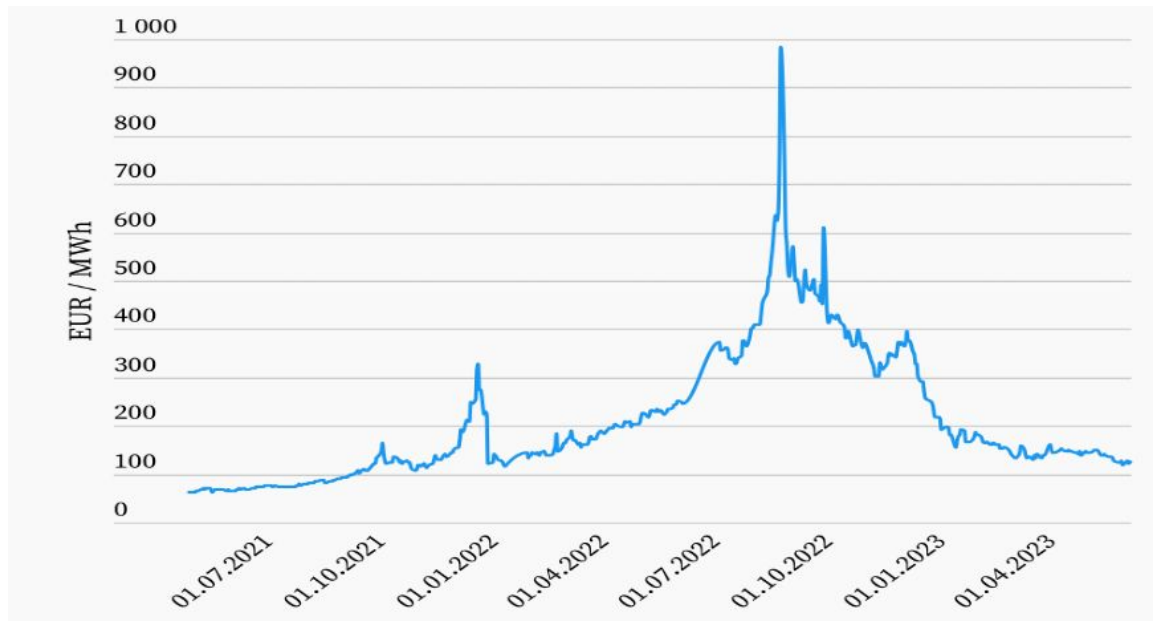
- **day-ahead**
 - electricity traded one day ahead of actual delivery
- **intraday**
 - adjusting positions closer to the time of delivery
 - continuous trades
- **forward and future markets**
 - locked prices for the future far ahead
 - tool against uncertainty
- **balancing market**
 - operates close to real-time
 - Transmission System Operator
- **capacity market**
 - meeting the demand during peak hours

Czech Electricity Market

- beginning of the competitive market with the Energy Act 2000
- Energy Regulatory Office
- 2002 admission to the Organization for Economic Co-Operation and Development (OECD)
- 2004 joining the EU
- 2007 - Power Exchange Central Europe (PXE)
- fully integrated Multi-Regional Coupling
- day-ahead most liquid
- strong connections to the other V4 countries
- member of SIDC and SDAC



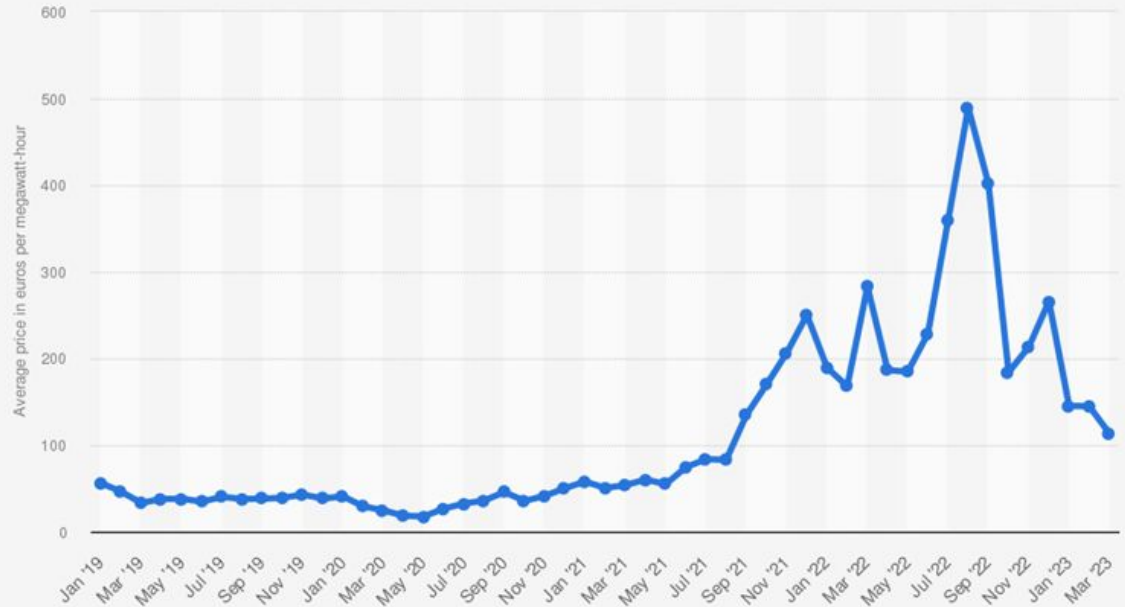
Czech Electricity Market



Austrian Electricity Market

- liberalized before the EU deadline
- hydropower dominant since the beginning
- electricity price highly dynamic over the past few years

Average monthly electricity wholesale price in Austria from January 2019 to March 2023 (in euros per megawatt-hour)

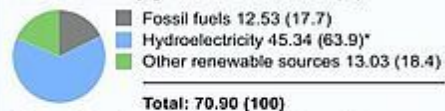


Source
Ember
© Statista 2023

Additional Information:
Austria; January 2019 to March 2023; day-ahead prices

Austria • Electricity

Gross electricity generation 2020, TWh (%):



Source: Based on the U.S. Energy Information Administration data (Dec 2021).

* including pumped storage

Gas power plants over 100 MW, MW:

- 1 Mellach, 832
- 2 Donaustadt I-II-III, 529
- 3 Timelkam, 408
- 4 Linz Mitte, 217
- 5 Linz-Süd, 172
- 6 Leopoldau, 140

Coal power plants over 100 MW, MW:

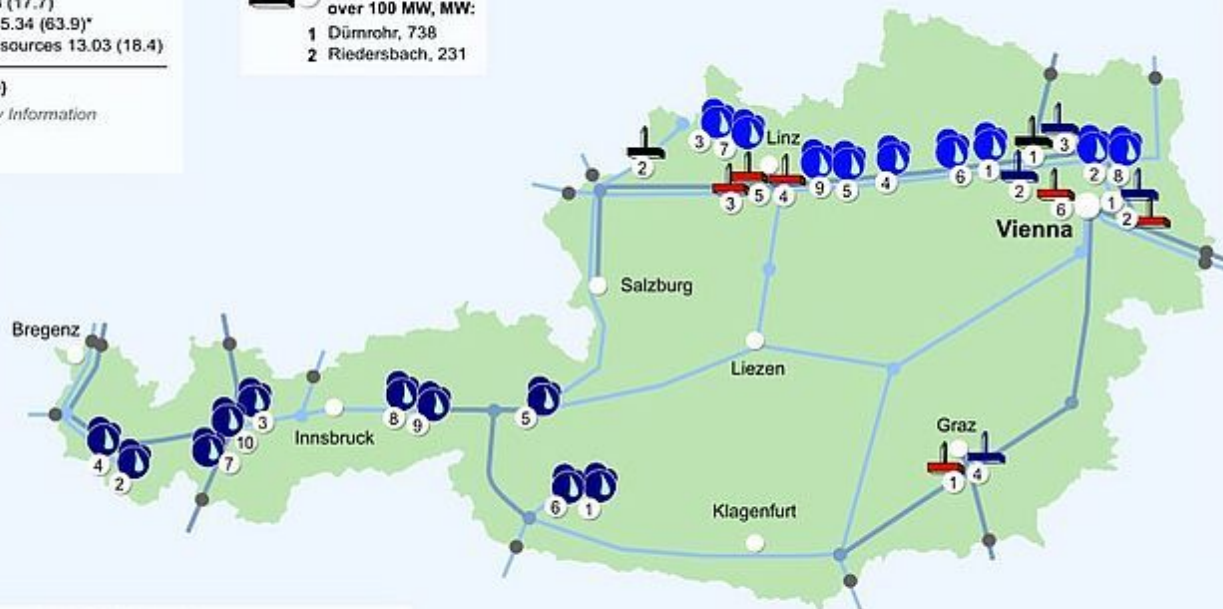
- 1 Dürnrohr, 738
- 2 Riedersbach, 231

Hydro power plants over 150 MW, MW:

- 1 Altenwörth, 328
- 2 Greifenstein, 293
- 3 Aschach, 287
- 4 Ybbs-Persenbeug, 236
- 5 Wallsee-Mitterkirchen, 210
- 6 Melk, 187
- 7 Ottensheim-Wilhering, 179
- 8 Vienna-Freudenau, 172
- 9 Abwinden-Asten, 168

Pumped-storage plants over 250 MW, MW:

- 1 Malta Hauptstufe, 730
- 2 Kops I-II, 772
- 3 Silz, 500
- 4 Rodund I-II, 493
- 5 Limberg II, 480
- 6 Reißbeck (Reisseck) II, 430
- 7 Prutz (Kauental), 390
- 8 Häusling, 360
- 9 Mayrhofen, 345
- 10 Kühtai, 289



- 380 kV line in service
- 220 kV line in service
- National grid 380 kV of other power plants, grid connection points, substations
- National grid 220 kV of other power plants, grid connection points, substations
- Border crossing

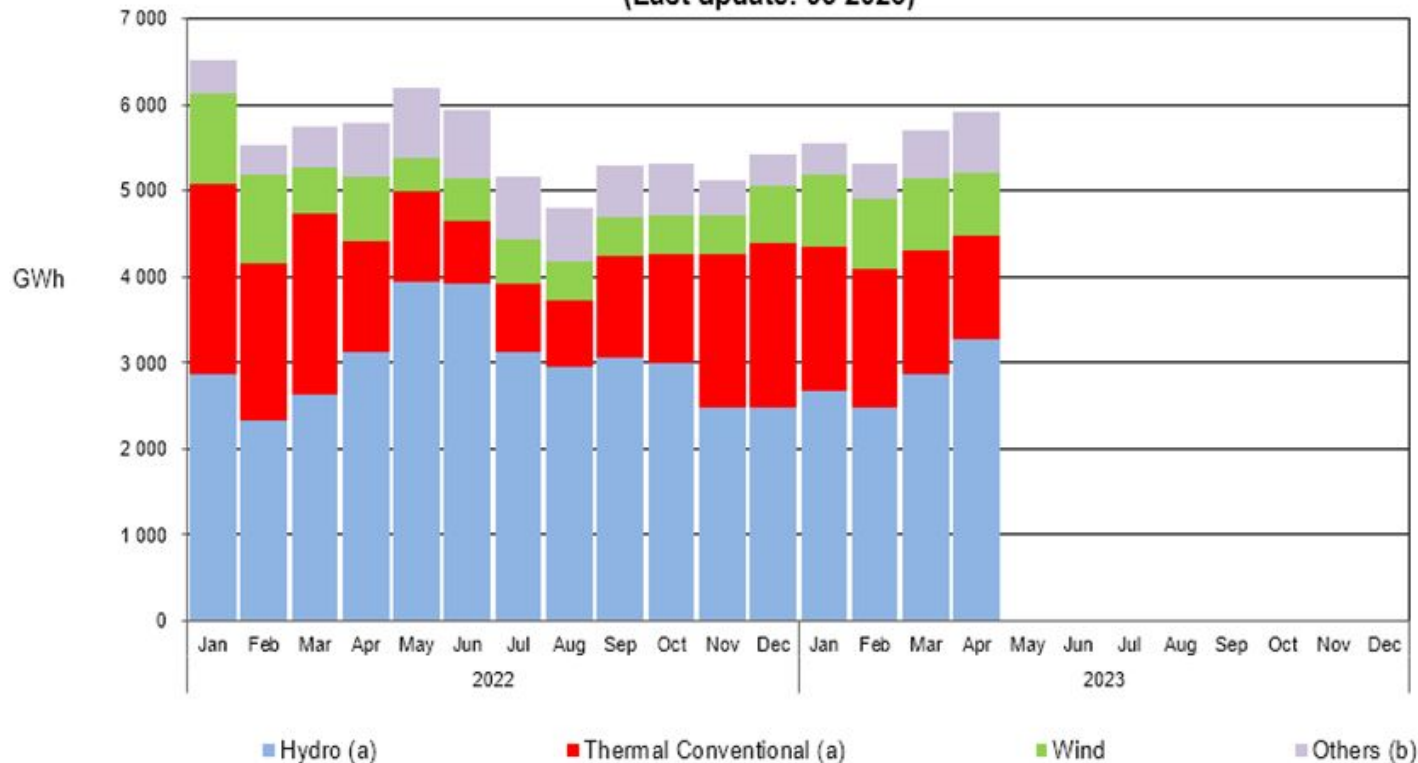
Combined power plants over 100 MW, MW:

- 1 Simmering, 1245
- 2 Theiß (Theiss), 765
- 3 Korneuburg, 455
- 4 Neudorf-Werndorf, 164

In 2019 Austria had 25.9 GW of electricity installed generating capacity. Gross theoretical hydropower capability, related to Austria, is 150 TWh/year. As of December 2016, Austria registered about 3262 small-scale hydropower plants up to 10 MW with a total installed capacity of 1523 MW, generating roughly 6853.8 GWh per year.

Sources: EU Commission Energy Statistics of the EU-27 Countries (2019); World Small Hydropower Development Report 2019; Used by permission of the World Energy Council (2013).

Operational statistics
Total Electricity Supply in Austria
Gross Production
(Last update: 05 2023)



(a) For monthly statistics plants from producers that have a minimum capacity of at least 10 MWe or are connected to the high-voltage grid. All plants for these producers are included.

(b) Monthly production of not gathered plants. Allocation of these volumes related to a specific type of power plant and/or primary energy source is annual.

Source: E-Control

Sources:

- front picture:
<https://www.moneyworks4me.com/investmentshastra/indian-power-sector-analysis-industry-overview-and-research-2011/>, accessed 8.6.2023
- <https://www.habsburger.net/en/chapter/let-there-be-light-gas-and-electricity-light-vienna>, accessed 10.6.2023
- <https://www.verbund.com/en-at/about-verbund/company/company-history>, accessed 10.6.2023