POLITYKA INSIGHT | **RESEARCH**

Hot topic for energy sector

Why promote co-generation

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Introduction

Cogeneration, or the simultaneous generation of electricity and heat (CHP), is one of the most efficient ways of producing energy. Using the technique, the same amount of fuel allows power plants to produce much more energy than conventional plants. By focusing on spreading of cogeneration, the Polish government can pursue three main objectives of energy policy effectively: energy security, competitiveness and environmental and climate protection.

Unlike power plants, combined heat and power stations are operating at full power for only a few months of the year, mainly in winter. They are expensive to run since they feature systems to generate not only heat but electrical power. They also employ more staff. They have, however, a number of advantages that coax many countries into supporting cogeneration nonetheless. The support mechanisms operate in countries including Denmark, Finland, the Czech Republic, the Netherlands and Germany.

Why supporting cogeneration plants makes sense

- **Improved air quality.** The development of cogeneration means more heating networks, which in turn reduces the need for outdated coal-fired stoves in households and can limit the phenomenon of heating homes using waste. It is the individual stove or boiler which is largely responsible for the sorry state of the air in Polish cities. According to the European Environment Agency, 47,000 premature deaths are recorded in Poland every year due to poor air quality[1]. This is over ten times more than the number killed in road traffic accidents over the course of a year.

- **Increased national energy security.** There is the potential to install 7.5-10GWe of additional capacity in cogeneration in Poland, both by building new sources, as well as the modernization of existing units. This will allow approx. 33.5TWh of electricity to be obtained, which is as much as one-fifth of the production of domestic power plants at present. The share of cogeneration in electricity production would then rise from 15 to about 25 per cent.

- **Compliance with the EU's climate policy.** Cogeneration reduces fuel consumption and reduces carbon emissions. In the years 2007-2014 alone Poland managed to save 769 mln gigajoules of primary energy through cogeneration[2]. This is the approximate equivalent of 34 million tonnes of coal or half of its annual consumption in the country and the avoided emission of 62 million tonnes of CO2. The increase in the share of cogeneration in electricity production to 25 per cent would mean reducing CO2 emissions by 15-26 million tonnes per year[3]. For this reason, cogeneration is considered by the EU as one way of achieving climate goals, that is to reduce CO2 emissions and increase energy efficiency.

- **Stabilizing RES.** Cogeneration can complement renewable energy sources well. The generation of electricity from wind and solar energy is unstable and dependent on weather conditions. An energy system needs capacity that can respond flexibly to changes in how much electricity is in the system. Gas is best suited to this since it can be quickly brought in. In the future, the development of water heat accumulators should enable cogeneration plants to take over the function of stabilization the grid.

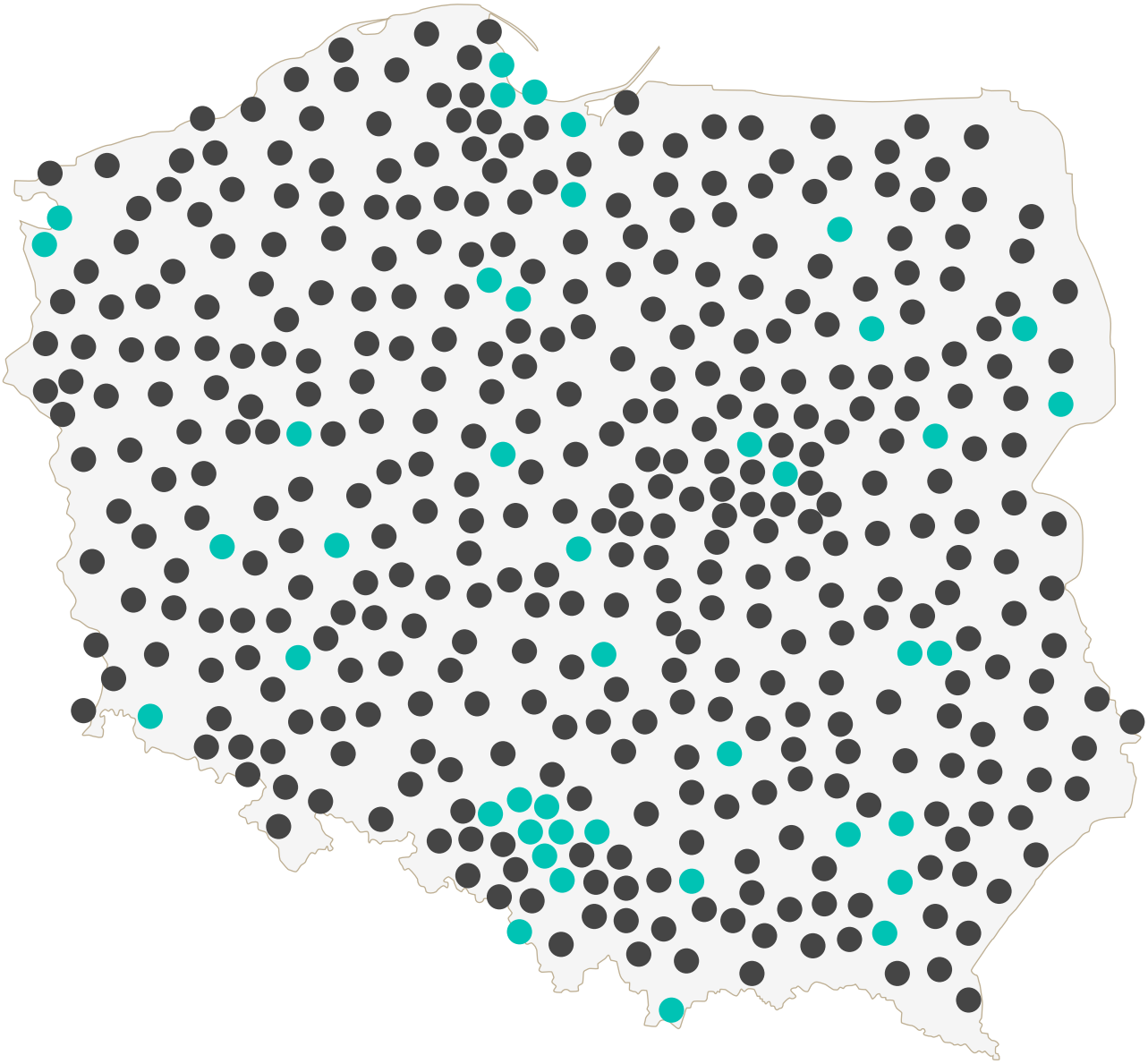
1 Air quality in Europe 2015 report, European Environmental Agency, 2015.

2 Statement of the Minister of Energy, April 5, 2016 on the report assessing progress towards increasing the share of electricity produced from high-efficiency cogeneration in the total national electricity production.

3 Estimates of the Institute of Applied Research, Warsaw University of Technology, Rzeczpospolita, July 26, 2016.

COMBINED HEAT AND POWER PLANTS IN POLAND

Source: PGNiG Termika



"Efficient cogeneration", where at least 75 per cent of energy comes from cogeneration or 50 per cent of the thermal energy produced is from RES or is derived from industrial processes.

„Inefficient" heating systems.

The future of cogeneration

There is a consensus in Poland that cogeneration should be supported. Up to the moment, however, there has been a lack of an appropriate strategy and effective tools. The cogeneration support system has operated since 2007, but it has merely increased the profitability of existing units by enough to maintain their competitiveness. It is not enough to give a boost to the building of new units, which would carry with them the whole range of benefits described above.

The current support system will expire at the end of 2018. Existing units are getting older, and more than half of the capacity is more than 30 years old. The modernization of the sector, and indeed its extension, is in the interest of the state. It is therefore necessary to develop a new, long-term support system, which will be compatible with the new energy market design, on which Brussels is currently working. It should also be consistent with the planned Polish capacity mechanism or be an integral part of it. Work on such a system should start as soon as possible.

Recommendations

- **The state should support cogeneration.** The simultaneous generation of heat and electricity is more efficient and has a good fit with the objectives of the EU climate policy. Combined heat and power plants can stabilize the power system, and building cogeneration plants is cheaper than constructing separate units producing heat and power. However, the seasonality of the technology means that its benefits can be used only with skilful support from the state. The Government should prepare customized solutions as soon as possible supporting the development of cogeneration.

- **The new support system should be long-term.** The existing support system, based on certificates, only covers firms' operating costs, without creating an incentive for the building of new units. For decisions to be taken to invest in new plants, it is necessary to provide support for a period of at least 15 years. A shorter time frame does not encourage investors to start new projects.

- **The system must be cost-effective.** At the moment, the cost of the cogeneration support falls on the final consumers, in their electricity bills. In 2015, subsidies for combined heat and power plants increased charges for electricity by an average of 1.6 per cent. The new system should have minimal impact on energy bills and promote competition. The solution could be to introduce a cogeneration auction, which would assist the most competitive entities. Cogeneration could also become an integral part of the capacity market.

- **Increased support for new and flexible units.** The level of support for new combined heat and power plants should be higher than for those already in operation. Higher subsidies should go to new gas-fired or multi-fuel CHP plants supplying heating systems. Thermal batteries should be promoted. Implementing all these ideas would accelerate the deployment of a modern combined heat and power plant fleet capable of reducing air pollution.

- **Incentives for modernization.** Support should be given for modernizing combined heat and power plants , as well as re-designing heating plants and power stations as cogeneration units. The level of subsidy should depend on the investment costs incurred. Such investment is the most cost-effective way to increase capacity within the Polish electricity generation system.

The Polish district heating sector

Poland is one of the largest manufacturers of heat in Europe. The country's heating plants and its cogeneration units feature 56 GW of installed thermal capacity. For comparison, the German heating sector has less than 50 GW thermal capacity.

Heat is supplied to customers in the form of hot water or steam. Due to the physical properties it is susceptible to changes in temperature and therefore it can only be transported over relatively short distances (40-50 km). Thus heating and cogeneration plants typically operate within cities. In Poland there are 317 such heat "islands"[4].

Poland is one of the leaders in sales of heat through heating networks. This is the way 53 per cent of Poles are supplied; the rest buy from small, local heating plants or produce their own supplies. In the EU, only the citizens of Estonia, Latvia and Denmark buy more heat from heating networks[5]. Moreover, Poland has one of the longest district heating networks in the EU. Nevertheless, the demand for heat is falling. From 2002 to 2015, sales declined by 26.3 per cent, attributable to the effect of economic transformation, the renovation of buildings and the increase in firms' energy efficiency among other things[6].

Local authorities are the main players in heat generation

There are 443 heating enterprises operating in the Polish market, of which over 60 per cent are publically owned, mainly by local authorities. The owners of the remaining companies are in the private sector[7]. The market is dominated by small production units - 57 per cent of companies have

4 Euroheat & Power, data for 2013.

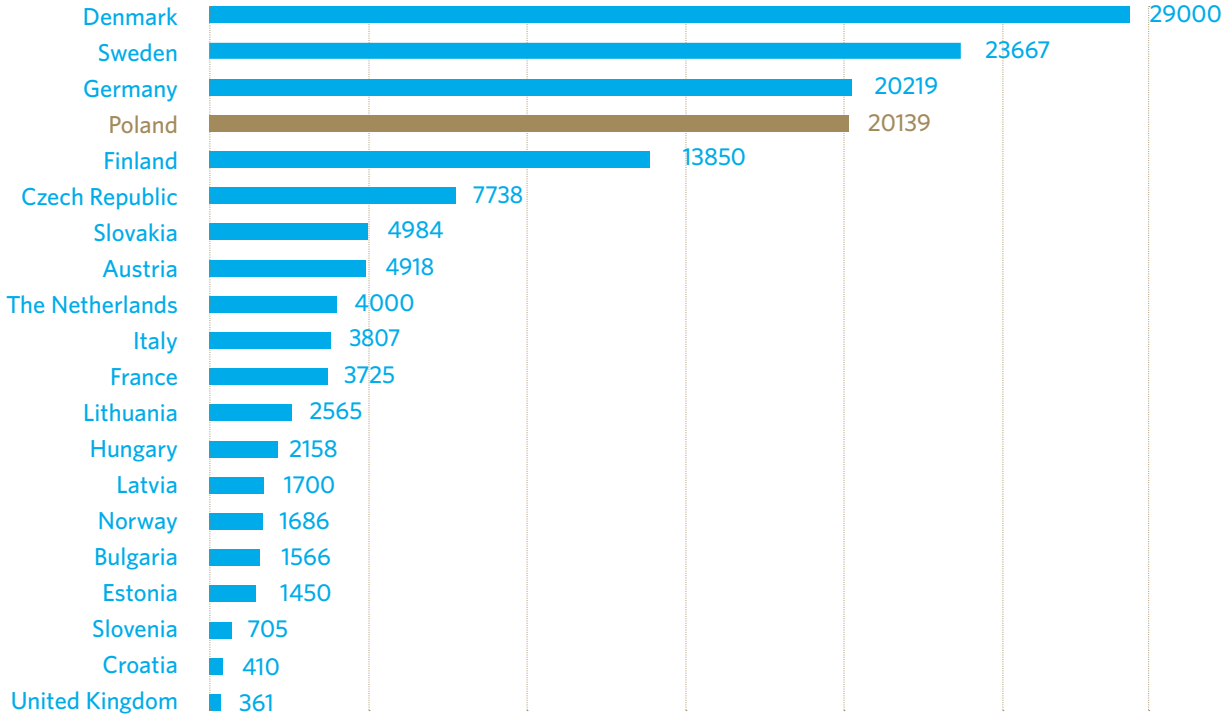
5 Euroheat & Power.

6 Energetyka cieplna w liczbach [Heat energy in figures], the Energy Regulatory Office, 2016.

7 Energetyka cieplna w liczbach.

LENGTH OF HEATING NETWORKS IN EUROPE (IN KM)

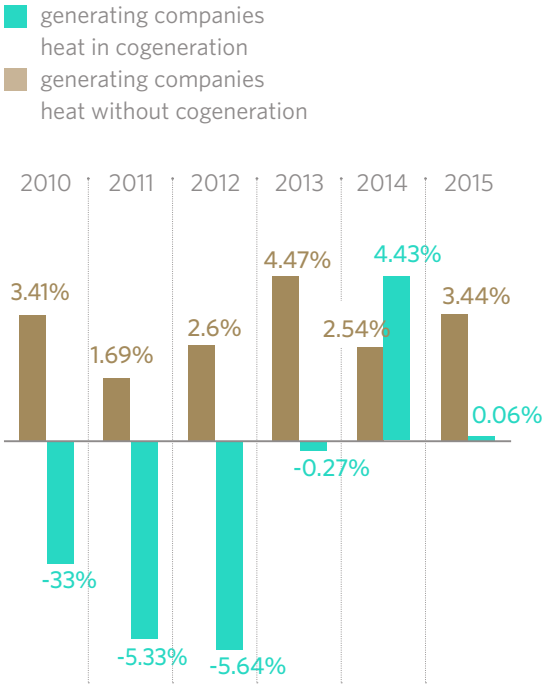
Source: Euroheat & Power



The profitability of the CHP sector in 2015 was only 0.06 per cent.

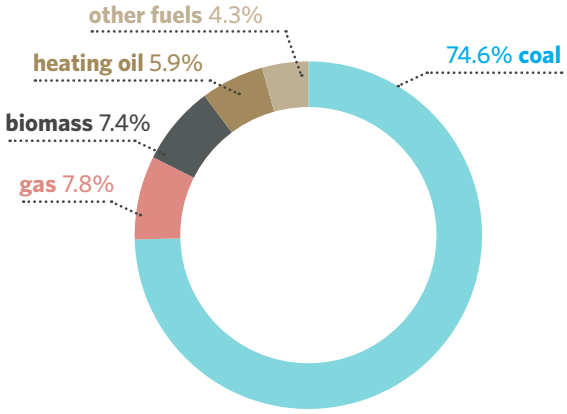
PROFITABILITY OF HEATING ENTERPRISES

Source: URE



FUELS USED IN THE POLISH HEATING SECTOR IN 2015

Source: URE



installations with a thermal capacity under 50 MW. In the country as a whole, only 11 companies have heating plants or cogeneration plants with a thermal capacity of more than 1,000 MW. The biggest players in the market for heat are EDF Polska, PGNiG Termika, PGE, Tauron, Fortum and ČEZ.

Heat generated mostly from coal

In 2015 coal accounted for 74.6 per cent of heat generation in Poland, in comparison with 76 per cent in 2010. The share of heat generated from gas was 7.8 per cent, as compared to 5 per cent in 2010. Biomass is becoming increasingly popular (7.4 per cent), which is associated with an increase in energy production from co-firing of biomass and coal, subsidized under the renewables support scheme. There is a greater diversification of fuels in cogeneration. Combined heat and power plants burn less coal than the heating sector as a whole (70 per cent), the same amount of gas (7.7 per cent) and more biomass (9.1 percent) and heating oil (7.9 per cent)[8].

CHP plants have a problem with profitability

The demand for heat depends mainly on the pace of economic development. The weather is a factor of considerable importance for the sector - warmer winters reduce the profitability of heating companies. The heating sector is profitable - in 2015, its revenues amounted to PLN 17.52 billion, 3.9 per cent up on the year before. At the same time, costs have greatly increased (up 6.9 per cent - to PLN 17.26 billion), attributable i.a. to the depreciation of assets. The situation looks different in cogeneration. The Energy Regulatory Office (URE) does not publish detailed financial results for companies, but it does report on the profitability of their sales. This shows what portion of net profit is left in the enterprise. Last year, the profitability of the sector was positive, but it was only 0.06 per cent as compared to 3.44 per cent for heating companies without cogeneration.

Apart from heat, cogeneration plants produce electricity which can be sold on the market. This gives them a technical advantage but only superficially. This is because these plants are more expensive to run – they have a much more elaborate systems for the simultaneous production of heat and power. At the same time, the higher costs are not offset by electricity sold, due to the its low prices on the wholesale

8 Energetyka cieplna w liczbach.

market. To promote investment in cogeneration, while holding heat prices unchanged, a support system has been implemented.

Three colours of certificates for cogeneration

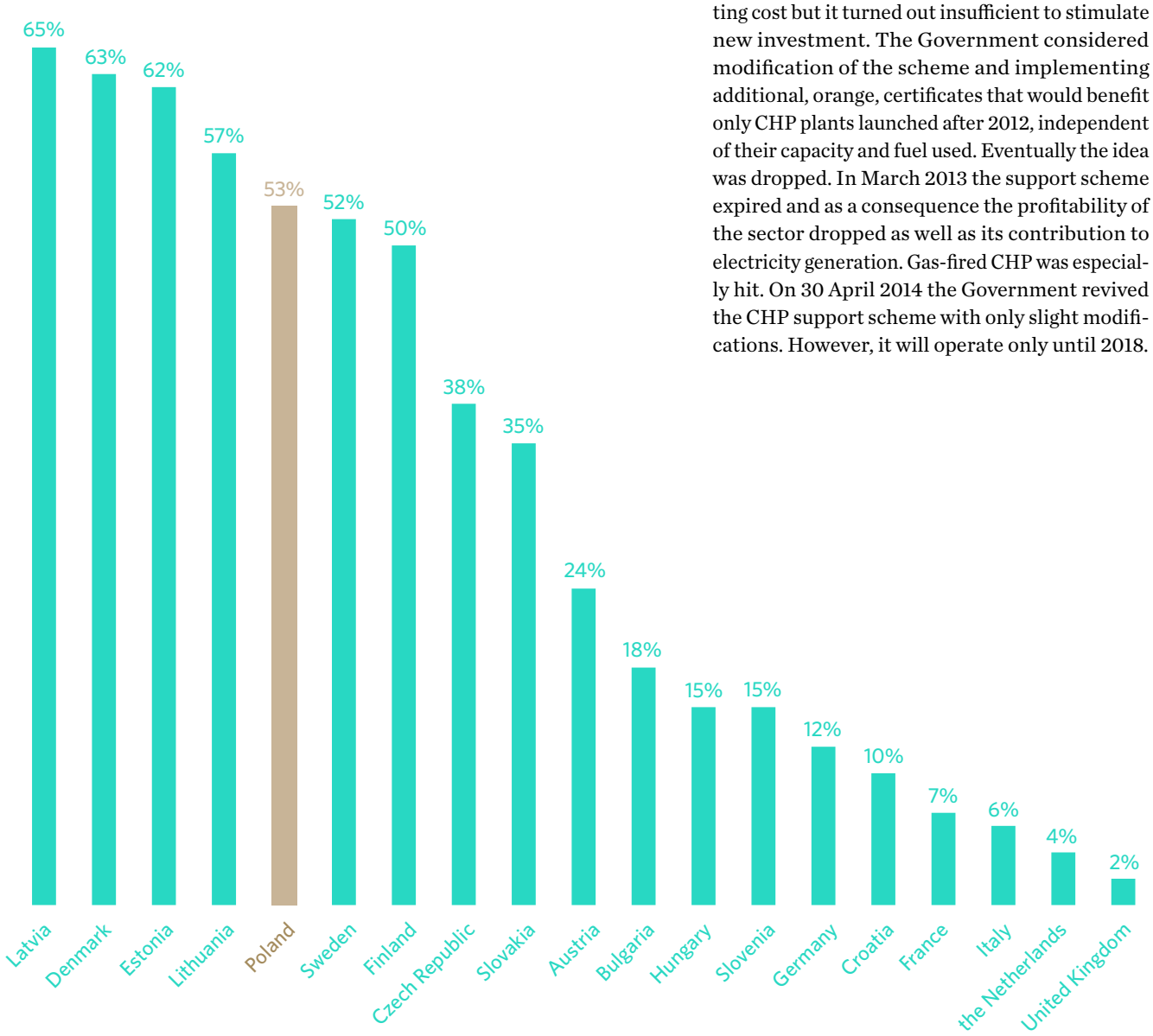
The first Polish mechanism to promote combined heat and power was launched on 1 July, 2007 and is based on the certificates of origin, popularly called "certificates". In this framework yellow certificates are granted for the generation of power in gas-fired CHP units; red certificates for power from coal-fired CHP units; and purple for those using methane extracted from coal mines or biogas. The price of certificates is determined by the market. Electricity suppliers have an obligation to buy a certain number of certificates, the cost of which are then added to customers' bills.

Certificates have not incentivised the building of new units

So far the support scheme covered a part of operating cost but it turned out insufficient to stimulate new investment. The Government considered modification of the scheme and implementing additional, orange, certificates that would benefit only CHP plants launched after 2012, independent of their capacity and fuel used. Eventually the idea was dropped. In March 2013 the support scheme expired and as a consequence the profitability of the sector dropped as well as its contribution to electricity generation. Gas-fired CHP was especially hit. On 30 April 2014 the Government revived the CHP support scheme with only slight modifications. However, it will operate only until 2018.

PROPORTION OF CITIZENS SERVED BY DISTRICT HEATING IN SELECTED COUNTRIES 2013

Source: Euroheat & Power

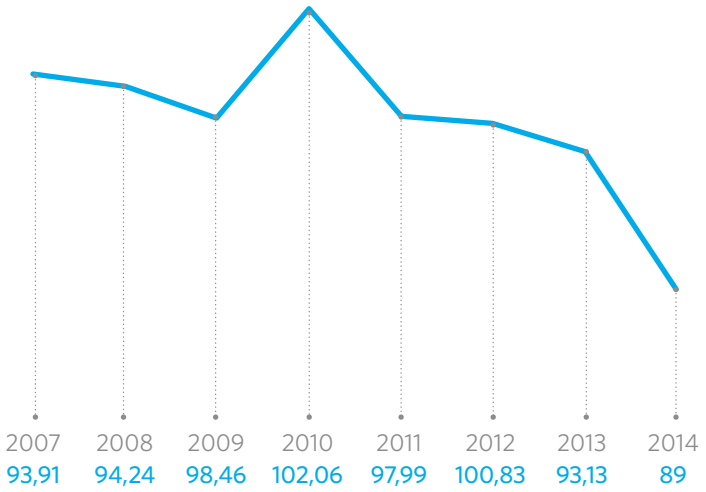


Cogeneration and what its advantages

Combined heat and power stations operate almost the same way as traditional power plants. The only difference is the way the heat, which is always created in the generation of electricity, is used.

ESTIMATED SAVING ENERGY, PRIMARY COGENERATION (IN PJ)

Source: Energy Ministry



Greater efficiency

In a conventional power plant approximately 60-65 per cent of the heat generated is released into the environment in the form of hot water discharged into rivers or as steam. In contrast, CHP plants introduce the heat into networks. Thanks to this they have higher conversion efficiency than conventional power plants.

Energy conversion efficiency means the ability to process the primary energy contained in the fuel into useful heat or electricity. In modern CHP plants, the efficiency can be as high as 90 per cent. This means that for 100 units of primary energy (such as coal), the plant can produce 90 units of electricity and heat. In modern gas power stations the conversion efficiency amounts to a maximum of approximately 60 per cent and in modern coal units up to 45 per cent. The average conversion efficiency for the Polish power plants today is approximately 36 per cent.

High efficiency of cogeneration translates into savings in fuel. In the years 2007-2014 alone the Polish CHP units reduced coal consumption by 34 million tonnes and avoided 62 million tonnes of CO2 emissions[9].

EU support

Due to lower fuel consumption, higher conversion efficiency and lower emissions of air pollutants and CO2 Brussels considers development of CHP as one of the ways to achieve the climate goals and reduce dependence on imported fossil fuels. According to the provisions made by the European Council in October 2014, the EU's electricity sector and industry need to reduce CO2 emissions by 43 per cent by 2030 as compared to the level of 2005. EU support for CHP began in 2004 with the Cogeneration Directive[10]. It introduced the model enabling calculation of eligibility of cogeneration units for support – units deemed eligible must demonstrate at least a 10 per cent fuel saving relative to heating plants and power stations. The Directive on Energy Efficiency came into force in 2012 (EED[11]) and replaced the Cogeneration Directive of 2004. It recognized CHP as one of the main technologies that support energy efficiency, alongside i.a. smart meters and building insulation.

Stabilization of electricity generation system

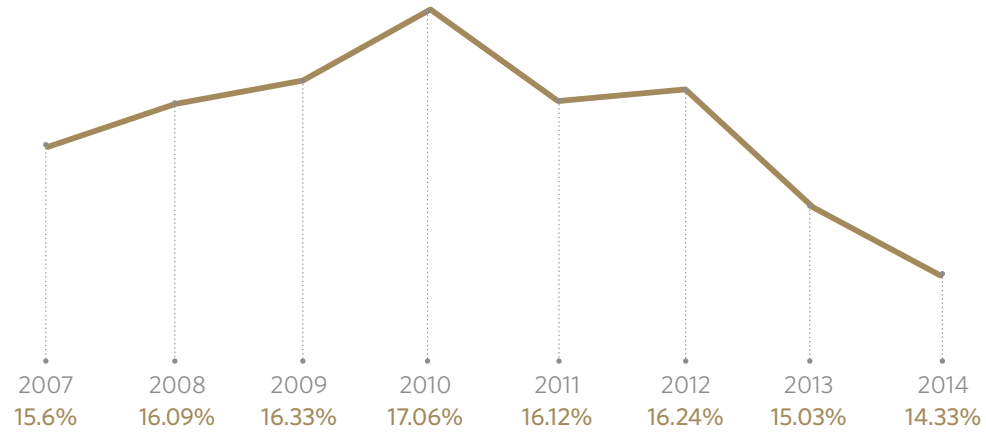
Combined heat and power plants are an important source of electricity supply for cities. Locating them near population centres and industrial plants reduces transmission losses. CHP plants account for a large share in electricity production - according to the Energy Regulatory Office they account

9 Statement of the Minister of Energy, 2016.
10 Directive 2004/8/EC on the promotion of cogeneration.
11 Directive 2012/27/EU on energy efficiency.

According to the World Health Organization (WHO), 33 of the 50 EU cities with the most polluted air are in Poland.

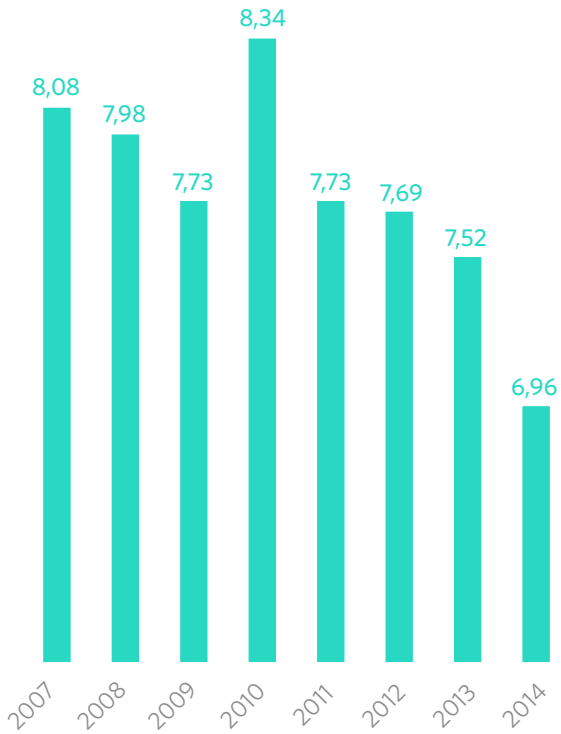
TOTAL SHARE OF ELECTRICITY FROM COGENERATION IN NATIONAL ELECTRICTY PRODUCTION (PER CENT)

Source: Ministry of Energy



REDUCTION OF CO2 EMISSIONS ARISING FROM FUEL SAVINGS IN CHP PLANTS(MILLION TONNES)

Source: Ministry of Energy



for approximately 14 per cent of the electricity produced in Poland. This share has, however, been slowly declining since 2010.

Reducing low-stack emission

The development of cogeneration and the expansion of district heating increases the chances of eliminating obsolete furnaces burning low-quality coal and even waste. According to data from 2012, 13.6 million households had 7.5 million coal stoves[12], in which the fuel burned is of very poor quality, even plastic waste. These sources largely worsen the condition of the air in Polish cities. According to the World Health Organization (WHO), 33 of the 50 most polluted cities in the EU are located in Poland. The biggest problem is the high concentration of particulate matter (PM10 and PM2.5) and Benzopyrenes. These compounds cause lung disease, cardiovascular problems and cancer. The European Environment Agency calculates that there are 47,000 premature deaths in Poland annually because of the poor condition of the air. Thus, year after year a city the size of Sanok or Sopot dies prematurely. The air breathed by 97 per cent of the Polish population does not meet WHO standards[13].

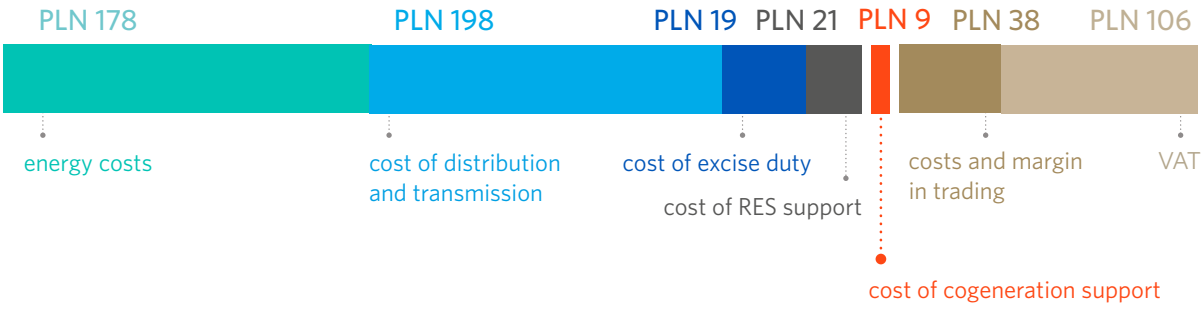
12 Justification for the draft Act amending the Statute – Environmental Protection Law, 20 February 2015.

13 In November 2015, the "Anti Smog Act came into force, allowing local authorities governments, among other things to determine the type and quality of fuel burned in their territory. Thanks to this the installation coal-fired boilers will be limited in favour of gas installations and fuels from renewable sources. Supporting cogeneration can contribute to the substitution of high-emission stoves by clean heat networks.

Disadvantages of cogeneration

COMPONENTS OF THE COST OF ELECTRICITY FOR CONSUMERS IN 2015

Source: Polska Rada Koordynacyjna OZE [Polish Coordination Council for RES]



The electricity prices in the wholesale market are currently too low to allow CHP plants to remain profitable without support.

CHP plants cannot make up for the low revenues from electricity sales by the sale of heat, as its prices are approved by the regulator. Nor is an increase in the price of heat the optimal solution. It could lead to customers disconnecting from the district heating network and the moving over to high-emission domestic stoves fired by coal. To prevent this, cogeneration needs support.

In 2015, the average household in Poland paid PLN 18 to cover the cost of the CHP support scheme. For comparison, support for renewable energy sources cost the average family PLN 42.

Short working year

Combined heat and power stations operate at full power only during the heating season, that is, for approximately 4,500 hours of the 8,700 hours possible. Conventional power plants do better – they work for 5,000-6,000 hours - but they are finding it increasingly difficult to stay on the market because of the increasing generation from renewables[14].

Limited coverage and grid losses

In contrast to electricity and gas, heat cannot be transmitted over long distances, and therefore it is produced and delivered within a single conurbation. There are usually several large heat generators and just one network operator on local markets. Creating additional transmission infrastructure would be uneconomic. The problem is losses within heating grids. According to URE, the regulator, the level of losses in the transmission of heat rose from 12.4 per cent in 2002 to 14.7 per cent in 2015. Large investments in the modernization of infrastructure are needed in order to halt this trend.

14 Combined heat and power plants running for industrial needs are in a better situation – estimates by PwC are that the total costs of production of electrical power and heat are 33 per cent and 22 per cent lower in these cases.

What can speed up the development of cogeneration

The development of cogeneration will depend on a political decision on the liberalization of the gas market and the pace of diversification of the fuel mix. In the longer term the development of the technology of district cooling and energy storage will be important.

Development of a competitive gas market

Thanks to the construction of the LNG terminal and gas connections with its neighbours, Poland is becoming more and more independent of Russian gas. Despite this, the domestic price is still determined by a contract between PGNiG and Gazprom[15]. Poland intends gradually to reduce imports of natural gas from the East in favour of other sources. According to government guidelines Poland is to be able to obtain 17-20 billion m3 of gas from the LNG terminal and Norway by 2025 (currently 5 billion). The opening of alternative routes to attract new gas suppliers to Poland will give impetus to accelerate the liberalization of the domestic market. The increase in the availability of gas will increase the attractiveness of investment in power plants burning it.

Reducing the risks of blackouts

The state-owned energy companies are focused on building large power plants (Opole, Kozienice, Jaworzno) but there is a need also for small and distributed sources, which can secure the work of large generators in case of a failure. This is a task well suited to combined heat and power plants. If Poland is to avoid a blackout, it should build new units with a total power of 17,4-24 GW before 2035[16]. According to a study by the Warsaw University of Technology, some of this gap (7.5-10 GW) can be filled by combined heat and power plants. This would translate into an increase in the stability of the power system and a reduction of annual CO2 emissions by 15-26 million tonnes.

Need for diversification of the fuel mix

The development of cogeneration creates an opportunity for the gradual diversification of the national energy mix. Modern combined heat and power plants can burn almost all available fuels, including gas, biomass, biogas as well as waste. Thanks to multi-fuel boilers, plant operators can make use of whichever fuel happens to be the cheapest available at the time. This reduces the investment risk and allows for a cost-effective use of available resources.

Energy clusters

Clusters[17] are designed to provide energy self-sufficiency for local communities. Participation in clusters will not be limited to renewable energy sources Conventional capacities can also contribute. This opens the possibility of building hybrid power plants (using different types of installations for energy production). One interesting solution is the development of small local cogeneration sources. Thanks to such units heat and electricity are produced close to the point of delivery, minimizing losses in transmission. Small CHP plants have the best prospects for development in cities from 20,000 to 100,000 inhabitants, which have heating networks, but no combined heat and power plant.

Energy storage

The importance of cogeneration for national energy security will increase in the future, mainly thanks to the development of thermal batteries. One of the available solutions is a hot water storage tank, which can be used to optimize the production of electricity. At present, they are used on a large scale in countries such as Denmark, Sweden

15 The Yamal Contract covers two-thirds of Poland's annual demand for gas.

16 Forecast for covering of peak demand for power in the years 2016-2035, Polish Power Grid, 2016.

17 Energy clusters were introduced to Polish law by an amendment to the law on renewable energy sources from June 2016.

and Germany. In Poland there are five such installations. They can respond flexibly to market needs and the needs of the network operator. In the future, development of this technology will allow combined heat and power stations to generate even more energy throughout the day or week. The European Commission is working on a new energy market design which could work in favour of the thermal batteries. This in fact promotes mechanisms for increasing the flexibility of the existing capacity.

Cold generation

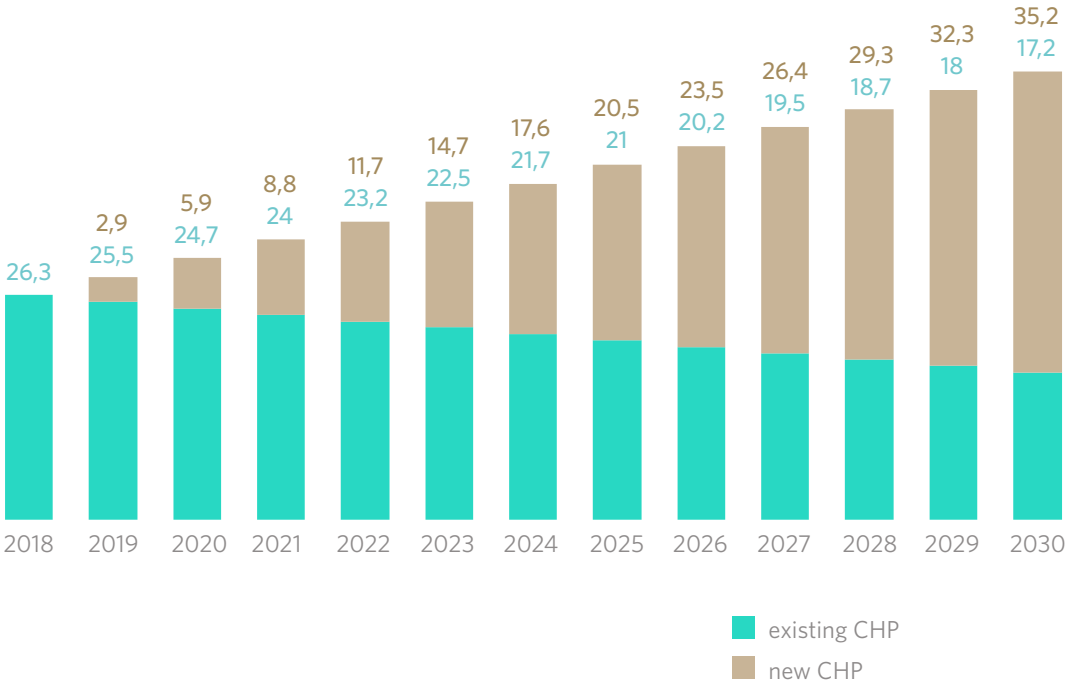
An opportunity to increase revenues of traditional heat suppliers is the provision of cooling. It may be produced by processing of hot water from the heating network into "iced water". The cooling can also be provided by means of "tri-generation", or the simultaneous production of electricity, heat and cold. The development of this technology would reduce the need for using air conditioning, which in summer increasingly falls on the electricity grid. It would also increase the profitability of CHP plants[18]. The obstacle is the high cost of this technology and low electricity prices, which make use of electric air conditioners more advantageous than buying network cooling.

Thermal batteries will gain in importance with the introduction of a new energy market design in the EU

18 According to data from 2013, installations for the production of cold have a power of 43 MW country-wide as against 7 MW in 2009. Sales of cold are also growing - in 2013 they amounted to 251 TJ, more than five times more than in 2009. According to government forecasts, the demand for cooling will increase by 300 per cent up to 2025 but the scale of its use remain the same - at 0.2 per cent of the production of heat in the same year.

FORECAST OF PRODUCTION OF ELECTRICITY FROM COGENERATION (IN TWH)

Source: EY



Challenges to combined heat and power plants

The basic problem for combined heat and power plants in Poland is that the CHP support system is to expire at the end of 2018. Short time horizon discourages investors from entering into any new projects. Unfortunately, this is not the only problem the industry faces.

More stringent environmental standards

Heat producers must upgrade their installations to adapt to the standards based on the Industrial Emission Directive (IED)[19]. This law significantly reduces the emissions of sulphur, nitrogen and particulates allowed for all energy-producing units, with a capacity of over 50 MW. Poland managed to obtain derogations which soften the impact of the directive. Despite this, by 2023 approximately 100 units in CHP plants working for the industry will disappear - including in International Paper in Kwidzyn, Mondi in Świecie and Synthos in Dwory. For the same reason worn-out units supplying district heating networks will be closed, including old blocks in Warsaw's Żerań plant.

Apart from the IED, the industry has to face the Medium Combustion Plant Directive (MCP)[20], which introduces emission limits for smaller installations (with a capacity of 1 to 50 MW)[21], and the National Emission Ceilings Directive (NEC)[22], which establishes new country-wide obligations for the reduction of emissions of the six main pollutants: Sulphur Dioxide, Nitrogen oxides, volatile organic compounds, Ammonia, particulate matter (soot) and methane, as well as possibly Mercury. Within these rules additional obligations for combined heat and power plants to reduce emissions are to be expected.

19 Industrial Emissions Directive, 2010/75/EU.

20 2015/2193.

21 new limits will come into force for new units from December 2018. Old units will have to comply by 2025 or 2030 depending on the installed capacity.

22 2001/81 / EC.

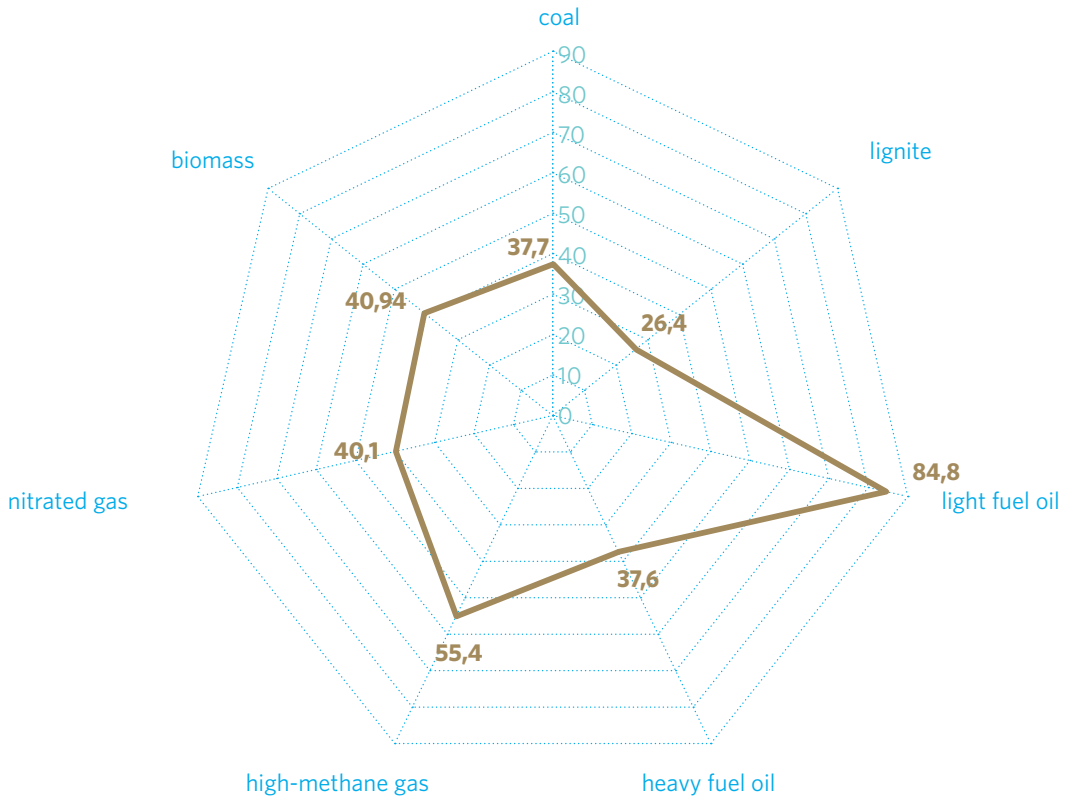
HEAT CAPACITIES NOTIFIED TO THE EUROPEAN COMMISSION FOR CLOSURE BY 2023 IN SELECTED CHP PLANTS

Źródło: Ministerstwo Środowiska

Name	Thermal power (MW)
PGNiG Termika (heat and power plant, Zeran)	874
PGE GiEK (heat and power plant, Lublin Wrotków)	526
PGE GiEK (heat and power plant, Rzeszów)	474
Grupa Azoty (heat and power plant, Tarnów)	450
Veolia Energia Łódź (heat and power plant, EC-3)	400
Energetyka (heat and power plant, E-3 Głogów)	306
Energetyka (heat and power plant, E-4 Polkowice)	255

PRICE OF HEAT GENERATED FROM DIFFERENT FUELS IN 2015 (PLN / GJ)

Source: URE



The cost of purchasing CO2 emissions allowances

Another challenge is the cost of CO2 emissions. Under the EU Emissions Trading Directive (EU ETS) all sources of heat with a capacity above 20 MW must cover each tonne of Carbon Dioxide emitted by surrendering the so-called EU Allowance Units or EUAs. Heat generators have received free allowances since 2005[23], the quantity of which gradually decreases. In the future the heat generating companies will have to buy the allowances they are missing on the market. Work is currently under way on the revision of the ETS, which is likely to reduce the pool of free CO2 emission allowances for heat producers.

Competition from small, individual generators of heat

A major challenge to CHP plants is the development of small sources of heat, such as heat pumps, biomass boilers and solar panels. The latter especially have a high potential for development. Installed on the roofs of individual family homes, collectors are used to convert solar radiation into heat. The development of this type of technology will encourage consumers to disconnect from the networks and produce heat on their own. According to forecasts 2.5 million m2 of solar collectors will be installed in Poland annually. By 2030, their total area will exceed 46 million m2, representing a more than eight-fold increase as compared with 2015[24].

No plans for development of district heating at the local level

CHP plants - unlike power plants - are designed and built to the requirements of specific locations and customers. Not everywhere opportunities exist to build new generating stations. The problem is the lack of local plans for heat generation. According to the Energy Law it is for local authorities to prepare such plans. The plans should be developed for 15 years and updated every three years. But at the moment more than half of the municipalities in Poland do not have them, making for another obstacle in the development of district heating.

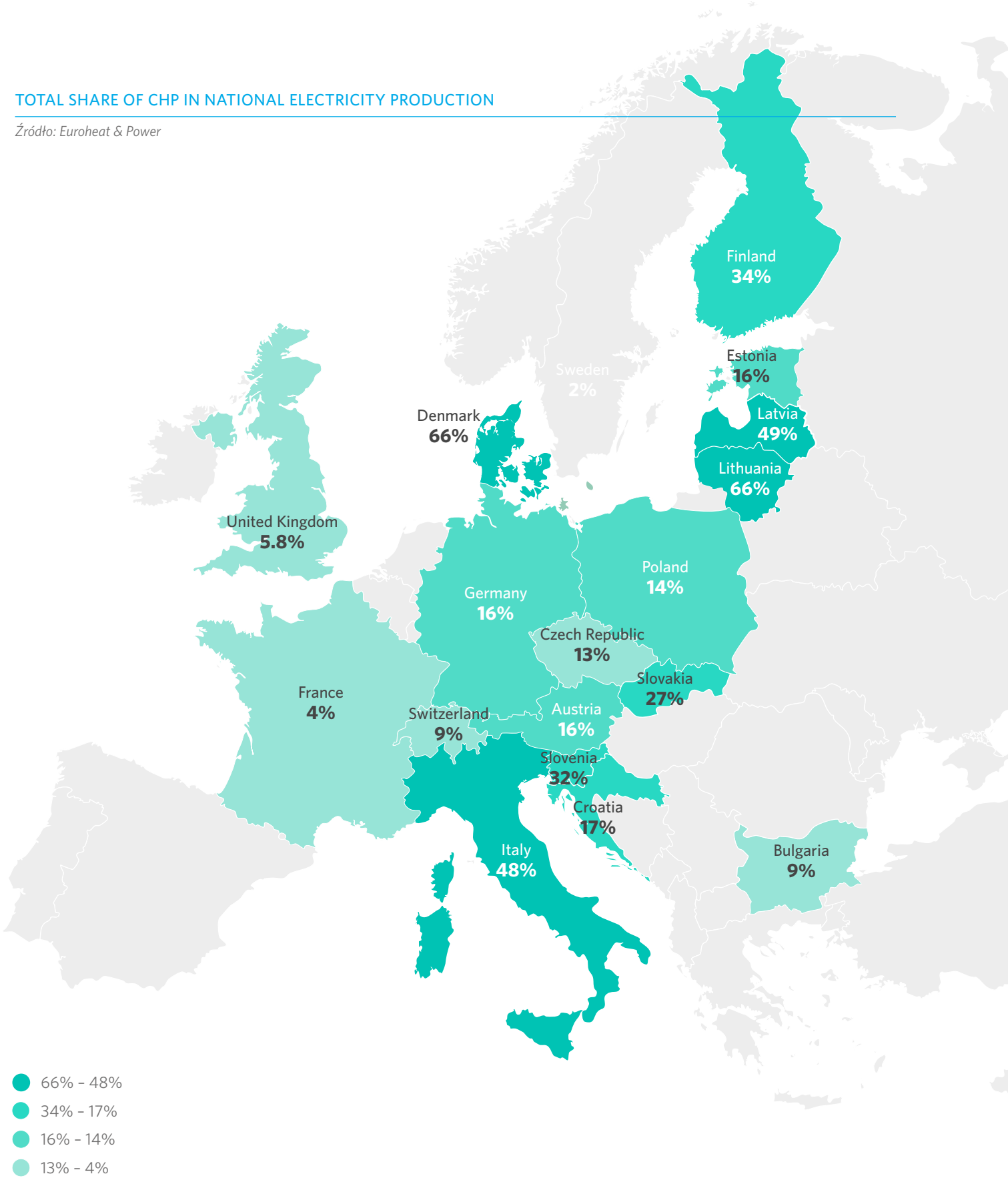
23 Free emission allowances for industry and heating are issued at the level of the "benchmark", that is, the level of CO2 emissions generated by the 10 per cent most efficient installations of a given type in the EU.

24 Rynek kolektorów słonecznych w Polsce [The market in solar collectors in Poland], J. Starościk, 2009.

Support for cogeneration in other countries

TOTAL SHARE OF CHP IN NATIONAL ELECTRICITY PRODUCTION

Źródło: Euroheat & Power



GERMANY

Type of support system	Capacity of combined heat power plants	Share of cogeneration in electricity production	Proportion of residents buying heat from the network
feed-in premium	27,2 tys. MW	16 proc.	12 proc.

Energiewende implies withdrawal from nuclear generation and coal-firing and a gradual transition to renewable energy sources. Germany wants to double the current capacity of CHP, mainly based on new, low-emission units. For this reason, the German cogeneration support system subsidizes only gas units. The size of subsidies for energy produced depends, among other things, on the size of the unit, whether it supplies energy to the grid or to the industry, whether it has been modernized and whether it takes part in the EU ETS. Coal-fired units are excluded from the support system. Exceptions from this rule are older power plants supplying to district heating networks, which would not be able to survive on the market because of low electricity prices. This support can be used for only 4,000 hours a year.

DENMARK

Type of support system	Capacity of combined heat power plants	Share of cogeneration in electricity production	Proportion of residents buying heat from the network
tax relief / *feed-in premium*	5,8 tys. MW	66 proc.	63 proc.

Denmark intends to abandon the use of fossil fuels in its energy sector and economy by 2025; CHP plants are to play a large part in the transition. The cogeneration support system is based on the feed-in premium tariff. Aid is given to combined heat and power generators for each unit of electricity produced. The costs are charged to consumers' energy bills. There is also additional support for CHP plants burning biomass and biogas. The cost is covered by the state budget. Moreover, heat production from such sources is not taxed. Subsidies are granted both for industrial CHP and installations supplying district heating networks. After 2018, the subsidy will be available only for power plants which use renewable energy sources. According to Danish law, all units with a thermal power greater than 1 MW must produce heat and electricity in cogeneration.

FINLAND

Type of support system	Capacity of combined heat power plants	Share of cogeneration in electricity production	Proportion of residents buying heat from the network
tax relief / *feed-in premium*	6,1 tys. MW	34 proc.	50 proc.

The Finnish support system for combined heat and power plants is based mainly on tax exemptions and has been set up so as to reduce the country's dependence on imports of Russian gas. Finnish combined heat and power plants can count on a partial exemption from the tax on Carbon Dioxide emissions, which is not available to the conventional heating plants. This is to ensure cogeneration is the more attractive mode of production. The Finnish system also favours the burning of biomass and biogas, which unlike peat and natural gas, are exempt from tax. On the other hand a fixed price for electricity (feed-in tariff) is available only to small combined heat and power plants that burn wood, biomass or biogas. They are also additionally rewarded if the heat they produce can be reused.

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