The changing energy mix- the role of nuclear power

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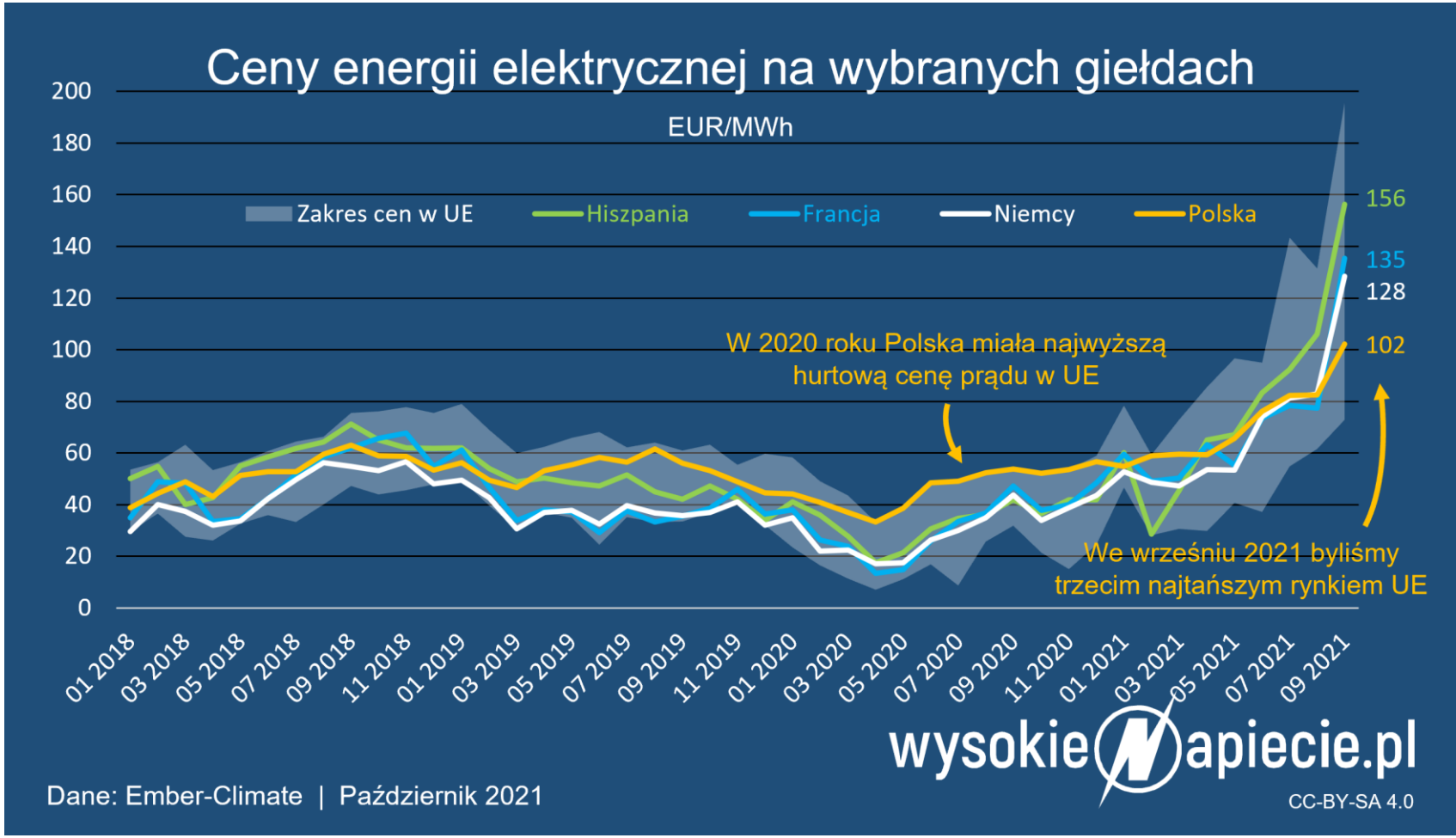
https://www.iaea.org

Why we are talking now about the nuclear power?

- In Europe electricity prices on open market in 2021 increased 2-3 times
- European Commission discuses Green Deal and Taxonomy
- On the Climate Summit in Glasgow (Nov. 2021) M. Morawiecki announced that Poland will stop coal in 40 years
- In 2022 decision on investor and technology in Program of Polish Nuclear Power
- Small Modular Reactors for Polish industry



Outline of the presentation

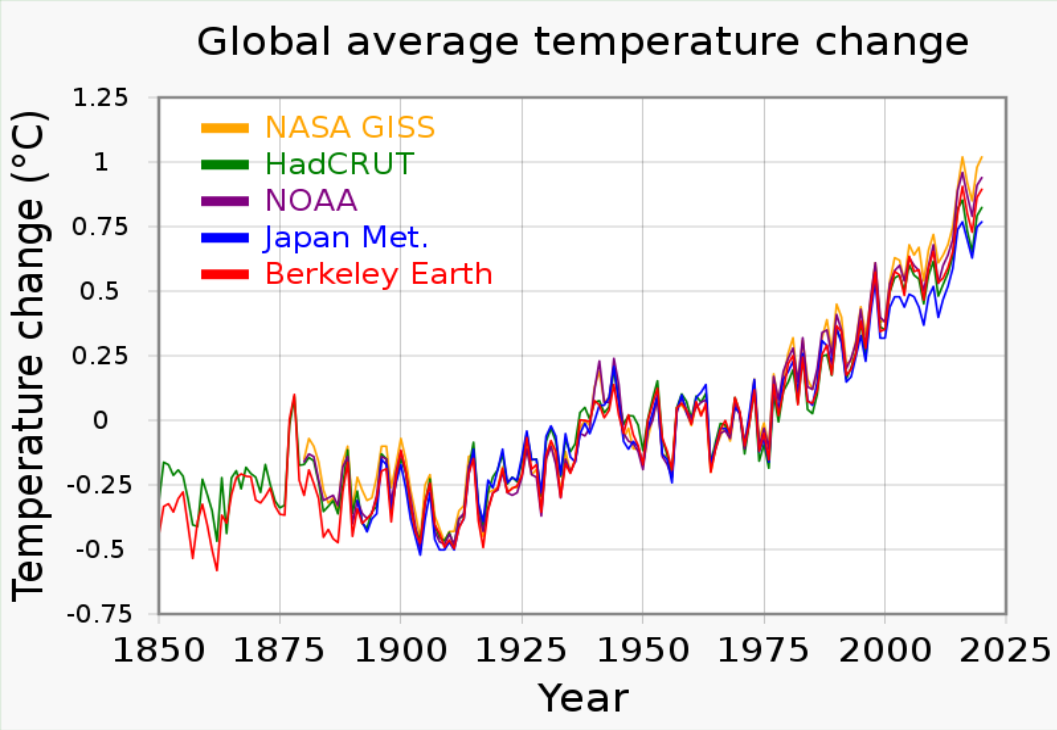
1. European climate policy- Green Deal and Taxonomy

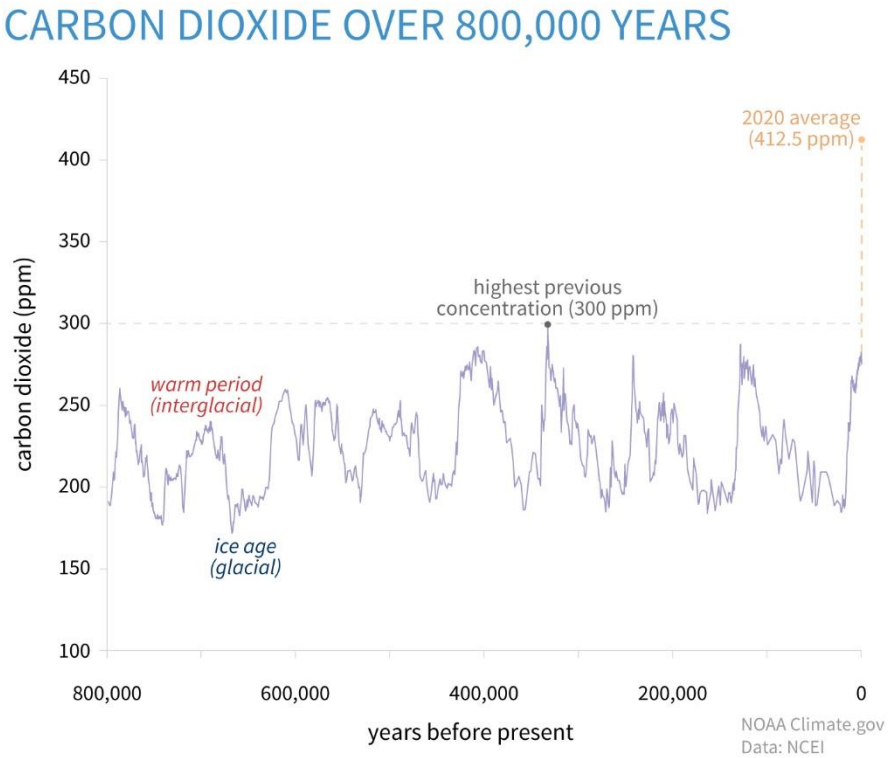
2. Changing Energy Mix
   a) Situation in Europe
   b) Program of Polish Nuclear Energy (PPEJ).
   c) Reactors for PPEJ and Small Modular Reactors (SMR)
   d) Perspectives

3. The role of IFJ PAN in the PPEJ
   a) Our competences
   b) Authorization at the Polish Atomic Agency

Radiation monitoring station at IFJ PAN

Markers of climate change





- Increase of average temperature
- Droughts
- Retreat of glaciers
- Increase of sea level

European climate policy- Green Deal and Taxonomy

EUROPEAN COMMISSION

Brussels, 11.12.2019

COM(2019) 640 final

COMMUNICATION FROM THE COMMISSION

The European Green Deal

1. INTRODUCTION – TURNING AN URGENT CHALLENGE INTO A UNIQUE OPPORTUNITY

This Communication sets out a European Green Deal for the European Union (EU) and its citizens. It resets the Commission's commitment to tackling climate and environmental-related challenges that is this generation's defining task. The atmosphere is warming and the climate is changing with each passing year. One million of the eight million species on the planet are at risk of being lost. Forests and oceans are being polluted and destroyed [1] .

European Green Deal

General aim: making the European Union (EU) **climate neutral in 2050**

EU has also raised its 2030 climate ambition, committing to cutting emissions by at least 55% by 2030 – **”FIT for 55”**

Dedicate to R&I related to the issue €10 billion

EU taxonomy for sustainable activities

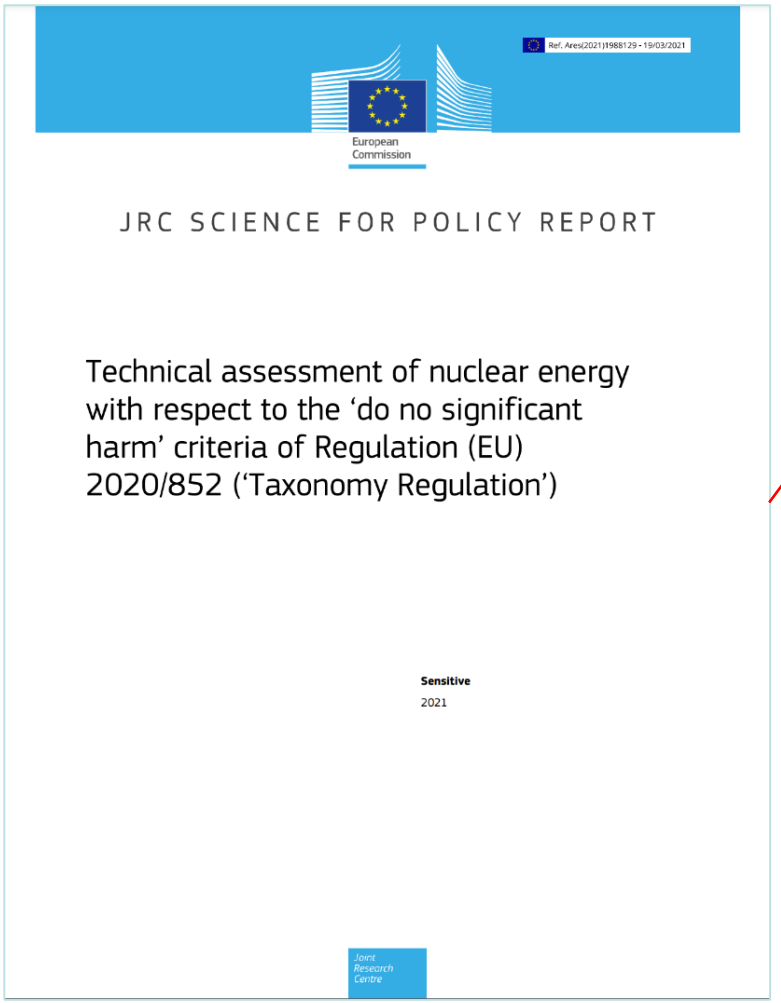
9 March 2020 published Final Report of the Technical Expert Group (TEG) on Sustainable Finance

The Taxonomy sets performance thresholds (referred to as 'technical screening criteria') for economic activities which:
- make a substantive contribution to one of six environmental objectives;
- do no significant harm (DNSH)
- meet minimum safeguards

The performance thresholds will help companies, project promoters and issuers access green financing

TEG could not "(…) conclude that the nuclear energy value chain does not cause significant harm (…)"

Joint Research Centre report - nuclear energy „does no significant harm" (08.20- 03.21)



"… no science-based evidence that nuclear energy does more harm to human health or to the environment than other electricity production technologies ….."

EC requested for an opinion under Article 31 Group of Expert of the EURATOM Treaty

- consequences of long-term nuclear waste management
- the level of scientific consensus
- existing gaps in scientific knowledge
- ……

19. 03.2021 Leaders of Czech, France, Hungary, Poland, Rumania, Slovakia and Slovenia –
sent letter to EC to "…assure equal rules for nuclear power"

Opinion of Group of Experts of Art.31 EURATOM (03-06.2021)

Opinion of the

Group of Experts referred to in Article 31 of the Euratom Treaty

on the Joint Research Centre's Report

Technical assessment of nuclear energy with respect to the 'do no significant harm' criteria of Regulation (EU) 2020/852 ('Taxonomy Regulation')

(Adopted by the Group of Experts referred to in Article 31 of the Euratom Treaty at the meeting on 28 June 2021 by vote, with 28 votes in favour[1], one against, and three abstentions).

The European Commission has requested an Opinion under Article 31 of the Euratom Treaty on "A technical assessment by JRC on nuclear energy under the 'do no significant harm' criterion of the Taxonomy Regulation". The request is presented in Annex 1 of this Opinion.

The European Commission distributed the report "Technical assessment of nuclear energy with respect to the 'do no significant harm' criteria of Regulation (EU) 2020/852 ('Taxonomy Regulation'), hereinafter "The JRC Report", to the Article 31 Group of Experts on 26.3.2021.

The Article 31 Group of Experts reviewed the JRC report in accordance with the European Commission's request. The review was conducted with respect to the Group's overall mandate and competence, namely the protection of workers, members of the public and the environment against the dangers arising from exposure to ionising radiation.

The below text is structured in the following manner. It starts with the summary of the Opinion of the Article 31 Group of Experts (in the form of a list of points). This is followed by explanations of the observations leading to each point of the Opinion, presenting first the observations based on a set of key points (1-5) included in the European Commission's request, and then followed by other observations made by the Article 31 Group of Experts.

The summary of the Opinion of the Article 31 Group of Experts is as follows:

- The European legal framework provides an adequate system of protection of workers, members of the public and of the environment, as well as, for the management of any risks in a manner that the residual risk remains acceptable.
- The provisions of the Euratom legislation regarding the protection of humans against harmful effects of ionising radiation are in line with relevant international recommendations and standards such as those of the International Commission on Radiological Protection (ICRP) and the International Atomic Energy Agency (IAEA). Compliance with the provisions of the Euratom legislation, which also require appropriate regulatory control to ensure the implementation of the requirements, provides sufficient confidence that the impact of the back end of the nuclear fuel cycle to humans remains acceptable.
- The Article 31 Group of Experts agrees with the JRC report conclusion that deep geological repositories (DGR) are considered, at the state of today's knowledge, appropriate and safe

[1] 26 members were present and 2 excused members sent their agreement with the Opinion in writing

1) The European legal framework provides an adequate system of protection (…)

2) Deep geological repositories (DGR) are considered appropriate and safe

3) Means of envir…t to ensure that other…

4) Current system…ve

5) Further researc… indication of some…

6) Technical Screening Criteria (TSC) (…) proposed are (…) adequate for protection

Opinion approved in voting:

27 in favor
3 abstention
1 against

One opposing opinion

Last months – the discussion is going on ….

Svenja Schulze, environment and nuclear safety minister - opposition to nuclear power's inclusion in the EU's green finance taxonomy **(**supported by Denmark, Austria, Portugal, Luxemburg)

26.10.2021 EU prime ministers met in Luxembourg to discuss the energy crisis
Bulgaria, Croatia, Czechia, Finland, France, Hungary, Poland, Romania, Slovakia, and Slovenia + Netherlands and Sweden, supported inclusion nuclear into taxonomy

Anna Moskwa, Ministry of Climate and Environment in Poland

..We will concentrate now our activities on legislation connected with hydrogen, atom and Fit For 55 ..

Changing the energy mix

Energy sources and their evaluation criteria

sources

1. Petroleum Crude Oil
2. Natural gas
3. Coal
4. Nuclear
5. Hydroelectric
6. Wind energy
7. Solar
8. Ethanol
9. Biomass
10. Geothermal
11. Hydrogen

evaluation criteria

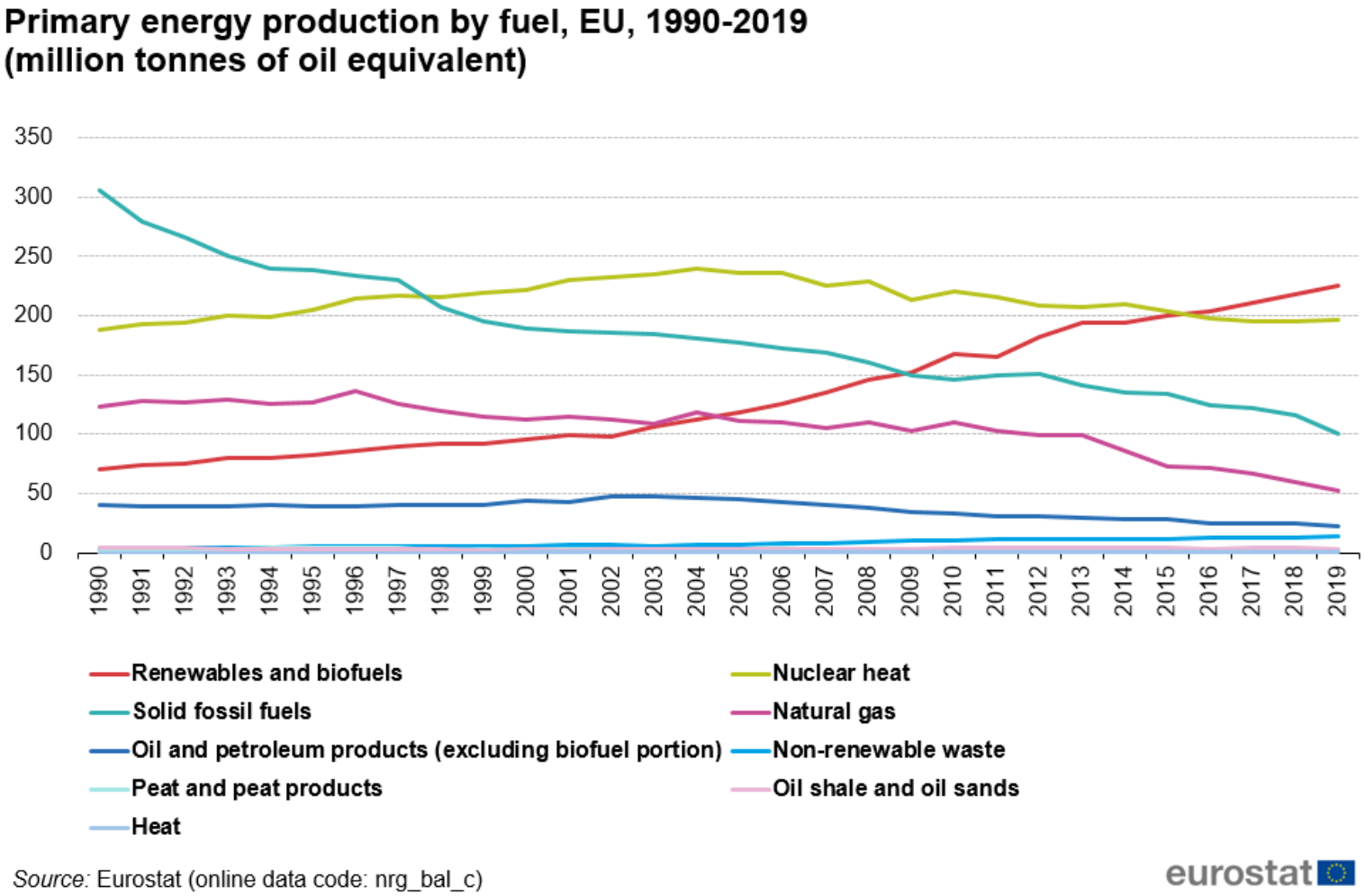
1. Proven reserves
2. Capital cost
3. Operating cost
4. Cost of energy
5. Capacity factor
6. Efficiency
7. Energy balance
8. Maturity
9. Infrastructure
10. Footprint and energy density
11. Environmental issues
12. CO_2 production

Proven reserves of energy sources

- Coal	~135 years
- Uranium	~100 years
- Oil	~50 years
- Gas	~50 years

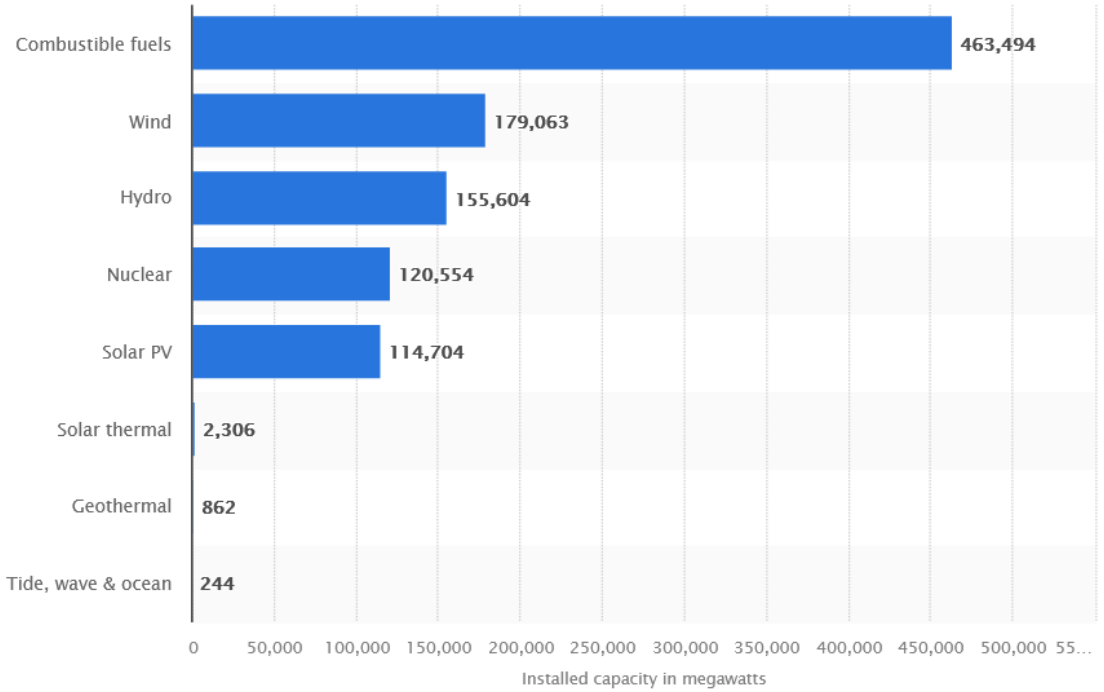
P. F. Meier The Changing Energy Mix , Oxford Univ. Press 2020

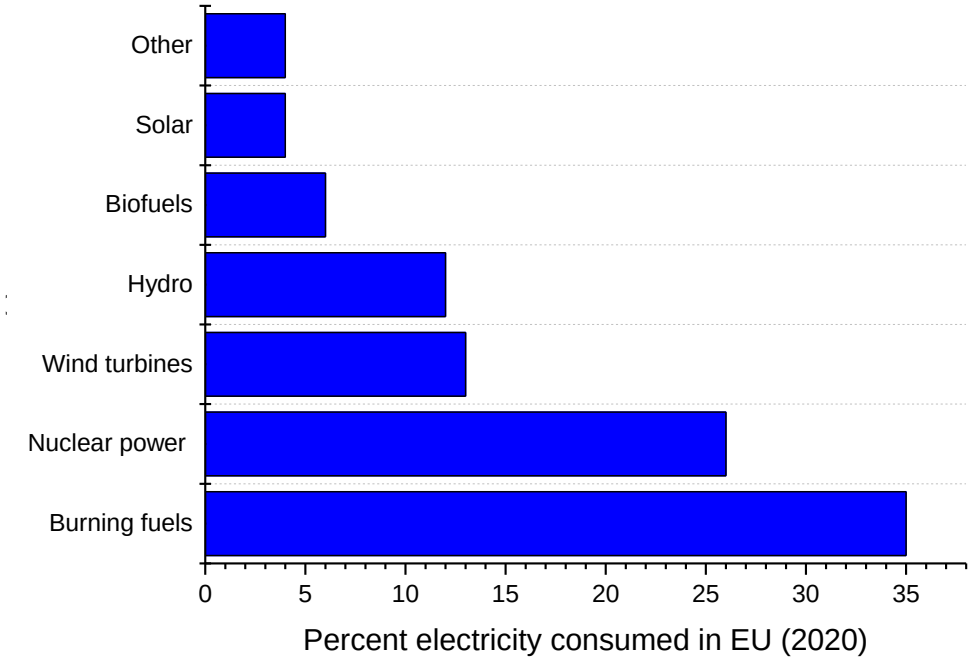
Primary energy production in EU until 2019



In 2019 nuclear energy was the major source of energy production in EU

Cumulative electricity capacity installed by generation type in the European Union (EU-28) as of 2018 (in MW)

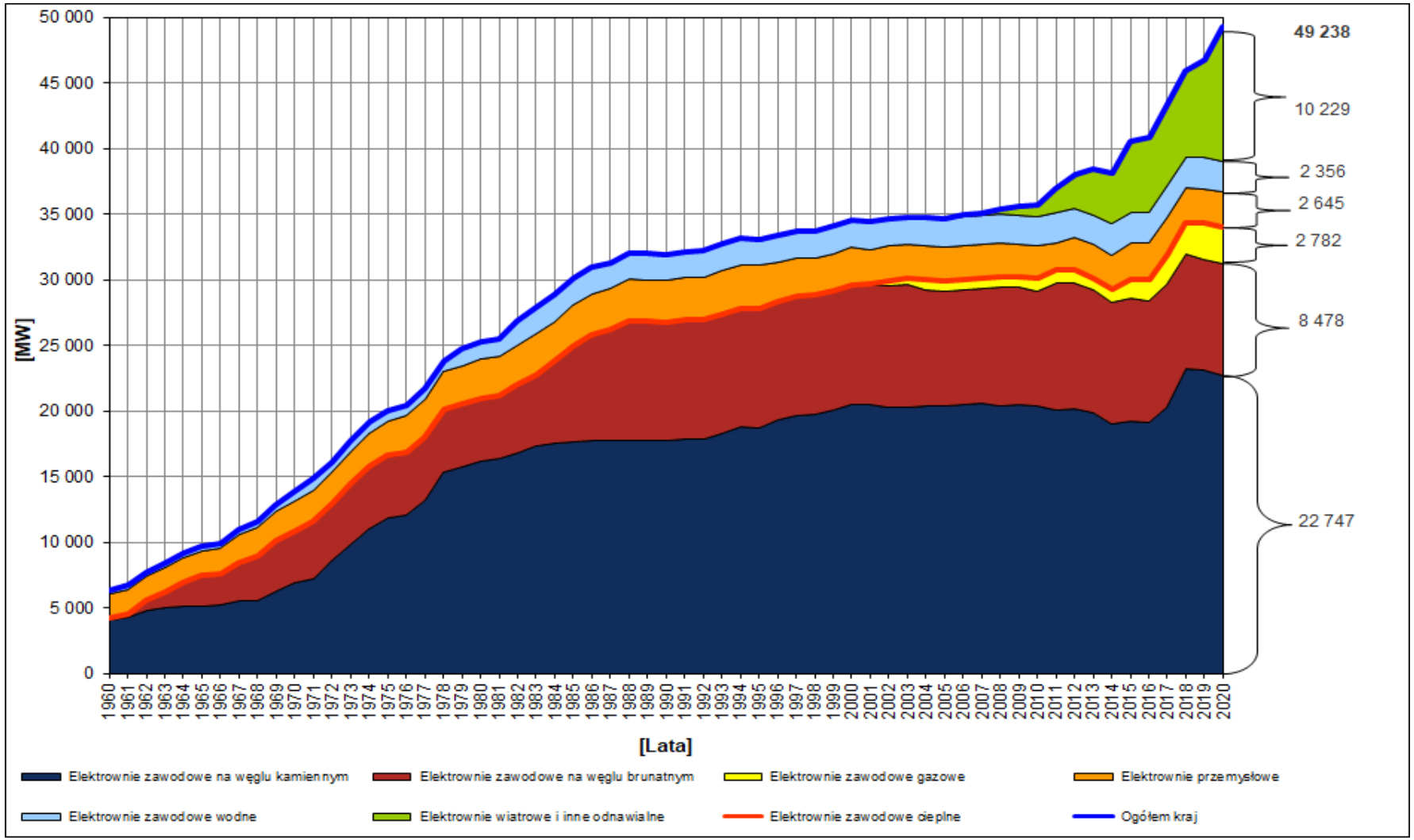




In 2018 nuclear power was 11.6% of total installed electric power in EU

.. but nuclear power produced 26 % of total electric energy

Electricity power [MW] installed in Poland (1960-2020)



renewable

water

gas

lignite

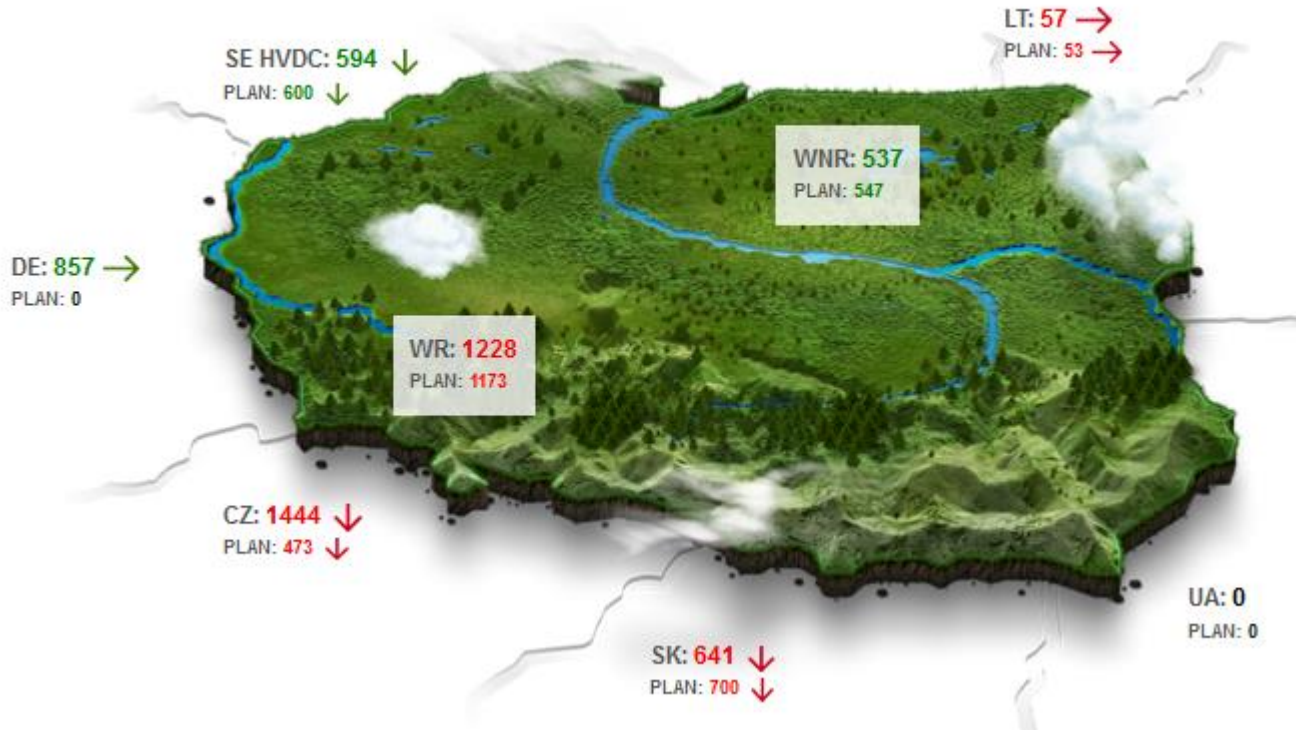
coal

Polish power system map (2021-12-03 21:15)

POLISH POWER SYSTEM MAP

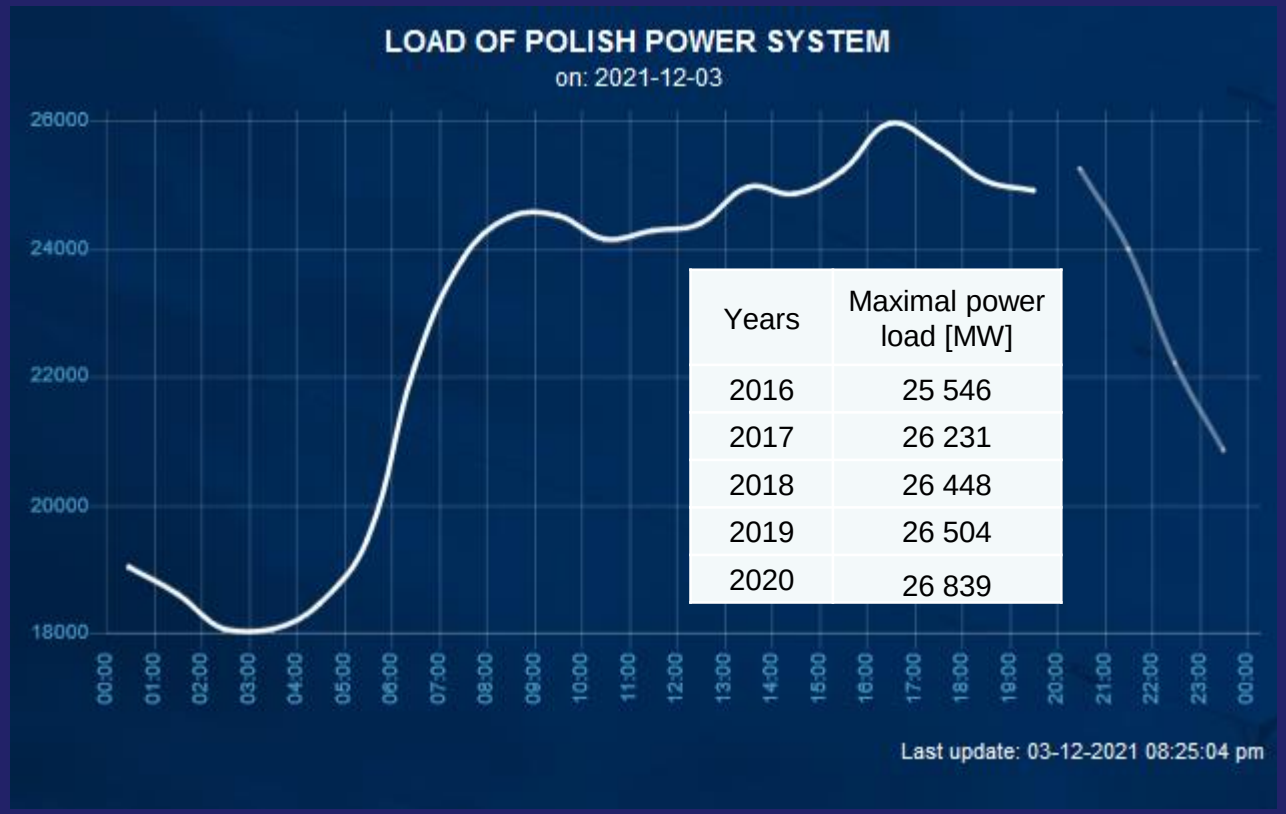
The map presents planned and actual flow on commercial profiles

LOAD [MW]	23 570
GENERATION [MW]	24 289
thermal power plants	19 198
water power plants	593
wind power plants	4 498
solar power plants	1
other renewables	0
ACTUAL TOTAL CROSS-BORDER EXCHANGE [MW]	632 EXPORT
FREQUENCY [Hz]	49,975

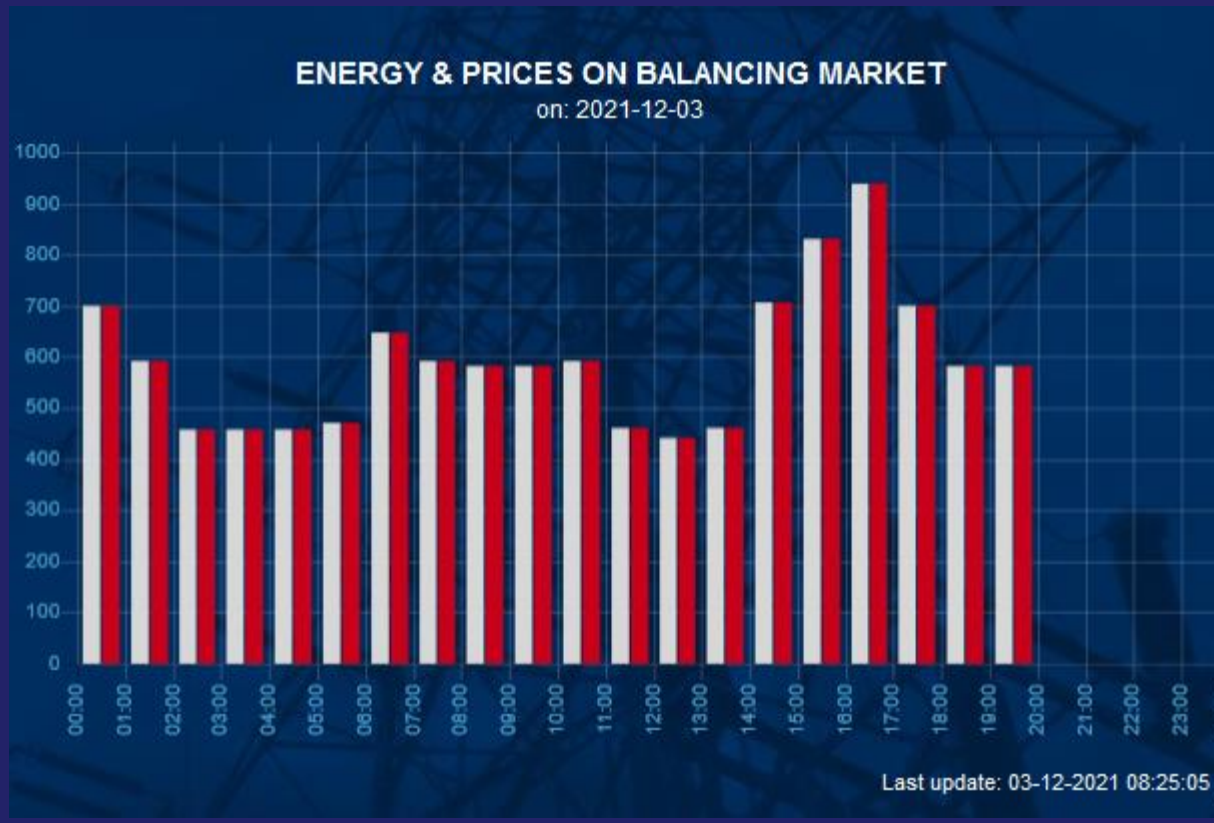


https://www.pse.pl

Polish energy market on 2021-12-03



Years	Maximal power load [MW]
2016	25 546
2017	26 231
2018	26 448
2019	26 504
2020	26 839



The minimal power needed in the night 18 GW

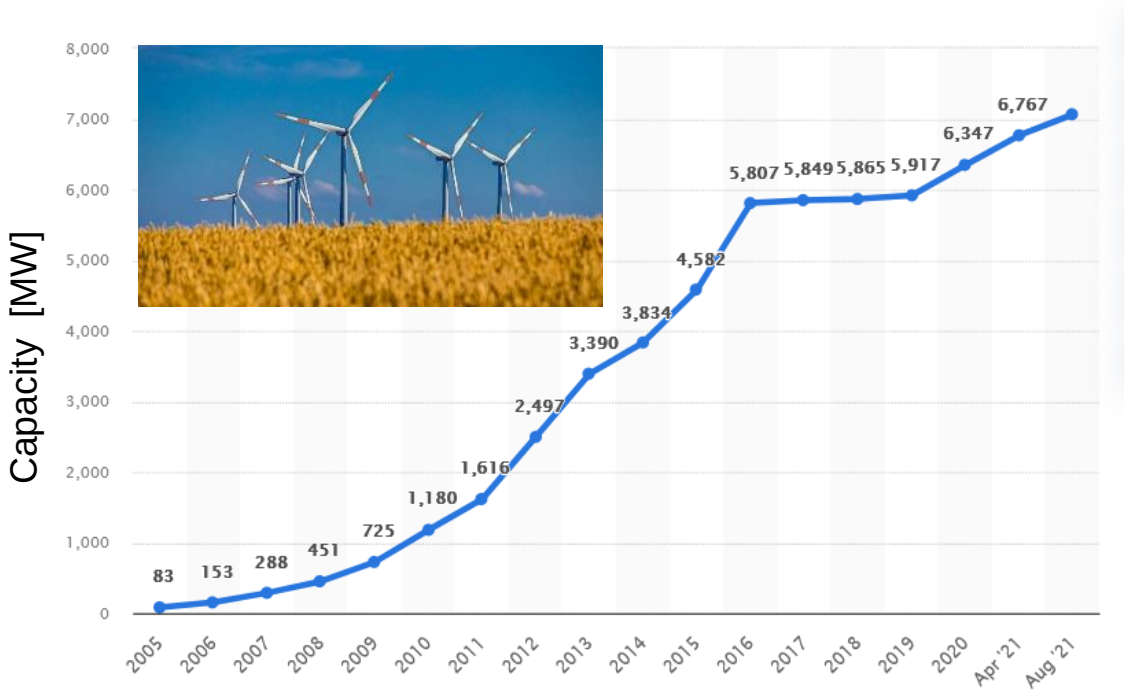
By growing actual consumption prices grow

Wind power capacity in Poland

The onshore

- the „ 10 H” legislation May 2016
- H is the height of windmill + length of the blade
- 10 H < distance to houses, forests

- It stopped installation of the new onshore farms
- now discussion in Sejm is to modify it

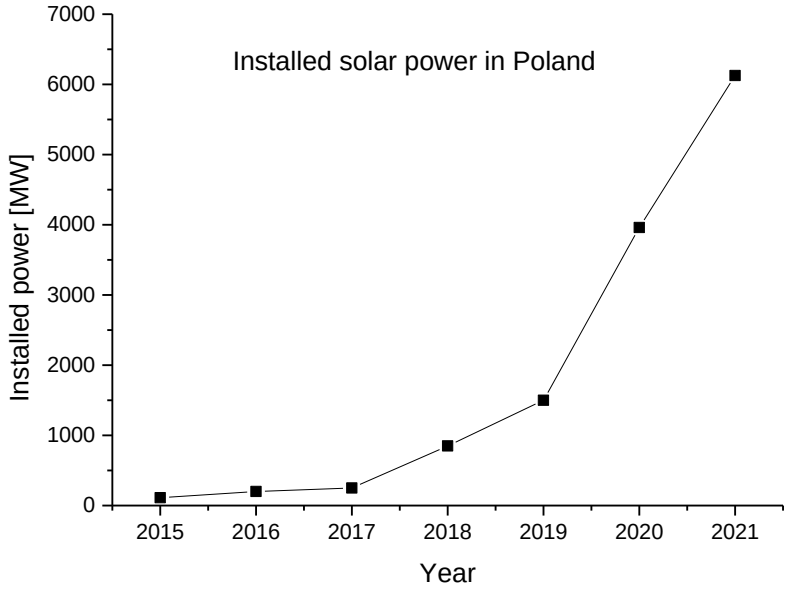


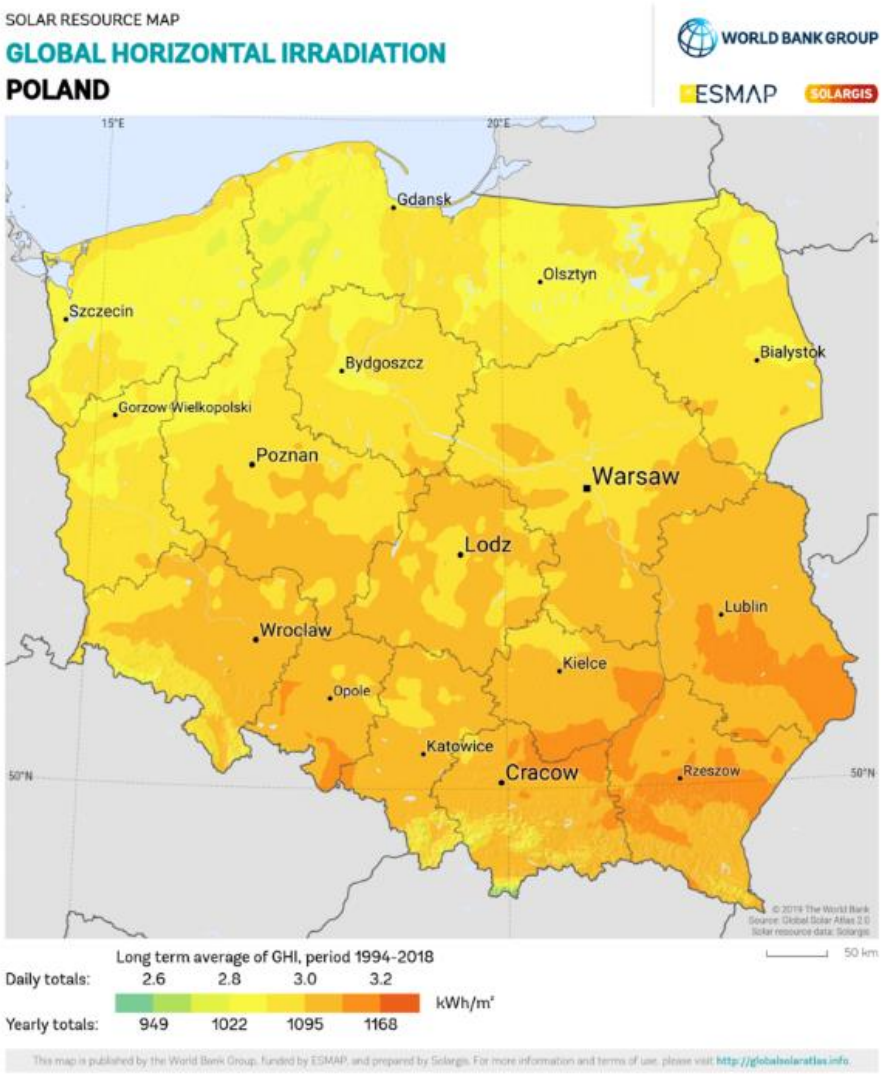
The off-shore

- New contracts (Jan. 2021) allow for installation up to 2030 the 5.9 GW

- Energy policy of Poland until 2040 – up to 11 GW installed offshore

Solar power capacity in Poland





- 75 % of photovoltaic (PV) power in micro-installations
- new contracts for big PV farms in 2021 for 1.9 GW
- in 2025 expected 10-15 GW power

9.04.2021, between 1-2 pm, wind 5.2 GWh, PV 2.6 GWh, in total 7.8 GWh ~ about 30%

Water power plants in Poland

Total water power installed 2042 MW –
produced energy 2600 GWh/year

Water energy potential:

- Wisła with tributaries 9270 GWh/year
- Odra with tributaries 2400 GWh/year
- Rivers by the Baltic sea 280 GWh/year

- 22% of water energy is currently used
- new big plants are not planned

- Pumped storage water power plants stabilize electricity system
- Żarnowiec (the biggest): electric power 716 MW
  the accumulated energy 3.6 GWh

The construction of the first Polish Nuclear Power Plant in Żarnowiec was stopped in 1990

CONSTRUCTION

- Decision to construct NPP 12.08.1971
- Construction started 1982
- 70 Polish companies involved in the construction of the major NPP components
- Decision to stop construction 17.12.1990
- Spent around 1 bln $

REACTORS

- Four WWER-440 Soviet design reactors
- Model V-213 (2nd generation)
- produced in Škoda factories in Czechoslovakia
- Pressurized Water Reactor (PWR)
- Fuel low enriched (ca. 2.4–4.4% ^{235}U)
- No containment
- After Czarnobyl – decision to install Siemens safety systems

Present status of NPP Żarnowiec

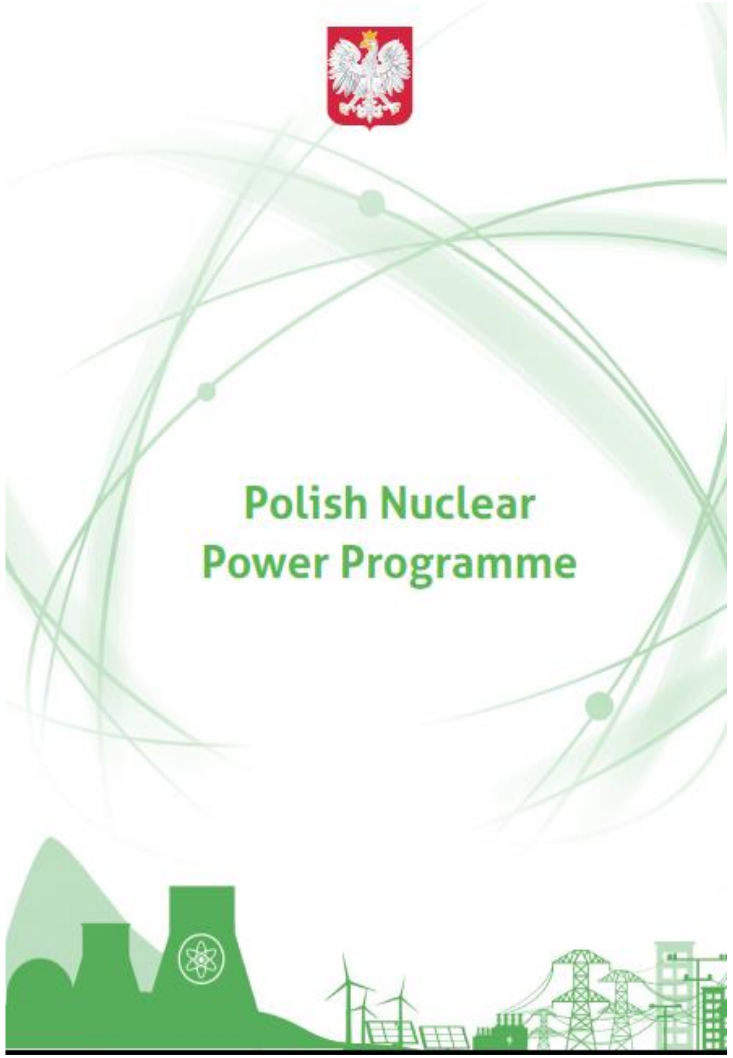
Nuclear to replace the fossile fuel - the Programme of Polish Nuclear Power (PPEJ) 2019

THE OBJECTIVE:

to build 6 – 9 GWe of installed nuclear capacity based on large, proven pressurized water reactors (PWR)

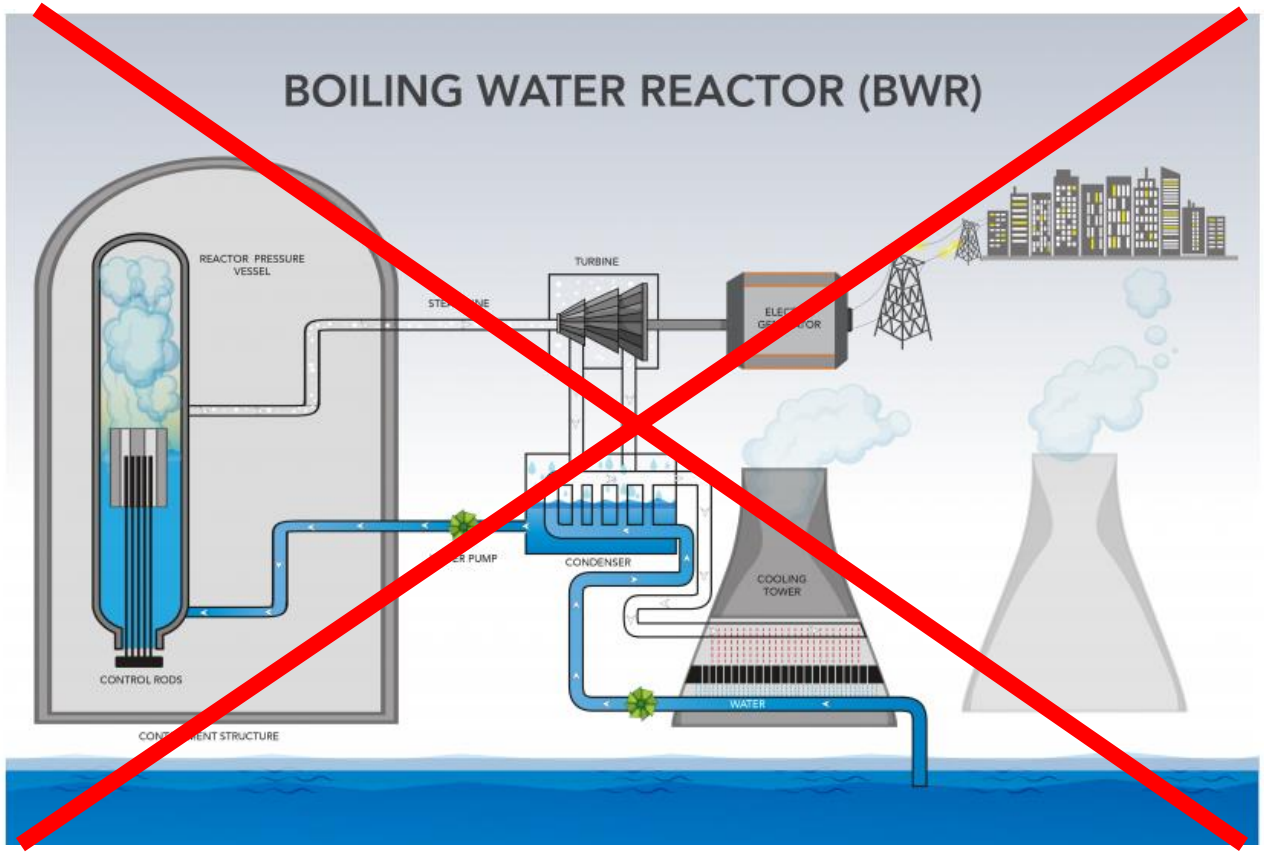
THE BUISNESS MODEL

- selecting one common reactor technology for all NPPs,
- selecting one strategic co-investor linked to the technology provider,
- acquisition by the State Treasury a 100% share in the SPV (Special Purpose Vehicle) (PGE EJ1 Sp. z o. o.),
- one strategic co-investor is selected, linked to the technology provider, retaining at least a 51% stake in the SPV.

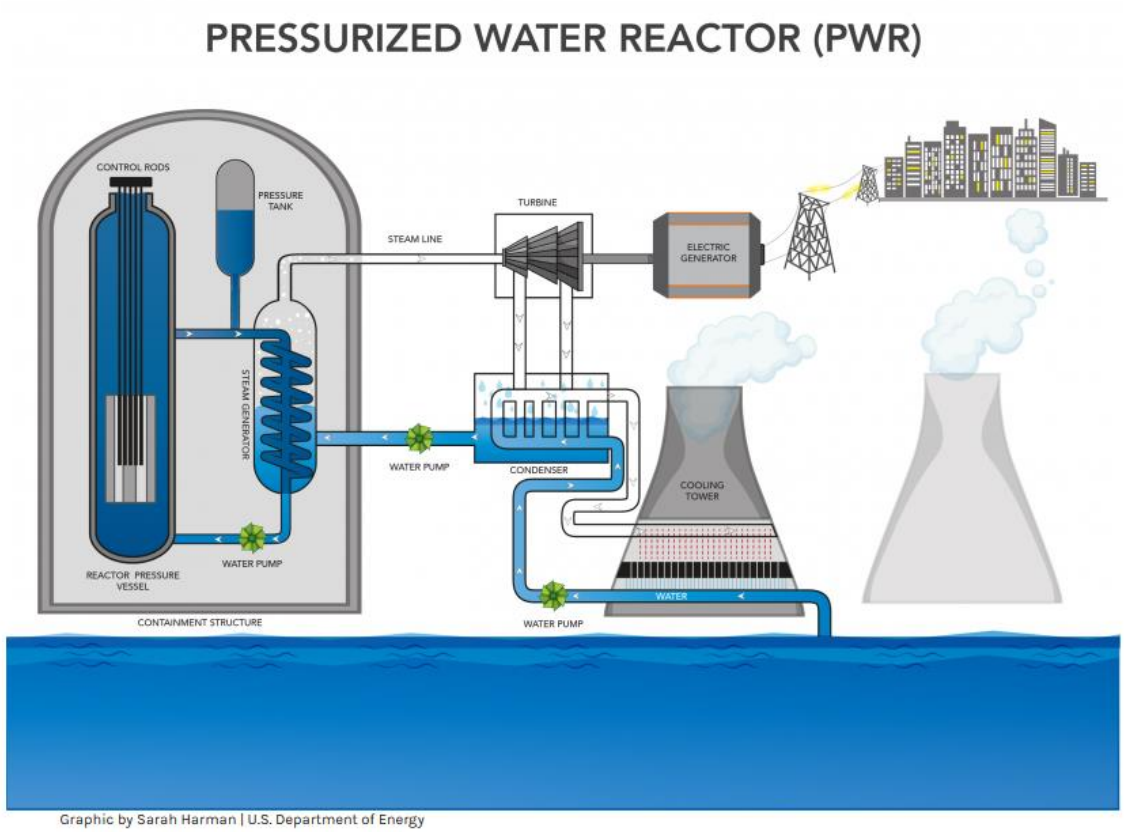


https://www.gov.pl/web/polski-atom/program-polskiej-energetyki-jadrowej

Why PWR nuclear reactors?



BWR produces steam directly using a single water circuit.
The loss of coolant accident (LOCA) the most severe.



PWR - two water circuits
The secondary circuit uses heat to convert liquid water into steam for the turbine. The steam is later condensed and recycled.

Reactors considered for the Polish NPP – AP1000 (USA)

Westighouse AP1000 (USA) reactor ,
Power: electrical 1100 MWe, thermal 3415 MW

2005 - the Nuclear Regulatory Commission (NRC) approved design certification
2018 – the first AP2018 commissioned at Sanmen NPP (China)

Generation III+ reactor PWR:

- longer operational life (60 years, extendable to 100+)
- Passive Core Cooling System uses a tank of water situated above the reactor, no operator action or electronic feedback needed to shut down
- less pumps, pipes, cables by 50-80%
- no safety margins in the event of a direct airplane strike?

Installations
4 working reactors in China (Senman, Haiyang),
construction 8-9 years

In USA in construction 2 reactors build in NPP Vogtle - big delays, not completed, cost from $14 bilion to $25 bilion, construction planned 2009-2016 will be completed 2023

AP1000 reactors at Haiyang NPP, China

Reactors considered for the Polish NPP – EPR (France)

European Pressurized Reactor (EPR) 1650 MWe, thermal power of 4500 MW

Active and passive safety:

- 4 independent cooling systems, each sufficient for 1 to 3 years after the reactor's initial shutdown (i.e., 300% redundancy)
- leak-tight containment around the reactor
- core catcher
- two-layer concrete walls to withstand impact by airplanes and internal overpressure

The two EPR units at the Taishan plant, Guangdong, China

3 types of fuel possible: 5% U, reprocessed U, or mixed U+PuO ,

Installations

- 2 reactors in Taishan China (2018-2019) investment cost doubled

Olkiluoto 3 (Finland) (13 years delay, start Sept. 2022?)
Flamanville 3 (France) (12 years of delay, start 2024?), planned cost €3bn, final estimated cost €12.4bn
Hinkley Point C (United Kingdom)

Welding anomaly found in Flamanville, delay of 3 years

Why big delays with EPR in Olkiluoto?

- Many nuclear power plants were constructed in Europe in the 1970s and 1980s. After that there was a long break in the construction, and experienced experts retired.
- Areva did not have experience in construction of nuclear power plants (only reactors)
- Many experienced subcontractors had left the business,
- Areva was not used to STUK's regulatory approach with an early focus on the quality of structures and components.
- The large size of the reactor and the application of new technologies brought major challenges. Some manufacturing technologies had not been used before.
- TVO's key persons did not have experience from management of a large construction project.

Jukka Laaksonen, Director General of STUK (2010)

Reactors considered for the Polish NPP – ARP-1400 (Korea)

Advanced Power Reactor, ARP-1400 by Korea Electric Power Corporation (KEPCO), 1400 MWe

3rd generation
Increased capacity, lifetime and enhanced safety

Fuel: UO_2, 2.6%

Installations
2 ARP-1400 at Kori NPP (2016, 2019) **<u>1 year delay only!</u>**
2 in Hanul NPP
1 Barakah, Arab Emirates (2017) in time, price 30-50% lower than AP1000 and EPR , **<u>built in time</u>**
6 reactors in other sites construction

Kori NPP, Korea. Two bigger reactors are ARP-1400

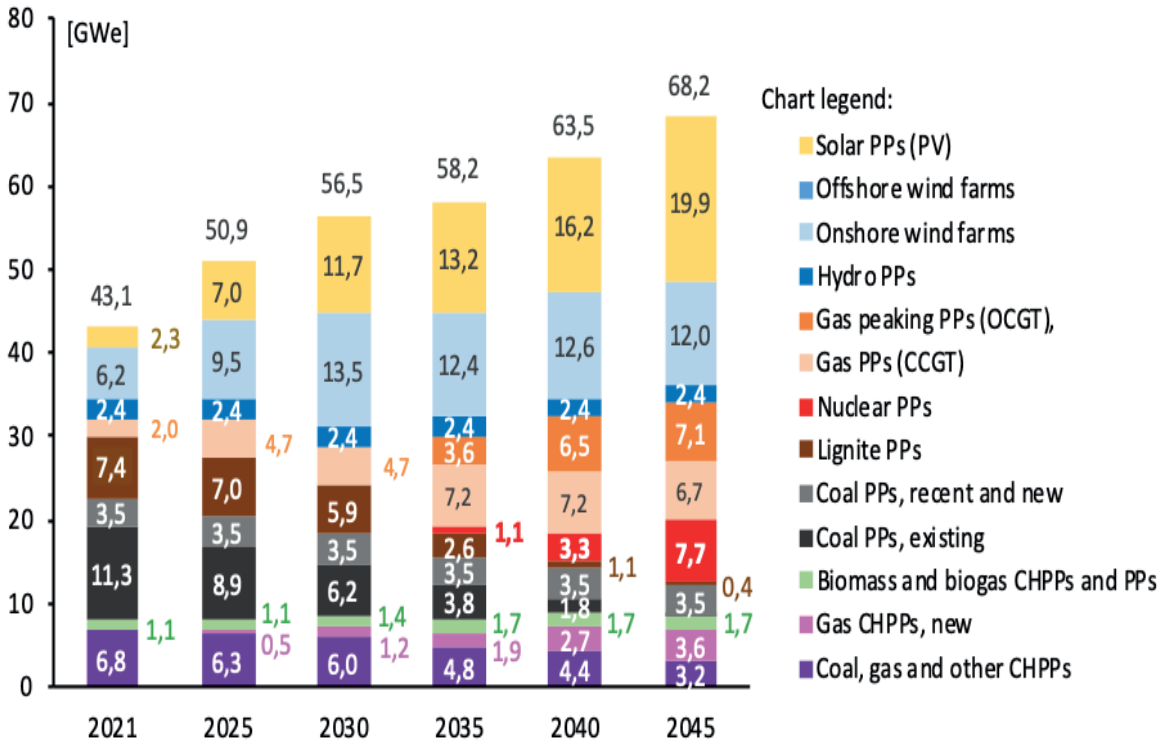
Milestones in PPEJ and the localization of NPP

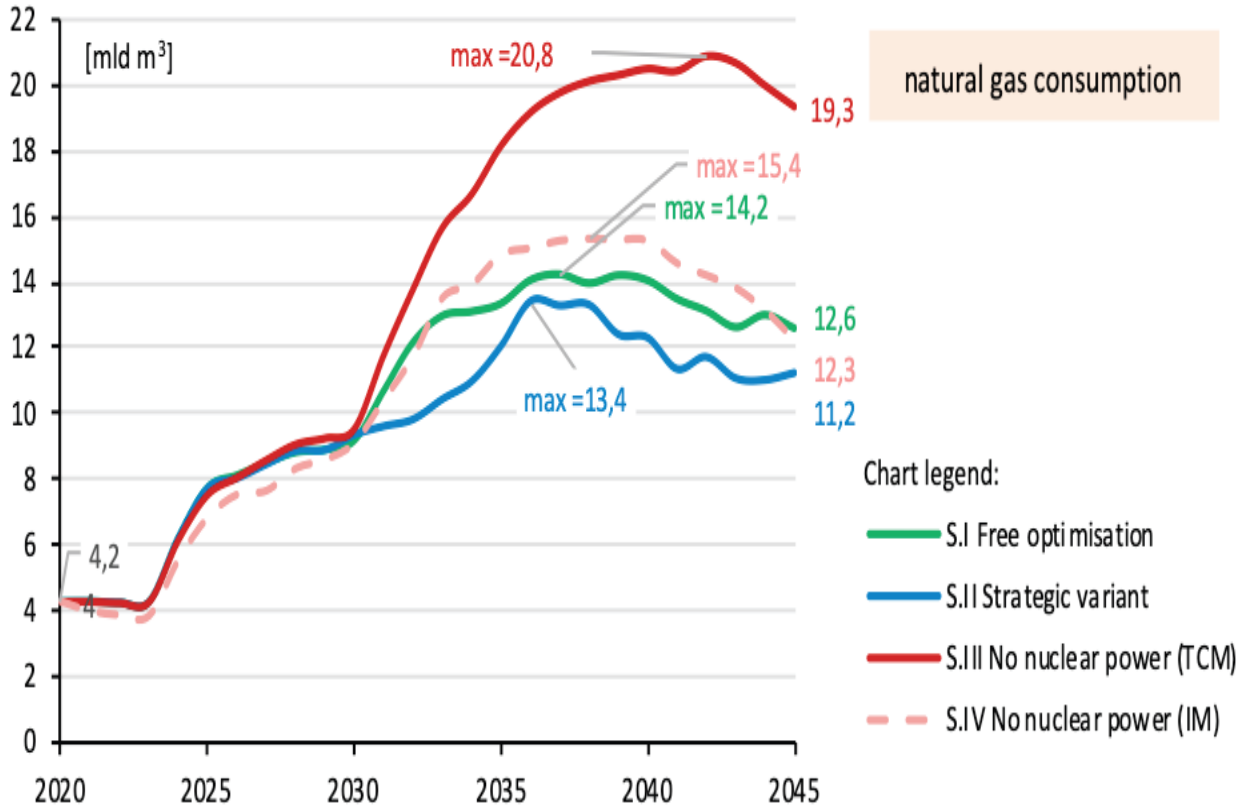
- 2021 Selection of the technology
- 2022 Selection of the localization
- 2026 Start the construction
- 2033 First reactor in operation
- 2043 Last reactor in operation

4 years for starting construction after decision ?

9 years for completing construction?

Planned energy mix in Poland – nuclear and gas (PPEJ)





The energy mix in 2045 will be essentially based on gas, because nuclear will give 7.7 GWh i.e. 35% of energy load in 2021.

Small Modular Reactors – the alternative solution?

SMR are dedicated to distributed systems, isolated energetic systems.

The principle in construction of SMR's - passive safety

More than 20 systems under design – no one working

Russian RITM installed 6 SMR on icebreakers, now the first installation on land, Ust-Kuyga, north Siberia planned in 2024

BWRX-300 SMR , Boiling Water Reactor (General Electric- Hitachi) offered for Poland

- Construction decreasing probability of accidents of LOCA type by factor 10
- Passive cooling, natural condensation and gravitation allow for self-cooling by 7 days without intervention
- Construction planned around 2030?

Name	Developer	Country	Power [MW_{el}]	Planned site
ACP100	NPIC, CNNC, CNPE	China	125	Zhangzhou, Shangrao, Ganzhou, Hunan, Jilin
ACPR100 ACPR50S	CGN	China	140 (ACPR100) 60 (ACPR50S)	n/a
BWRX-300	GE Hitachi Nuclear Energy	USA	300	n/a
CAP200/150/50	SNERDI	China	> 200	n/a
CAREM	CNEA	Argentina	31	Atucha
DHR-400	CNNC	China	- (400 MW_{th})	Xudapu, Liaoning
Flexblue	DCNS	France	160	Cancelled
IMR	MHI	Japan	350	n/a
IRIS	ENEA, SIET, CIRTEN	Italy	335	n/a
KLT-40S	OKBM Afrikantov	Russia	35	Akademik Lomonosov (Barge)
mPower	B&W	USA	195	Cancelled
NuScale	NuScale Power, Fluor	USA	50	n/a
NUWARD	EdF, Technicatome, CEA, Naval Group	France	170	n/a
RITM-200 RITM-200M	OKBM Afrikantov	Russia	50	n/a
Rolls-Royce SMR	Rolls-Royce	UK	443	n/a
SMART	KAERI	Korea	100	Saudi Arabia
SMR-160	Holtec International	USA	160	n/a
SNP350	SNERDI	China	350	n/a
VBER-300 / RP	OKBM Afrikantov	Russia	325	n/a
VK-300	NIKIET	Russia	250	n/a
Westinghouse SMR	Westinghouse	USA	> 225	Suspended

Buchholtz, EU ELSMOR project

Small Modular Reactors in Poland

October 2019 - General Electric Hitachi and Synthos (Poland) signed memorandum for construction BWR X-300 w Polsce

2020 - Synthos Green Energy began a regulatory dialogue with the Polish National Atomic Energy Agency on the possibility of building the BWRX-300 in Poland.

Sept. 2021 - Michal Sołowow i Zygmunt Solorz signed the agreement to work towards installation in Pątnów (middle Poland) 4-6 SMRs.

Sept. 2021 - KGHM and Nuscale signed agreement on the construction on SMR

Dec. 7 2021 Synthos and Orlen create a joint venture ORLEN Synthos Green Energy to install and operate SMR. They claim that the cost is lower by 30% per MW comparing

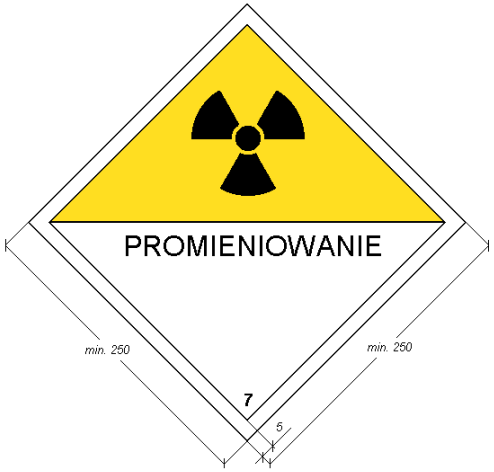
23 September 2021

SMRs should replace existing coal and lignite blocks, to use the existing grid and infrastructure.

It is however unlikely that the first reactor is in grid before 2030

IFJ PAN and the Program of Polish Nuclear Energy (PPEJ)

One of the major factor for public acceptance of nuclear power is safety of installations and the trust for the competences of independent experts and measurements.

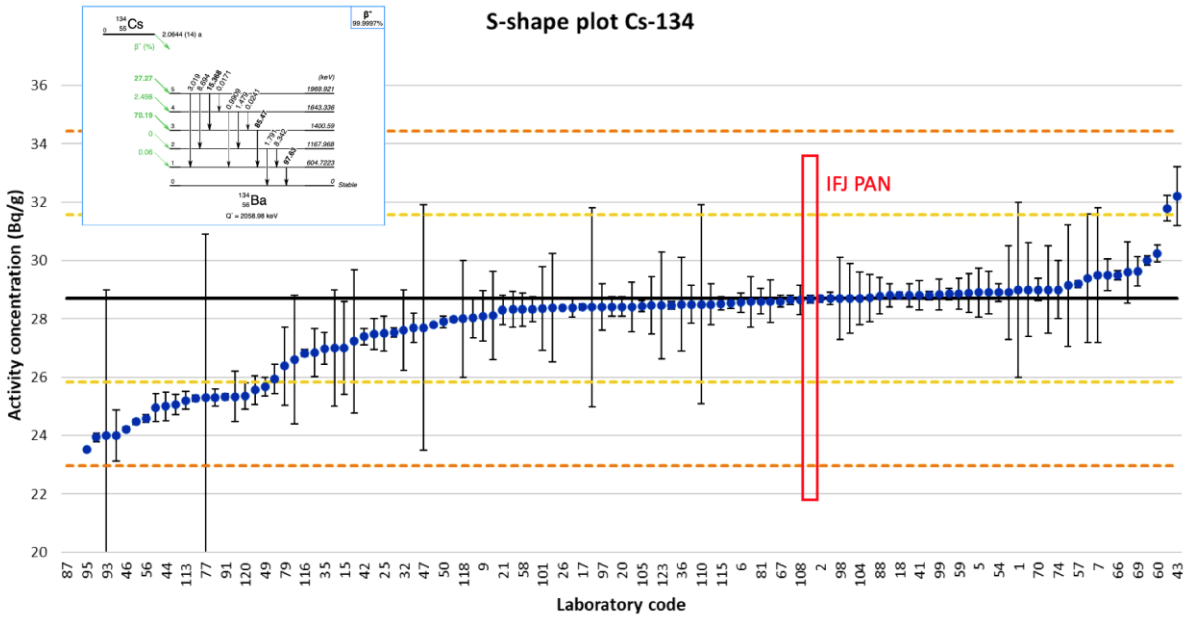


Several groups at IFJ PAN is specialized in the low-background radioactivity monitoring of air and environment and low-dose measurements

IFJ PAN expertise: radioactivity monitoring (1)

Dept. of Physical Chemistry, Z64

- Continues monitoring of radioactivity of air and environment is performed.
- The monitoring station ASS-500 is part of the national monitoring service.
- The monitoring service is the part of the *ALMERA* network (Analytical Laboratories for the Measurement of Environmental Radioactivity) coordinated by IAEA.
- The accredited laboratory measures radioactive α,β,γ isotopes in air and in environment.
- Unique low-background, digital γ-rays spectrometer allows for measurements comparable to those in an underground laboratory
- Whole Body Counter (2nd in Poland) allows for measurements contaminations of human.



Results of ConvEx 3 intercomparison, for Cs-134 (R. Kierepko, K. Gorzkiewicz)

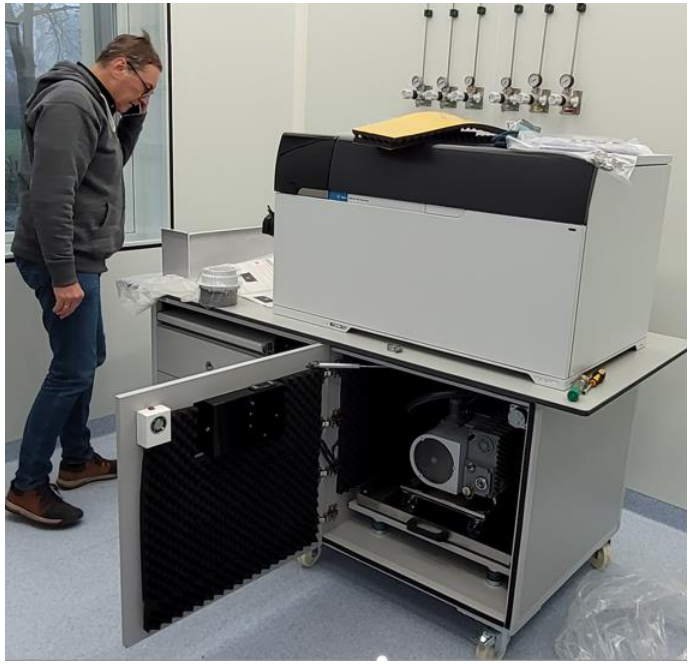
IFJ PAN expertise: radioactivity monitoring (2)

- A concept is discussed to develop in Wieliczka or Bochnia salt mines an underground, low–level radioactivity laboratory (Z64)

- The new mass spectrometry laboratory will measure the concentration of Pu, Tc-99, Sr-90, Cs-137 at the concentration of 1 ppt (parts per trillion) (Dept. Mass Spectrometry, Z65)

- A mobile radiometric laboratory with β- and γ-spectrometry and measurements of environmental dose rates. (Lab. of Radiometric Expertise, NLR)

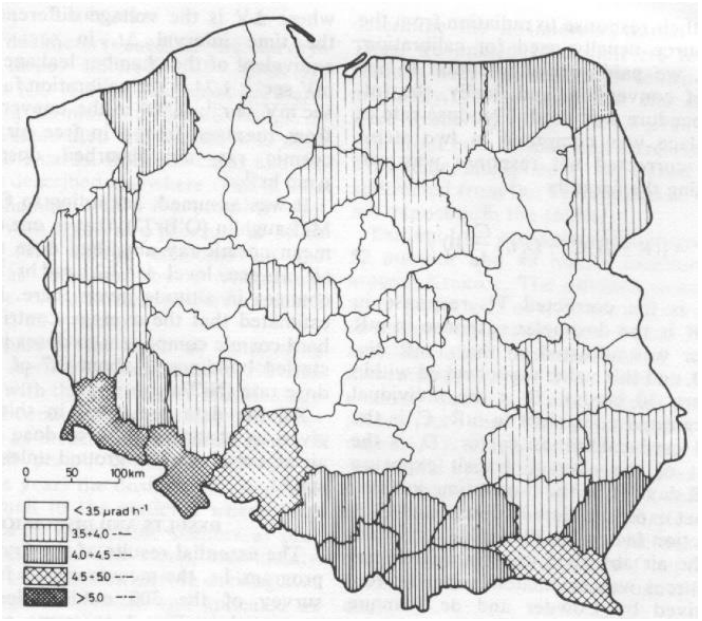
New mass spectrometer installed on Dec.6, 2021



Mobile radiometric laboratory

IFJ PAN expertise: environmental dosimetry

- IFJ PAN is one the most experienced in the world in thermoluminescence dosimetry. TLDs system were developed here and implemented to individual, environmental, medical, cosmic dosimetry.
- Laboratory of Individual and Environmental Dosimetry (LADIS, NLD) performs yearly 18,000 environmental measurements for customers in Poland with high sensitive MCP-N
- We are now discussing with the Polish Atomic Agency the possibilities to perform with Central Laboratory of Radiation Protection systematic measurements of environmental doses in Poland using our TLD systems (meeting with PAA 12.01 2022).



T. Niewiadomski Environmental dose rate in Poland measured with TLDs (1977)

IFJ PAN expertise: transport calculations, dosimetry, calibrations

- Neutron transport calculation, development of neutron instruments and shielding – long term competences confirmed in international EURATOM projects (Dept. of Radiat. Transport, Z61)
- Popular drugs are proposed as accidental dosimeters – to be read-out using OSL systems (Dept. of Radiat. Phys. & Dosimetry, Z63)
- Biological dosimetry based on frequency of aberrations in human lymphocytes (Dept. of Exp. Phys. & Complex Systems, Z52)
- Calibration of radiation protection instruments – about 1000 radiometers per year (Lab. Calib. of Radiat. Prot. Instruments, NLW)

Calibration of radiometers at Cs-137 calibration bench

IFJ PAN application to Ministry of Climate to join PPEJ (Nov.16, 2021)

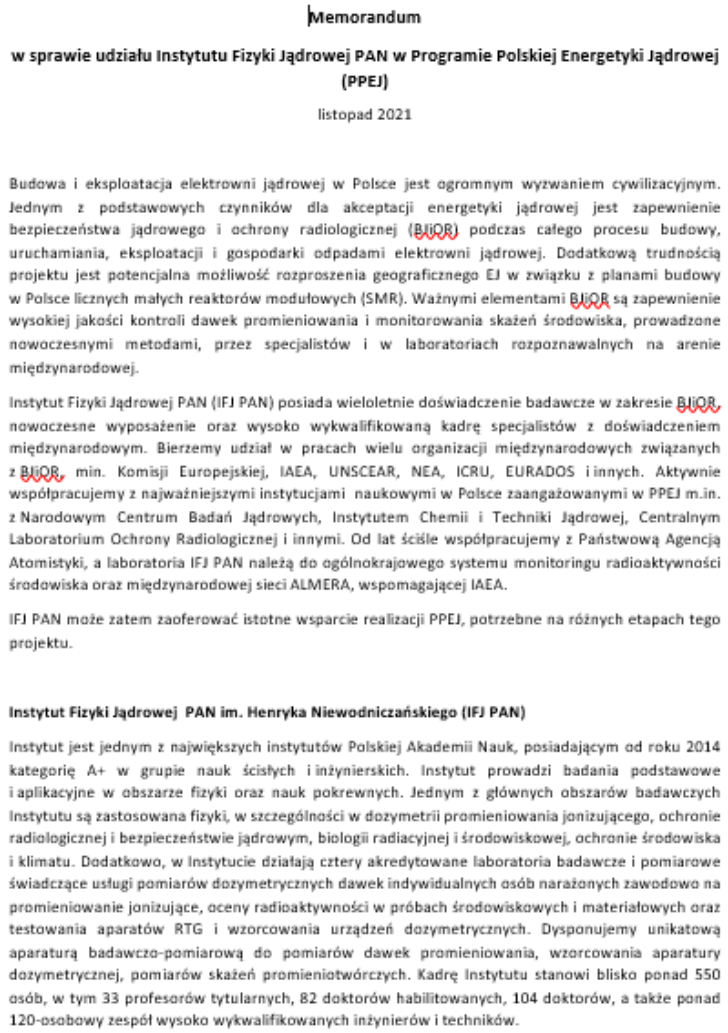
Scientific institutes involved in PPEJ

- National Centre of Nuclear Research (NCBJ)
- Institute of Nuclear Technique and Chemistry
- Central Laboratory of Radiation Protection

Planned consortium for radiation protection with IFJ PAN

IFJ PAN applied to the Ministry of Climate to be included in the program PPEJ offering the competences in low-level radioactivity and low-dose monitoring

On **Dec. 8, 2021** –letter from Tomasz Nowacki, director of the Dept. of Nucl. Energy – to apply for the authorisation of PAA



Memorandum

w sprawie udziału Instytutu Fizyki Jądrowej PAN w Programie Polskiej Energetyki Jądrowej (PPEJ)

listopad 2021

Budowa i eksploatacja elektrowni jądrowej w Polsce jest ogromnym wyzwaniem cywilizacyjnym. Jednym z podstawowych czynników dla akceptacji energetyki jądrowej jest zapewnienie bezpieczeństwa jądrowego i ochrony radiologicznej (BiOR) podczas całego procesu budowy, uruchamiania, eksploatacji i gospodarki odpadami elektrowni jądrowej. Dodatkową trudnością projektu jest potencjalna możliwość rozproszenia geograficznego EJ w związku z planami budowy w Polsce licznych małych reaktorów modułowych (SMR). Ważnymi elementami BiOR są zapewnienie wysokiej jakości kontroli dawek promieniowania i monitorowania skażeń środowiska, prowadzone nowoczesnymi metodami, przez specjalistów i w laboratoriach rozpoznawalnych na arenie międzynarodowej.

Instytut Fizyki Jądrowej PAN (IFJ PAN) posiada wieloletnie doświadczenie badawcze w zakresie BiOR, nowoczesne wyposażenie oraz wysoko wykwalifikowaną kadrę specjalistów z doświadczeniem międzynarodowym. Bierzemy udział w pracach wielu organizacji międzynarodowych związanych z BiOR, min. Komisji Europejskiej, IAEA, UNSCEAR, NEA, ICRU, EURADOS i innych. Aktywnie współpracujemy z najważniejszymi instytucjami naukowymi w Polsce zaangażowanymi w PPEJ m.in. z Narodowym Centrum Badań Jądrowych, Instytutem Chemii i Techniki Jądrowej, Centralnym Laboratorium Ochrony Radiologicznej i innymi. Od lat ściśle współpracujemy z Państwową Agencją Atomistyki, a laboratoria IFJ PAN należą do ogólnokrajowego systemu monitoringu radioaktywności środowiska oraz międzynarodowej sieci ALMERA, wspomagającej IAEA.

IFJ PAN może zatem zaoferować istotne wsparcie realizacji PPEJ, potrzebne na różnych etapach tego projektu.

Instytut Fizyki Jądrowej PAN im. Henryka Niewodniczańskiego (IFJ PAN)

Instytut jest jednym z największych instytutów Polskiej Akademii Nauk, posiadającym od roku 2014 kategorię A+ w grupie nauk ścisłych i inżynierskich. Instytut prowadzi badania podstawowe i aplikacyjne w obszarze fizyki oraz nauk pokrewnych. Jednym z głównych obszarów badawczych Instytutu są zastosowana fizyki, w szczególności w dozymetrii promieniowania jonizującego, ochronie radiologicznej i bezpieczeństwie jądrowym, biologii radiacyjnej i środowiskowej, ochronie środowiska i klimatu. Dodatkowo, w Instytucie działają cztery akredytowane laboratoria badawcze i pomiarowe świadczące usługi pomiarów dozymetrycznych dawek indywidualnych osób narażonych zawodowo na promieniowanie jonizujące, oceny radioaktywności w próbach środowiskowych i materiałowych oraz testowania aparatów RTG i wzorcowania urządzeń dozymetrycznych. Dysponujemy unikatową aparaturą badawczo-pomiarową do pomiarów dawek promieniowania, wzorcowania aparatury dozymetrycznej, pomiarów skażeń promieniotwórczych. Kadrę Instytutu stanowi blisko ponad 550 osób, w tym 33 profesorów tytularnych, 82 doktorów habilitowanych, 104 doktorów, a także ponad 120-osobowy zespół wysoko wykwalifikowanych inżynierów i techników.

Measurements for Polish Atomic Agency (PAA) only after authorization

In a process of licensing and control of a Nuclear Power Plants PAA may need an additional expertise.

This can be done only by those organizations, which have authorization of PAA.

PAA predefined topics of interest:

- radiological consequences of the safety analysis
- input data for emergency procedures in NPP
- procedures in case of heavy accidents

IFJ PAN should submit documents for authorization in the near future

10.12.2021 Meeting at IFJ PAN on PAA authorization

Summary and Conclusions

- European Union discuses the Green Deal and Taxonomy, which will have a significant impact on the future energy mix used for electricity production
- Polish government announced that the energy production from coal and lignite will be closed in Poland until 2050.
- To partly replace the fossil fuel the Program of Polish Nuclear Power foreseen construction of 6 power reactors. The selection of the vendor will be announced in 2022.
- 3 reactors are considered: AP1000 (USA), EPR (France) and AR-1400 (Korea)
- Small Modular Reactors for Polish industry are probably not possible before 2030
- IFJ PAN applies for joining PPEJ by offering competences in low –level radioactivity and low-dose monitoring.
- IFJ PAN will apply for authorization of our competences to PAA