REPORT

on the **12TH International Power Ring Conference**

and on the

„Integrated conferences related to Poland's transformation to low-carbon economy as a key to defining its energy mix" including the following:

1. "Low carbon transformation – a recipe for greater competitiveness and innovativeness of the economy" debate held on October 24th 2016 at the Polish Press Agency PAP, Warsaw, 6/8 Bracka Street
2. "Smart Living" debate held on November 23rd 2016 at the seat of "Polityka", Warsaw, 6 Słupecka Street
3. Consultations with the young generation, held on December 8th 2016 at the Faculty of Civil Engineering, Warsaw, 16 Armii Ludowej Street
4. 12th International Power Ring Conference, held on December 15th at the Ministry of Development XII, Warsaw, 3/5 Trzech Krzyży Square

organized under the auspices of the Ministry of Energy, Ministry of Environment, Sobieski Institute, Polish Bank Association and the Mining and Energy Sector Secretariat of NSZZ Solidarność.

PROCESY INWESTYCYJNE

Dofinansowano ze środków Narodowego Funduszu Ochrony Środowiska i Gospodarki Wodnej

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12th INTERNATIONAL POWER RING CONFERENCE

CONFERENCE OPENING CEREMONY

- Krzysztof Tchórzewski, Minister of Energy,
- prof. Jan Szyszko, Minister of Environment,

SESSION 1

The role and place of energy in sustainable development

Special appearance:

- Paweł Sałek, Secretary of State at the Ministry of Environment and Government Plenipotentiary for Climate Policy.

Panel discussion with the participation of:

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- Artur Michalski, Vice-President of the National Fund for Environmental Protection and Water Management,
- Andrzej Kaczmarek, President of PSE Inwestycje SA,
- Bolesław Jankowski, Vice-President of PGE Polska Grupa Energetyczna SA,
- Jacek Janas, President of Tauron Wytwarzanie SA,
- Stefan Świątkowski, Vice-President of KGHM Polska Miedź SA,
- Robert Stelmaszczyk, President of innogy Stoen Operator Sp. z o.o., Chairman of the Polish Power Transmission and Distribution Association,
- Gerard Bourland, General Director of Veolia Poland,
- Grzegorz Nowaczewski, President of Virtual Power Plant.

Moderator: Wojciech Jakóbik, Biznes Alert

SESSION 2

Integrated energy and climate plans for Poland 2030 and 2050

Special appearance:

- Samuele Furfari, Policy Coordinator for Director General, DG Energy, European Commission

Panel discussion with the participation of:

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- Waldemar Szulc, Towarzystwo Gospodarcze Polskie Elektrownie,
- Roman Szwed, President of ATENDE SA,
- Maciej Bukowski, President of WiseEuropa,
- Stanisław Poręba, expert, EY,
- Tadeusz Bąk, President of Clean World Energy Systems,
- prof. Jan Popczyk, Silesian University of Technology,
- Marcin Korolec, President of the Foundation for the Promotion of Electric Vehicles

Moderator: Bartłomiej Sawicki, Biznes Alert

SESSION 3

Circular economy – a flawless solution, in principle, but one difficult to fully implement

Special appearance:

- Halina Bownik-Trymucha, Chairwoman of The Policy Council of Procesy Inwestycyjne Sp. z o.o.

Panel discussion with the participation of:

- Małgorzata Mika-Bryska, Regulations and Public Relations Director, Veolia Energia Polska,
- Tomasz Szczygielski, Polish Combustion Byproducts Union,
- Leszk Drogosz, Director of the Infrastructure Department of the Warsaw Capital City
- Bogdan Ślęk, Chairman of Development Committee of the "Pro-Lighting" Union of Lighting Equipment Manufacturers,
- Jarosław Tworóg, Vice-President of the National Economic Chamber for Electronics and Telecommunications.

Moderator: Bartłomiej Derski, wysokienapiecie.pl

Conclusions from the 12th International Power Ring Conference

1. Poland significantly reduced its greenhouse gases emissions between 1988 and 2000;
2. Since 2000, emission levels have been more or less constant (about 400 million tons of CO_2 excluding land use changes and about 360 million tons of CO_2 taking into account LULUCF), despite significant economic growth;
3. The Polish Government will endeavour to ensure that the EU climate and energy package includes similar principles as those of the UN climate agreement and takes into account land use changes;

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4. Replacing old coal-fuelled generation units with new high-efficiency ones is one of the ways to reduce CO2 emissions from the energy sector;
5. With the increasing share of renewable energy sources (RES), newly built coal-fuelled generation units may in the future slip down the merit order, thereby aggravating their difficult economic situation;
6. This is why some experts recommend to revitalize and increase the flexibility of existing coal-fuelled units that will be able to work in tandem with RES;
7. The financial situation of energy companies may also be aggravated by some of their clients switching to individual sources of energy;
8. In the future, this may give rise to problems with the maintenance costs of side-lined power lines;
9. Another way to reduce greenhouse gas emissions is to use the underrated potential for energy efficiency improvement (especially in the building sector), including development of CHP;
10. The present RES support model should be replaced by one that is more competitive and that encourages RES to participate in the energy market;
11. The power market mechanism may help solve the problems of maintaining power capacity reserves and financing new investments;
12. The construction of coal-fuelled generation units, planned by the Polish Government, will be negatively affected if the proposal of the European Commission to render projects with unit emission of more than 550 kg CO_2/MWh ineligible for financing through the power market is accepted;
13. Poland should put forward to the EU a comprehensive long-term vision for the transformation of the Polish energy sector; such an initiative could be helpful in the implementation of medium-term goals, such as a power market for coal-fuelled power plants;
14. In addition to energy efficiency, electrical transport could become the second ground breaking technology in the Polish energy sector; the Government should pursue its development for various reasons related to both economy and environmental protection;
15. Successful implementation of circular economy requires both new regulations and public awareness building;
16. New technologies provide a growing contribution to circular economy by, among others, virtualizing some segments of consumption and providing solutions such as car sharing or integrated urban transport systems.

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Poland is reducing emissions

In his opening address at the 12th International Power Ring Conference, **Krzysztof Tchórzewski, Minister of Energy**, pointed out that the transformation of the Polish energy sector is a difficult, complex and costly process. He remarked that "old" EU countries began their transformation decades earlier whereas Poland in 1989 was at a very different starting point. "We have to remind our EU partners of this from time to time […]. This is also the reason why we expect a different approach on their part" – the Minister said, adding that he had used such argumentation when notifying the EU of the latest mining industry restructuring programme.

He also said it is not Poland's fault that at the start of the transformation its energy sector was almost 100% coal-dependent and based on obsolete technologies. The rate at which we are switching to other sources may be "a subject of debate". The Minister stressed we are aware of the inevitability of further efforts to modernize and develop the Polish generation industry. Projects which are under way or in the planning phase are coal-based, but from the point of view of energy efficiency the difference between existing and future coal-fuelled units is enormous. "Some scientists say that traditional coal-fuelled power plants can reach efficiencies of about 60%. If we can generate twice as much energy per unit of coal input, emission reduction will be significant" - Krzysztof Tchórzewski pointed out.

The Minister explained that the transformation of the Polish energy sector will be based on coal and that the Government will not give up on it despite the obstacles posed by EU legislation. He brought up the case of the gas-fuelled generation unit in Stalowa Wola as one of the arguments in favour of coal-based energy. "A virtually identical power plant in Germany is profitable while our plant generates PLN 100 million of losses per year with the heat prices for end users 15% higher than from a coal-fuelled heat and power plant"- he said.

"There is no risk of Poland lagging behind with achieving the required share of RES. In fact, our share is even higher" – added Minister Tchórzewski. "This is very good from the point of view of the European Commission, but not so good from the point of view of electricity prices, as households and companies have to pay hundreds of millions more in energy bills. We should be straightforward about it – this is not in our interest. We must minimize the risk of end consumer energy price increases" – he noted.

Paweł Sałek, Deputy Minister of Environment, agreed, remarking that climate policy as a whole, and emission reduction technologies in particular, are costly, and somebody has to pay for them in the end. "Personally, I think it should be as cheap as possible" - he said. "Some of our European

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partners don't understand or don't want to understand Poland's situation. While there is understanding on the global level, talks on the European stage are difficult. But we have been clear about our position for a year" – he added.

Deputy Minister Sałek also noted that Poland has made great progress in emission reduction. We used to emit 1000 kg of CO_2 per MWh and now we are down to 700. Once can say this is Polish science's natural input – a contribution within the framework of global agreements" – he argued.

Bolesław Jankowski, Vice-president of PGE Polska Grupa Energetyczna pointed to the inconsistency between the national energy policy and the regulatory framework. "Poland's energy policy underlines the role of coal as an important element of the energy sector and the foundation of energy security. However, on the regulatory level there are many elements transposed from the EU level that implement the policy of decarbonization. This refers to in particular to the carbon credit system which aims to put a cost on CO_2 emission and effectively make fossil fuel sources less competitive" – he said. In his opinion, from the Polish economic perspective it makes sense to stick to coal-based energy, at least for some time, while transforming the sector so that it achieves higher energy efficiency using new technologies. "It also makes sense to develop new RES solutions that fit Polish conditions" – he added.

He also stressed that PGE's strategy includes both the development of state-of-the-art conventional energy and the development of new technologies and business models. "From the point of view of such strategy, it is important that political goals and regulations be coherent" – Bolesław Jankowski assessed. "With rising CO_2 prices, and that's what the EU policy is about, it will be difficult to develop coal-based energy, even if it is to rely on energy-efficient solutions" – he noted.

EU decarbonization vs. the Paris agreement

Representatives of the Polish Government noted that the European Union's energy and climate policy is much more stringent than the global Paris agreement.

Jan Szyszko, Minister of Environment, argued that Poland should focus more on the fulfilment of its obligations under the global climate agreement rather than on a regional agreement, by which he meant the EU energy and climate package. Szyszko stated that energy policy is part of climate policy and that the latter is part of global sustainable development as defined in 1992. "Sustainable development is economic growth coupled with rational use of resources" – he added.

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“Poland is a world phenomenon in terms of the concentration of traditional energy resources on such a small area. About 80% of EU hard coal and 25% of brown coal is in Poland, we have immensely rich shale gas deposits and geothermal resources” – prof. Szyszko continued.

The Minister stressed that Poland is strongly committed to climate policy, as evidenced by its full implementation of the Kyoto Protocol. He also noted that the new Paris climate agreement aims at reducing atmospheric CO_2 as quickly, as cheaply and as effectively as possible. “Poland has two opportunities – innovative combustion technologies and carbon sequestration by forests and soils to aid the regeneration of these natural systems” – he assessed.

“Poland has the possibility to use regional resources and we must build our energy security on our own resources which may also guarantee energy security for many EU regions. We have new technologies and will work on reducing emissions, but we will also be making use of our strengths recognized worldwide” – the Minister said. He explained that what he had in mind was carbon sequestration by forests. “We have one of the best organized forestry sectors that is capable of sequestering up to 30 million tons of CO_2 per year while protecting biodiversity and producing wood as a zero-carbon raw material. And wood waste is a renewable energy resource. This is our idea of circular economy and an opportunity for Poland to become carbon neutral. We must not forget the foundations of the UN climate convention, restored by the Paris agreement” – the professor said.

Paweł Sałek, Deputy Minister of Environment and the Government’s plenipotentiary for climate policy expressed the view that the Paris agreement brought about a fundamental change in the global approach to climate protection. “Every state, depending on its potential and natural resources, may shape its climate and energy policy, contributing to the implementation of the agreement. Therefore, nobody should be coerced into reducing emissions and forced to use certain technologies, but unfortunately this is just what is happening” – he argued. He also noted that the Paris agreement does not mention decarbonization. “This is a very trendy word in Europe, a word, to put it bluntly, that the Polish Government does not accept. The Paris agreement encourages climate neutrality. We point out to our European partners that we should be using language used on the global level instead of creating a “language of decarbonization” on the European level, because this is not what the whole approach is about” – Deputy Minister Sałek stressed.

The Plenipotentiary added that the Polish Government believes there should be more focus on CO_2 utilization. “And it is our original Polish idea that reducing atmospheric CO_2 concentrations should be approached using the cheapest, most cost-effective methods. If we are to reduce these concentrations, we should, among others, use forests” – he stated.

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“We don’t need to end up in a situation where we will be forced to reduce emissions from the manufacturing and energy sectors through some red tape mechanisms like MSR (Market Stability Reserve). Europe is very vocal about development and innovations but, on the other hand, the matter boils down to how much can each party emit” - Paweł Sałek added.

The representative of the largest state-controlled energy company shared the views of the representatives of the Ministry of Environment. **Bolesław Jankowski, Vice-president of PGE Polska Grupa Energetyczna**, underlined that the Paris agreement allows for great elasticity in the achievement of goals, but in spite of that Poland has to implement a very restrictive European policy that leads to decarbonization through high CO_2 prices. “This is a contradiction. Poland should endeavour to enjoy terms similar to those that apply to other countries under the global process, to ensure that equal terms apply to all countries of the world. After all, climate is a global problem and EU policy is regional and as such should also conform to the global framework” – he said.

The Vice-president of PGE noted that there are countries in the world that have serious climatic obligations and yet they pursue the development of conventional energy. “One example is Japan, where coal is one of 4 pillars of the future energy sector and where gasification technologies are being developed. This is a reference point for Poland” – he assessed. In his view, coal-based technologies are and can be competitive. “True, they will not withstand high CO_2 emission prices, but the imposition of these prices is a political decision” – he noted. According to Bolesław Jankowski, transformation towards low carbon may take place without additional costs, e.g. if the shape of the development programme is imposed by appropriate regulations. “Competitiveness could then be maintained without charging the clients with the high CO_2 costs” – he assessed.

In relation to the statements of representatives of the Polish government, **Professor Samuele Furfari, advisor to Director-General for Energy at the European Commission**, indicated that Brussels has neither the powers nor the tools to impose specific fuel mixes on the individual Member States. – EU takes efforts to act in many fields. The "winter package" envisages the introduction of 18 legal instruments in total, which is a comprehensive approach. It tells us how the individual solutions can help Poland as a country, and is also a method of implementing the provisions of the Paris agreement, said Furfari.

On his part, **Stanisław Poręba from the EY consulting company** suggested that Poland should quickly develop on its own “aggressive” integrated national energy and climate plan provided for by the regulation on the governance of the Energy Union. According to an analysis by EY, such a plan, while ensuring rational greenhouse gas reduction levels, could include coal in amounts close to the present level, as well as 10-12 GW of wind and photovoltaics installed power, with room for gas

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and biomass. Poręba stressed that the energy mix could follow various scenarios, but most of them would include enough coal to ensure that problems in the mining sector are resolved smoothly. The analysed scenarios did not take into account the construction of new, large coal-fuelled units (900-1000 MW), as they would be difficult to fit in the Polish energy system. “An aggressive plan and an attempt to get it approved by the EU would change the opinion about us, we could show we are implementing an energy and climate policy and not just defending Polish coal” – Stanisław Poręba said.

The sensibility of construction new large coal-fuelled units, as announced by Minister Tchórzewski, was also questioned by **prof. Jan Popczyk of the Silesian University of Technology**. “How do we reconcile the construction of a unit in Ostrołęka with the “winter package” which is primarily about efficiency?” – he asked rhetorically.

In the opinion of **Maciej Bukowski of the Wise-Europa think-tank**, in the long run, it will be impossible to reconcile coal, or even gas, with climate policy. “If CCS does not go mainstream, developed countries will have to give up on fossil fuels in 2070 at the latest” – he said. According to him, by planning to invest further in large coal-fuelled units, the Government is running a serious risk of wasting billions of zlotys. “They require huge expenditure and make sense only if they operate non-stop. This is in serious conflict with the development of renewable sources whose competitiveness is rapidly growing and at some point will be unstoppable even through regulations” – Bukowski said. In his view, such projects are threatened by a huge rise in emission costs that will eventually materialize. “As soon as that happens, they will become unprofitable” – he added. According to Bukowski, fossil fuels are indispensable during transition towards low carbon, and whether it should be coal or gas is not that important. “What is more important is to ensure that they are supplementary rather than basic sources” – he explained.

The impact of global and EU policies on the Polish energy sector was also assessed, thorugh a vote, by the panel’s audience gathered in the Dome Hall of the Ministry of Development. A vast majority of the audience decided that the Paris Agreement will also have a significant impact on Poland’s energy sector and will create a need to intensify work on innovative solutions reducing emissions from the sector. The audience also pointed to the possibility that EU regulations concerning greenhouse gas reduction will become even more stringent.

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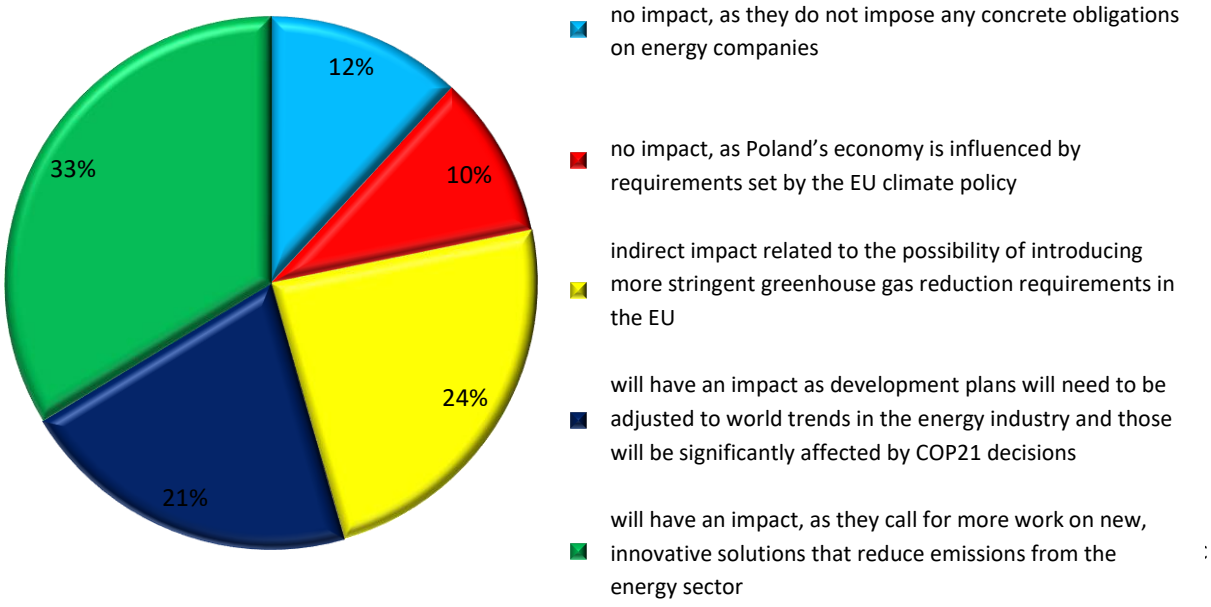
What impact, if any, do the COP21 decisions made in Paris have on the Polish energy sector:



Power markets closed for coal?

In the opinion of **Krzysztof Tchórzewski, Minister of Energy**, the EU energy and climate policy first and foremost affects directly the Polish energy sector. He cited the 550 kg CO_2/MWh emission limit, proposed by Brussels to be the limit up to which projects could be supported through the power market, as the best example supporting his claim. "However," – he noted - "we can still afford a lot and shall not stray from our path" – he said reassuringly.

"To put it bluntly, we don't like this limit. The question is, are we for fair climate protection in Europe or for forced technological transfers, because this is what the issue comes down to. I doubt if this is a fair approach to climate protection" - **Paweł Sałek, Deputy Minister of Environment**, echoed him.

In his assessment, the power market mechanism has been biased by this limit. He also noted that precisely this value (550 kg CO_2/MWh) has been featuring in recent years in the internal regulations of certain non-commercial banks which have governments among their stakeholders. This means that these banks will not invest in technologies that emit in excess of the limit. "The fact that such provisions are making it into EU law is dangerous. To put it mildly, this is not OK" – said Paweł Sałek, assessing that this might also affect the Modernization Fund of which Poland is supposed to be the

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largest beneficiary. “The Fund is to be managed by one of those banks” – the Deputy Minister said, adding that the Polish energy sector, covering utility power plants, heat and power plants and heating plants, cannot invest and buy emission credits at the same time.

Andrzej Kaczmarek, President of PSE Inwestycje, argued that excluding coal-based conventional energy from the power market through the 550 kg CO_2/MWh limit will make it impossible to balance the energy system, even in the short term, and the power market will cease to make sense. He remarked that today the National Electric Energy System (KSE) includes 26 GW of disposable sources, all of which are conventional. 60-70% of the 20 GW-worth of long term connection contracts that PSE has signed will also be supplied by conventional sources.

As he said, power demand, and especially peak power demand, is growing and while today peak demand is about 26 GW in winter and 22 GW in summer, in 2035 these values will be 10 GW higher, if present trends continue. And this is by how much disposable power in the system has to increase. The only possible answer to these challenges is to invest in the network and in energy generation.

Interestingly, in a vote held at the end of the discussion, the majority of the **audience** expressed the view that the low carbon transformation will result in either a minor increase or no increase in energy demand.

Waldemar Szulc of Towarzystwo Gospodarcze Polskie Elektrownie explained that power markets are one of the mechanisms of energy security, i.e. ensuring uninterrupted and reliable supply of energy at acceptable prices. “Under the winter package, individual countries should act in a way that ensures common goals are reached at the lowest possible cost. Poland’s utility energy sector is a leader in the achievement of reduction goals” - Szulc said. He also pointed out that 11 EU countries have various mechanisms for supporting energy producers, so why is there no such thing in Poland?

According to Szulc, today, with subsidized RES which enjoy preferential development terms, have priority grid access as well as guaranteed power sales and prices, the energy market can hardly be called a market. “Even if 80% of energy came from RES, stable reserves would have to be maintained as backup for a large portion of RES, thereby generating costs that would need to be covered, among others through the power market” – he argued.

“Let RES develop, but not at the expense of our clients. Let’s all generate and deliver our product on equal terms” – he added. In his opinion, we should not be afraid of the “winter package” but it should be implemented in a way that benefits all EU residents. Hence, we need derogations,

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depending on how much time each country needs for adapting. “The deadlines should be shorter where there’s little coal and longer where its use is widespread” – Waldemar Szulc argued.

Professor Samuele Furfari of DG Energy, the European Commission, agreed with the previous speaker. As he said, one of the main objectives of the winter package is to rebuild the power market. – It should be admitted that under the previous directive, too often the market was distorted. It is therefore necessary to reduce subsidies so that the market mechanisms can finally work, pointed Professor Furfari. He also argued that sometimes the power market mechanisms are necessary to avoid subsidizing of energy. – One of the ways is to use the neighbouring country’s resources, before we start subsidizing our own ones. This promotes better integration, he explained.

Referring to the threshold of 550 kg CO2/MWh, Furfari emphasized that Poland may build coal-fuelled power plants if it intends to. – Yet, we suggest not to accept such power plants as subsidized reserves. It is not prohibited to construct such plants, but it is prohibited to subsidize them under the capacity mechanisms. Moreover, the Directive may enter into force in 2025. Those who start to build power units earlier, will be able to use the capacity market without restrictions, he stressed. He also indicated that the European Parliament and the European Council will have to accept the final provisions and thus, there will be debates and discussions. – It is uncertain how they will end, but there will be negotiations. This will certainly take a lot of time, assessed Furfari.

New technologies will aid the transformation

Kamel Ben Naceur from the International Energy Agency presented, at the Power Ring conference, the IEA‘s work of the IEA on the global economy decarbonisation paths which would limit the average temperature increase to 2 degrees by the end of the century. He reminded that in order to achieve this target, by 2050 the annual global CO2 emissions must drop from 35 to 15 Gt (billion tonnes). – There are five main factors which jointly make it possible to achieve the target, said Ben Naceur. A third part of the necessary efforts should be devoted to improving energy efficiency, and the same amount to the development of renewable energy sources. 15% should go to CO2 sequestration, 11% to nuclear power, and 10% to the transition from coal to gas, he enumerated. He also noted that the cost of decarbonisation will be much higher if measures taken in those individual areas are not consistent with each other.

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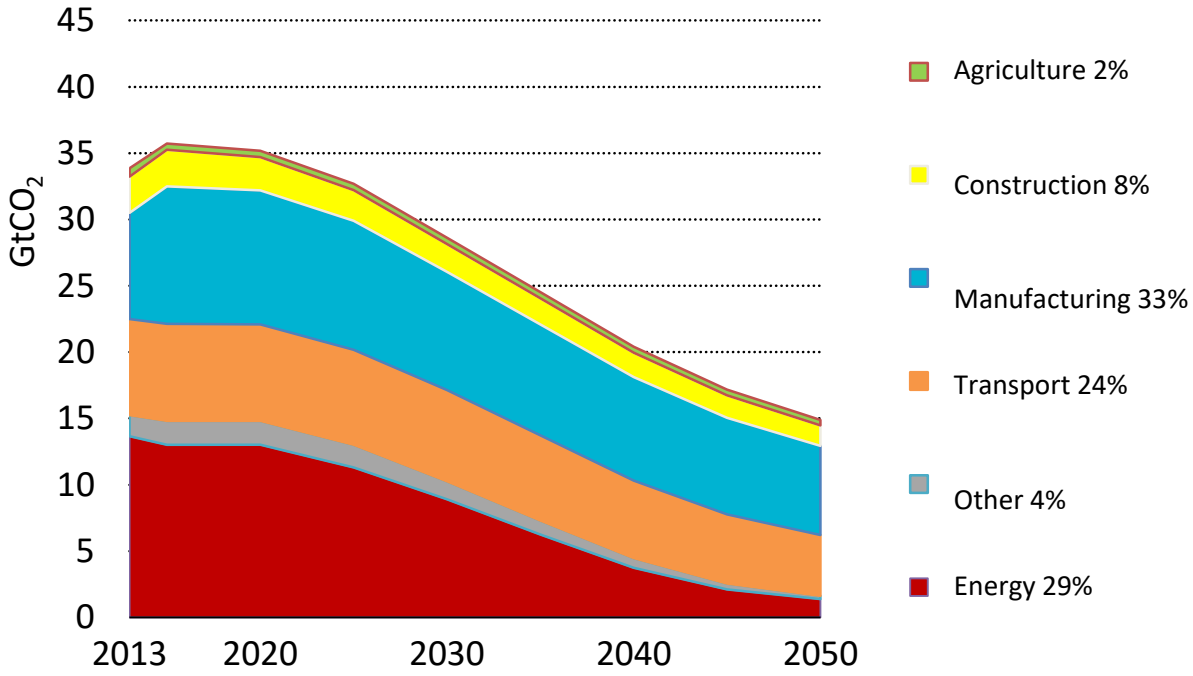
Required reduction of CO2 emissions by sector in order keep the global temperature rise at 2 C above the preindustrial era, according to the IEA scenario



According to the IEA analyses presented by Ben Naceur, until 2050 the largest emissions reductions will occur in industry and transport. In that period, the power sector should achieve a very low level of emissions. In 2050, the largest source of primary energy should be biomass, and fossil fuels' share should decrease from 80% to a maximum of 50% or, preferably, even 45%.

The Agency also evaluated the activities in the individual areas in order to indicate where the efforts are insufficient, where some progress is achieved, and where everything is on the right track. As Ben Naceur said, significant improvement is required in: coal combustion efficiency, CO2 capture, biofuels and construction. Some progress, although insufficient is observed in nuclear power, renewable energy sources, energy storage, lighting, transport and industry. On the right track are: photovoltaics, wind power and electric cars. He also noted that the costs of RES are falling rapidly because of the technology price decrease as well as the support systems' transformation towards auction systems.

The IEA representative remarked also that it has already been a few years since the main weight of investments shifted from the EU and USA to China.

Technology development vs. Demand (according to IEA)

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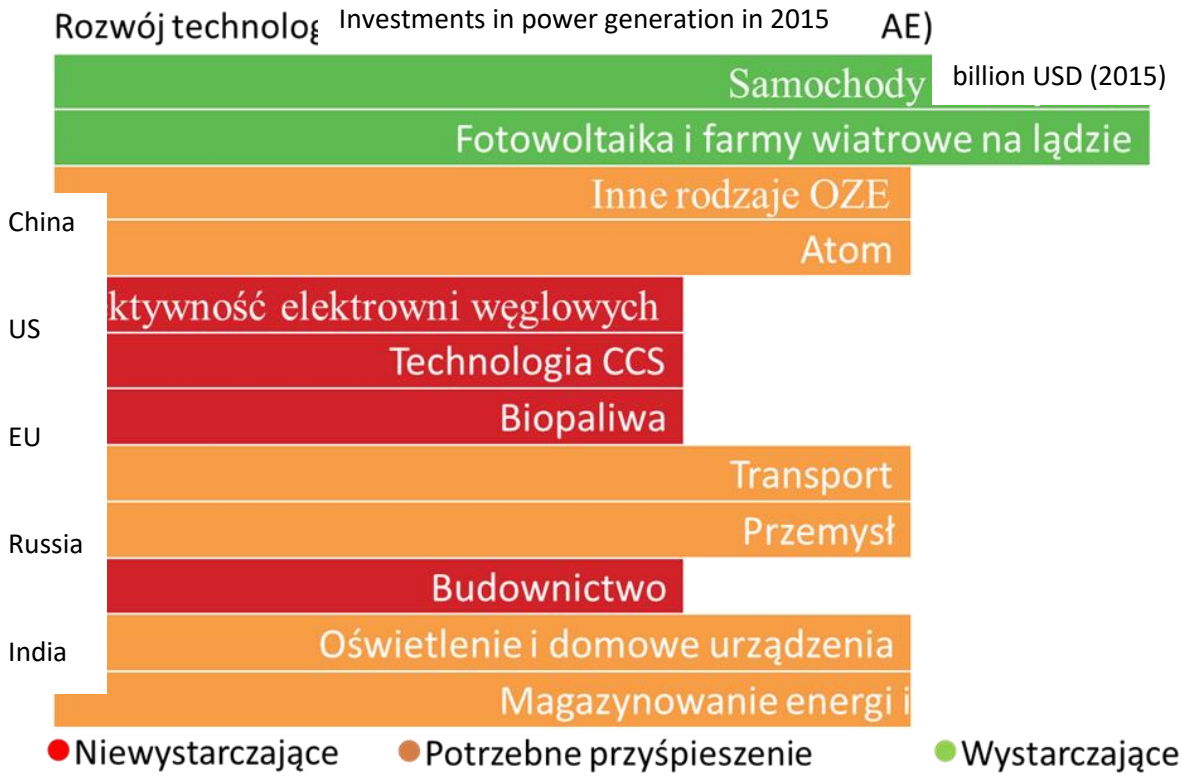
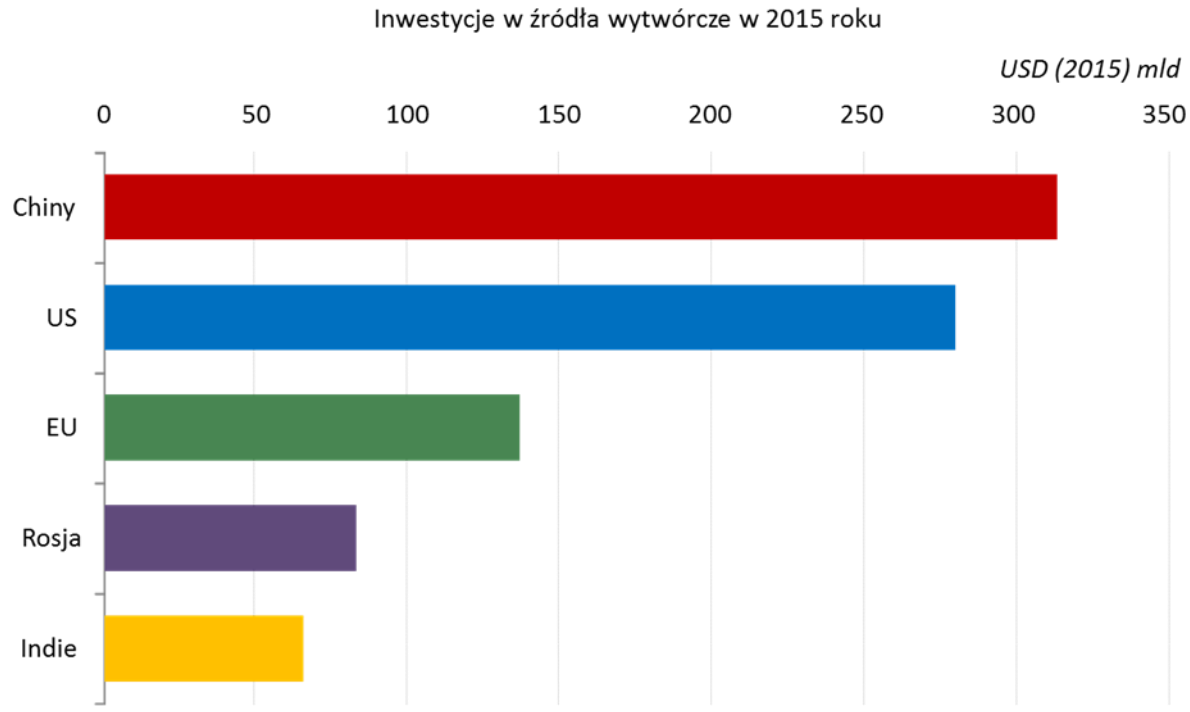
Electric cars

Photovoltaics and land based wind farms

Other RES





Professor Jan Popczyk pointed to those development trends that may play a key role in Poland. "Electrification of the transport and construction sectors and passive housing should be the key areas in the transformation of the energy sector with the participation of prosumers. Looking at

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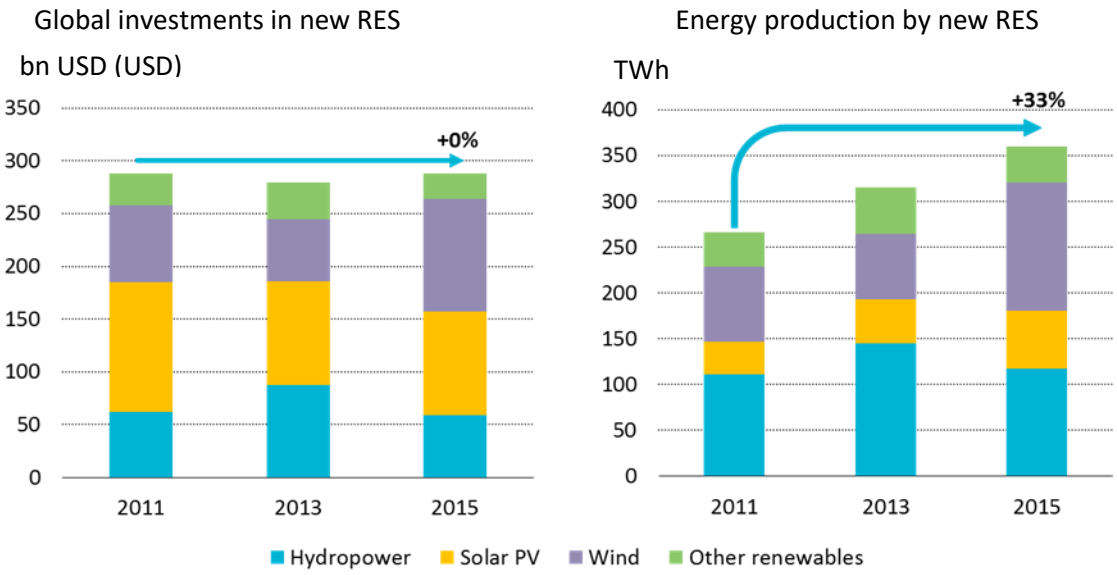
Poland's energy balance, today we have 1000 TWh in fuel (coal, crude oil, gas) and only 520 TWh on the end user level. With electrification and passive housing, 200 TWh would be enough, but that amount would come from RES. This is the scale of the challenge ahead" – Popczyk said. In his opinion, the EC could accept some compromise regarding Poland's coal energy sector in return for declarations and action in other areas of the "package". "But the coal-based energy industry should be revitalized and not built anew" – Popczyk added.

Global trends resulting in growing efficiency and decreasing prices of RES installations are conducive to the changes proposed by prof. Popczyk. According to data of the International Energy Agency, presented at the Power Ring conference, investments in new renewable energy sources have not grown in recent years, but with the same investment level the energy output is one third higher than just five years ago. This is the combined result of falling prices of individual RES installations and of the growing power generation efficiency of new technologies.



Marcin Korolec, former Minster of Environment, on the other hand, pointed to transport electrification and electromobility as potentially a strong stimulus for the Polish economy. "Electrification could have the same phenomenal effect as EU funds" – he argued.

Korolec continued that the technological race in electric transport is heating up and the greatest changes are to be expected in the field of batteries. "Luckily we are still far from the limits of what's possible. The things that are used in cars today were basically developed for laptop computers. Batteries designed from step one as car batteries are only just entering the scene" – he said.

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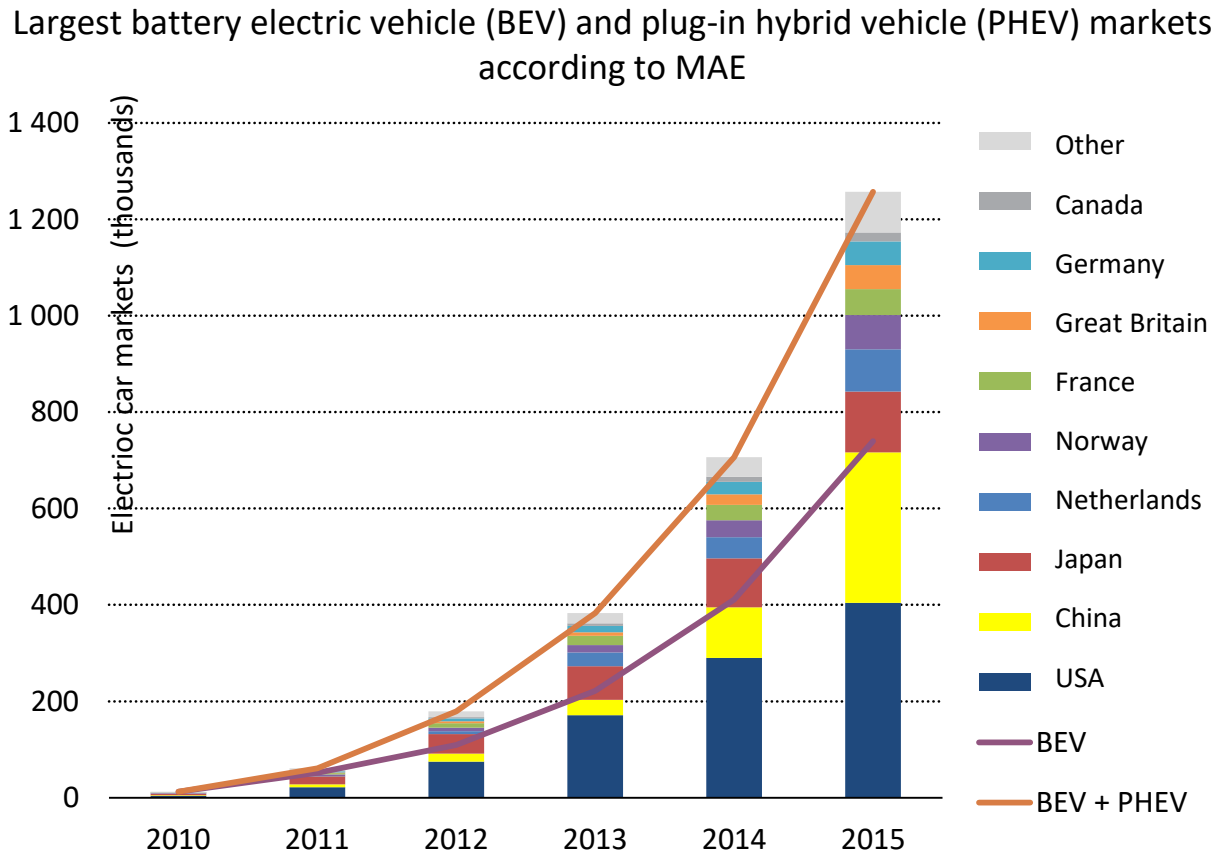
It is important that Poland be at the head of this race and not at the tail end. “Otherwise we might find ourselves in a situation sometimes referred to as the moderate development trap, but which may also be called the old diesel trap. With the aggressive promotion policy in Europe, we might face a reality where cars will be parked the streets of Berlin, Paris or Amsterdam with notices under the windshield wiper saying “the keys are in the switch, please drive away – I need this place to park my new electric car” – Korolec explained.

In his opinion, tax issues will also play a significant role. “I hope Deputy Prime Minister Morawiecki will be more true to his first post, that of Minister of Development than to the post of Minister of Finance, which he assumed later. Travel by an electric car is 2/3 cheaper. And taxes make up half of the price of fuels” - Korolec pointed to possible fiscal temptations. This is why, according to him, Poland should put forward to the European Council a proposal not to charge VAT or excise duty on electric energy for cars, as our input to the debate.

Unfortunately, as of today, according to data presented by the representative of the International Energy Agency, Poland is not even visible in most statistics on electric and plug-in hybrid cars:



Roman Szwed, President of Atende, remarked that large-scale implementation of electromobility could cut the harmful effects of emissions by half to two thirds and perhaps the EU would notice

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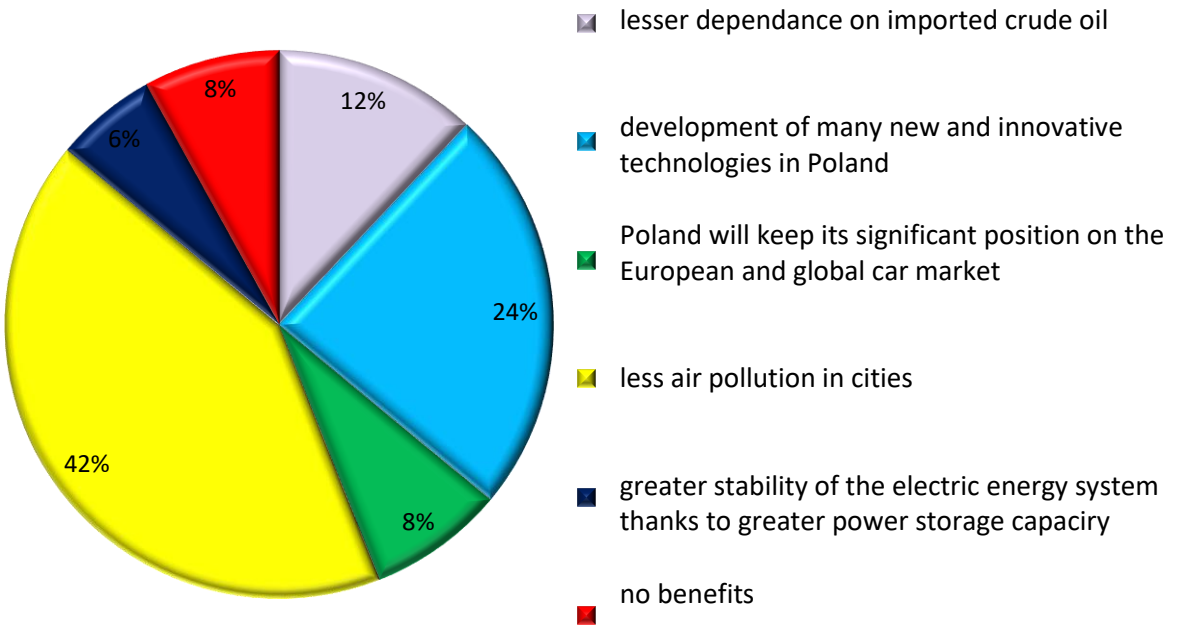
and appreciate such a development. “We should have a clear goal, an economy based on electric energy” – Szwed said. “Not on coal, because something will eventually replace it as a source of electric energy” – he added. “But we need to build a “smart grid” and energy stores, and solve other grid problems” – he remarked, stressing that the coal era will come to an end, but the grid will remain.

However, in their vote, the **audience of the conference** expressed the view that in the case of transport electrification, the development of innovation and technology will be of secondary importance. In their opinion, the greatest opportunity associated with e-mobility is the reduction of emissions from combustion fuels.

What main benefits would an electromobility programme bring:



Interestingly, according to IEA data, Japan and the European Union, the superpowers of electromobility and innovation in general, have already been overtaken by China, a country which until recently has been considered the West’s factory. According to the Agency’s forecasts, China will very soon overtake the United States in terms of expenditure on research and development.

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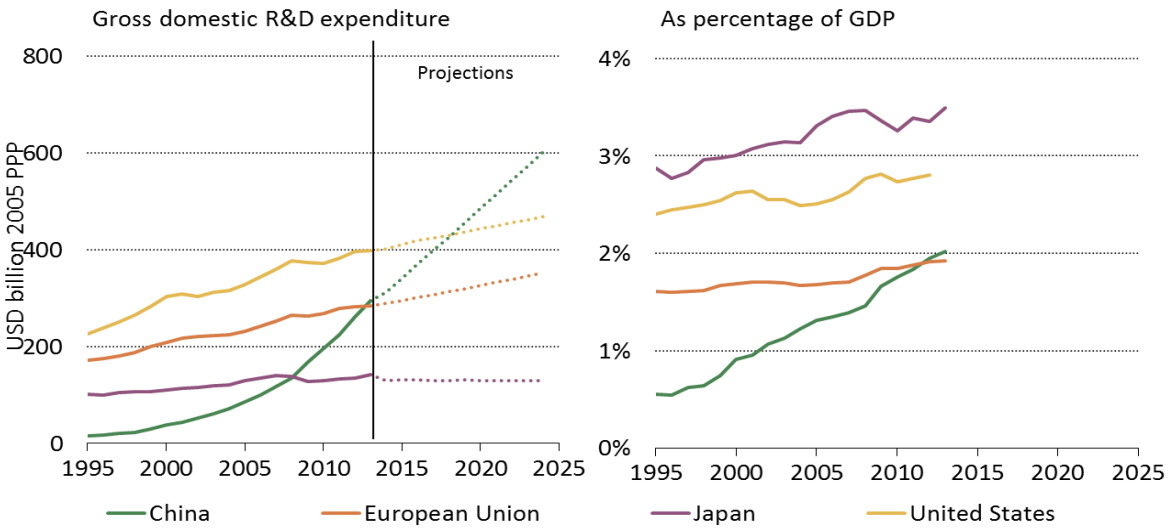

Jacek Janas, President of Tauron, remarked that the role of energy companies themselves has also changed in the past 3-4 years. “Their main task is not just to deliver their product (electricity) but to guarantee uninterrupted functioning” – he pointed out. As he said, it will take 20-30 years to fully develop a method for storing electricity and in the meantime conventional energy will provide a very good bridge to the future. “Coal-fuelled power plants are becoming more efficient and flexible” – he noted. Janas also assessed about PLN 140 billion will be needed in order to reach a 30% share of RES in Poland’s energy generation. According to him, about 20 billion may be provided by various compensation mechanisms, but the rest will have to be found on the market.

Other market actors are also aware of the changes taking place in energy companies. **Grzegorz Nowaczewski, President of VPPPlant**, noted that the attitude of traditional energy companies to state of the art efficiency solutions is changing for the better. As he said, his company, together with the energy companies, offered some types of clients energy use optimization services bundled with the energy supply contract. “We return 50% of the savings to the end user and split the rest between us and the energy company, and it works” – Nowaczewski said. He argued the best development model would be to implement small pilot-scale new technology projects, with minimum bureaucracy, partly for research and development purposes, but with commercialization in mind.

Clients are gaining independence

The panel participants noted one more challenge faced by energy companies – the fact that more and more of their clients begin generating energy themselves, thereby depriving the companies of

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some of their income. This trend concerns the business sector as well as individual clients (so called prosumers).

Stefan Świątkowski, Vice-president of KGHM, recalled that after the 2007 Cyryl hurricane, which had seriously damaged the power grid in Lower Silesia, KGHM built its own energy sources – two gas-fuelled units capable of operating in total isolation from the grid. Moreover, what has been implemented may be called a tri-generation solution, as some of the heat, depending on demand, is used for cooling. Both heating and cooling agents are required for copper mine air conditioning. "In all, we are making huge savings" – Świątkowski assessed, adding that, contrary to what Minister Tchórzewski had said, in the case of KGHM, gas turned out to be more competitive than coal.

Taking his turn, **Robert Stelmaszczyk, President of innogy Stoen Operator**, mentioned growing challenges faced by distribution grid operators in connection with increasing autoproduction. "The tariff structure is not consistent with the grid cost structure and bills do not reflect actual costs generated by particular grid users" – he said, citing such practices as shifting grid costs from prosumers and distributed generation entities to energy consumers. "There is no other option but to gradually harmonize the bill structure with the degree to which the grid is being utilized. This means the prices per transmitted kWh will fall, so energy will be cheaper, but fixed charges and power-related charges will rise" – President Stelmaszczyk argued. In his opinion, we are also facing a debate on another issue – whether to stick with the solidarity-based, regulated grid tariff model, in which everybody pays the same amount and everybody is guaranteed access to the grid, or to take into account the growing independence of energy users and shift to a free market system, where you pay as much as you really cost. "The problem is that with the latter model operators would be able to connect only those users who will pay for the costs they generate, meaning that some prosumers and the proverbial pensioner from the house beyond the woods will be left out" – he noted.

The question of covering grid operation costs is gaining importance as distributed generation in Poland is gaining momentum. And according to a poll among the **audience of the conference**, in 2050 the share of distributed generation should be at least 70%.

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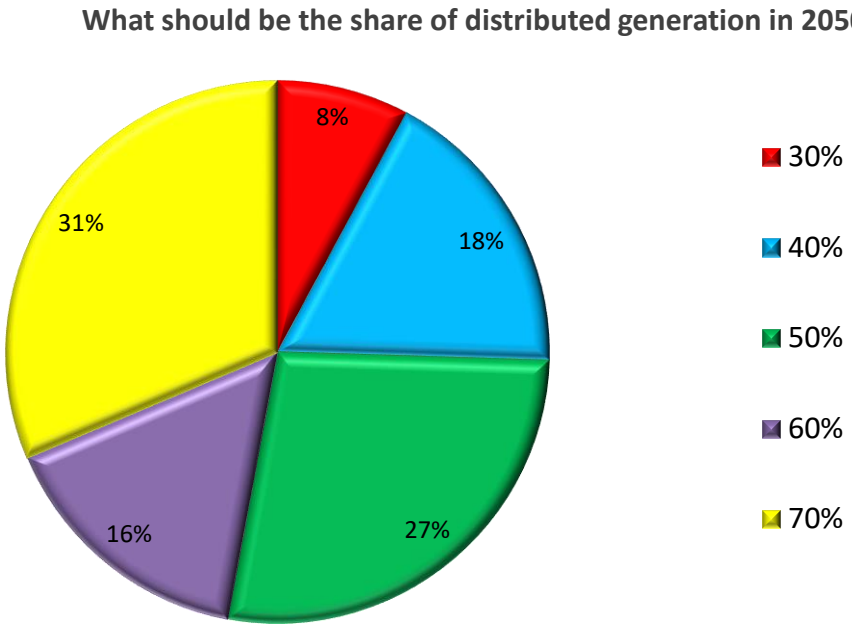

Cogeneration can also cut emissions

Artur Michalski, Vice-president of the National Fund for Environmental Protection and Water Management, pointed out that from the Fund's perspective an attempt to turn Polish heating plants into CHPs would be interesting. We are talking about 5 GW, potentially, and I guess that's worth a thought" – he said. "What's needed is will and money, and some of the latter could be found at the NFEPW" – he added

"Cogeneration is a very good way to produce electricity" – **Gerard Bourland, General Director of Veolia Polska** agreed. "We don't treat heat as a by-product, for cities heat is an element of security and cogeneration contributes to it" – he noted. Bourland added there is huge potential in effective district heating management, but there are obstacles to releasing it. He said one of the obstacles is the fact that Veolia does not own heating substations and hence cannot optimize substation control.

Director Małgorzata Mika-Bryska of Veolia added during the third panel discussion that the benefits of improved energy efficiency are sometimes underestimated even by those with great potential in this respect. "It is Veolia's experience that the cause is poor environmental awareness.

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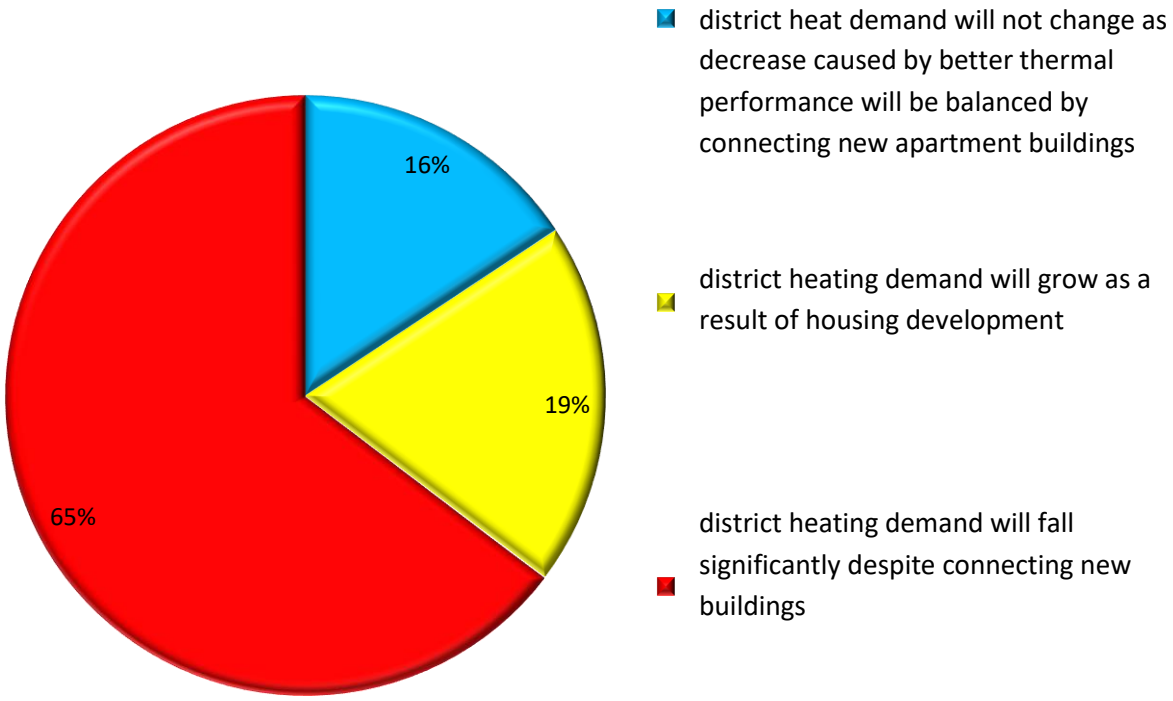
We often think that if we are poor, we cannot afford expenses – as efficiency requires expenditure at the start while the savings come later" Director Mika-Byska said.

However, in her view, we are witnessing a rapid growth of awareness, not just in households, but also among large and medium-sized manufacturers. "We implement specific efficiency projects commissioned by enterprises or in cooperation with individual end-users, and we share the profits. More and more often such cooperation starts with efficiency issues and then we go on to considering best water saving technologies. Water prices will rise, so saving water will make more and more sense as a way to cut costs" – she argued.

In a poll at the end of the discussion, **the conference audience** expressed the view that thorough improvement of building thermal performance and construction of zero net energy buildings will lead to a clear decrease of district heat demand despite the rising number of connected buildings.

What effect will thorough improvement of thermal performance of existing buildings and widespread use of zero-net-energy technologies in new buildings have on district heating:



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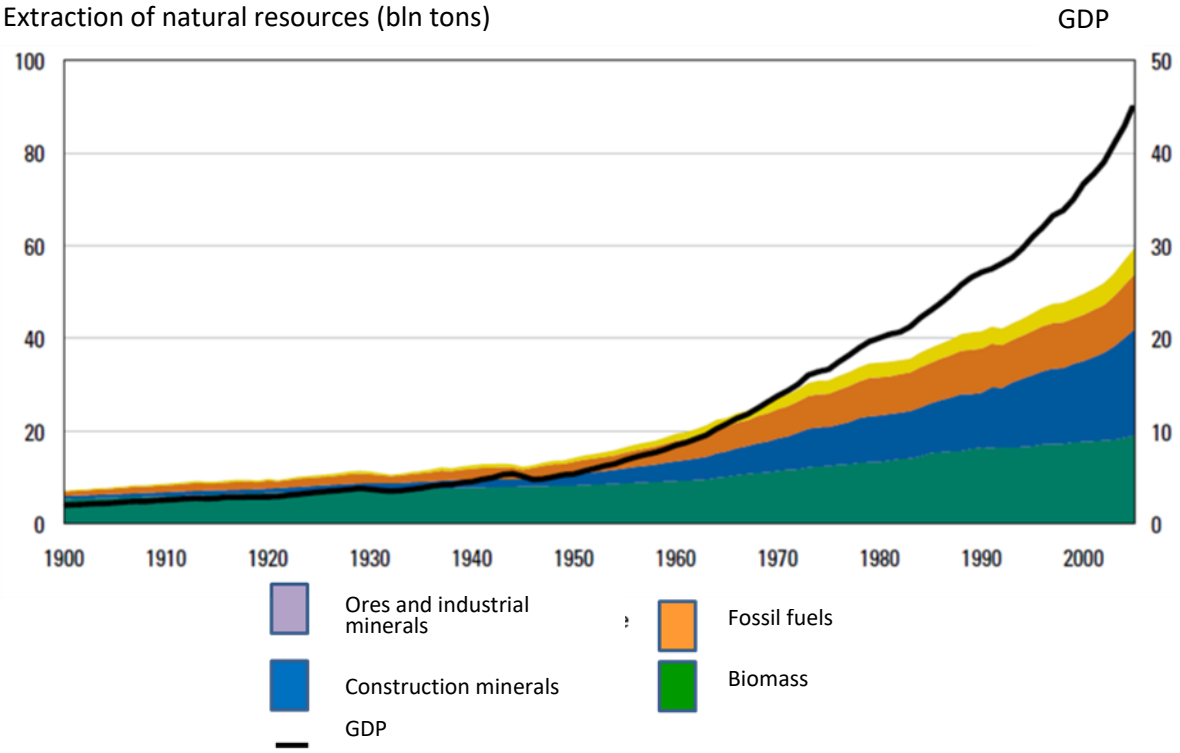
Toward a circular economy

The third panel discussion of the Power Ring conference focused on the package concerning circular economy, presented by the European Commission in 2015. In the introduction, **Halina Bownik-Trymucha, Chairwoman of the Policy Council of Procesy Inwestycyjne**, put forward the proposition that, in principle, circular economy has no flaws, but it is very difficult to fully implement. As she said, the EC believes the circular economy package is consistent with the climate policy and that its implementation will give the EU a competitive edge. The initiative is meant to lead to joint action that, supported by appropriate legislation, will aim at closing resource loops in the economy. Why are we starting to close these loops? As Halina Bownik-Trymucha explained, the extraction of natural resources is on the rise and if it continues at this rate, in a few decades the planet's resources will be exhausted. "One may grumble at the EC's proposals, but this is just what growing extraction is leading to. A change in business and consumption models is therefore needed, so as to extend product lifetime at every possible stage – from the design, which should facilitate materials reuse, to durability and ease of repair" – she said.



According to European Commission' statement, *with the present rate of resource use, by 2050 we will jointly need more than 2 planets to suport us and the aspirations of many people striving to imporve their living standard will remain unfulfilled*

"At the same time, we make very little use of some products. According to statistics, we use only 8% of the potential of our private cars. This shows the potential for car sharing. The same goes for

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office space, the rate of use of which is 30-35%, although companies try to improve on this in order to minimize costs. We use 69% of the food we produce and 30-75% of recyclables such as steel, PET and paper, contained in wastes" – the expert related.

Key targets set in the circular economy package include:

- waste recycling rate of 65% by 2030, which is a 3-fold increase from the 21% recycled today;
- common EU packaging waste recycling rate target of 75% by 2030, as compared with today's 36%;
- binding landfill target to reduce landfill to a maximum of 10% of municipal waste by 2030, as compared with today's 47%;
- promotion of reuse.

As **Bogdan Ślęk** of the "Pro-Lighting" Union of Lighting Equipment Manufacturers said, the EU package redefines and readdresses all economic cycle elements. He noted that the energy-related "winter package" also aims to redirect the energy sector towards circular economy. "The package puts energy efficiency in the first place, which is a sensible thing" – Ślęk said. "We often forget about the obvious truth that if we don't need energy, we don't use it. Efficiency in general should be the priority of Polish economy, bearing in mind all the burdens associated with the transition towards low-carbon economy. "Efficiency is the least painful path towards transforming the economy" – he assessed. He expressed his support to the binding 30% efficiency target for 2030. "Some discipline is needed in the case of Poland's economy" – he noted.

Ślęk also said the circular approach begins in the mind, when equipment and services are in the design phase. "There are always a number of paths we can take, and the way a product is designed impacts the production costs, user benefits and options for recycling. A product's life cycle should therefore be considered in the design phase" – he assessed.

Tomasz Szczygielski of the Polish Combustion Byproducts Union noted that the circular economy package was developed basing on research that showed the EU produces almost 2,5 billion tons of wastes per year. "For enterprises, this is a cost of EUR 700 billion per year. And it's something to be ashamed of. The fact that with 4 000 kilos of wastes per capita Poland ranks somewhere close to the EU average is by no means a reason to rejoice. People of honour do not generate wastes and do not leave their children with garbage and dumps. What they leave them with is resources." - Szczygielski said.

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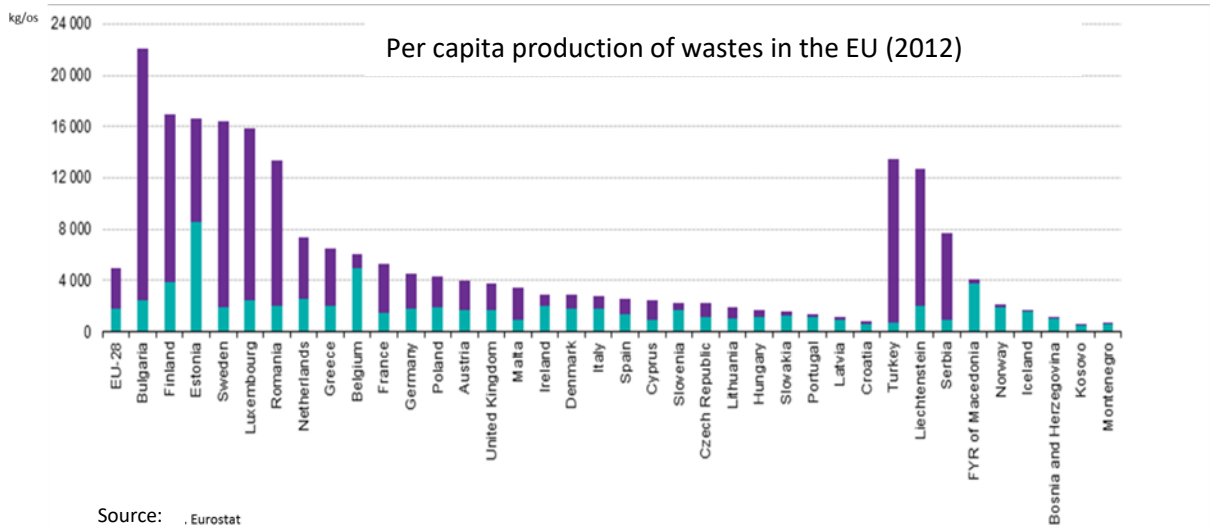

Per capita production of wastes in the EU (2012)

Source: . Eurostat

He stressed that the EU is dramatically ineffective. “We waste 30% of processed and packaged food delivered to shops, while others are hungry. If we are in an upbeat mood, we shouldn’t be.” – he said.

Moving on to the consequences of the enactment of the package for Poland, Tomasz Szczygielski underlined that it will become virtually impossible to landfill ashes generated by coal-fuelled power plants in the amount of 21 million tons per year. “On top of that there will be a huge problem with 35 million of wastes from coal mining.” – he added. He also noted that Polish scientists have long been working on the use of such wastes, among others for road construction, but the problem is that there are no regulations whatsoever that would give priority to such reusable wastes.

“At the COP summit in Marrakesh, Poland presented an absolutely innovative approach to the problem, referred to as waste-free coal energy. It involves modifying ashes as they are generated, for use in the construction industry. “In this way, we would implement the circular approach, if not within the mining industry, then in the wider context of the economy. We would save resources.” – he said. In his view, even minimal regulation favouring waste reuse would be enough to create a waste-free coal-based energy industry and turn a problem into an opportunity. “We are working on a “road map” that will assess the costs for the power plants, propose how to give priority to reused materials in public procurement regulations, e.g. by bonus points for materials characterized by lowest emission levels, how to incorporate an anthropogenic origin index so that the design engineers will be obliged to provide for a certain level of reused minerals” – Szczygielski said.

Jarosław Tworóg, Vice-President of the National Economic Chamber for Electronics and Telecommunications, declared himself an optimist with regard to the feasibility of the circular

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model. He noted that it has already been a while since Adam Smith's economic model that assumed labour and mineral resources are limitless became obsolete. Tworóg also said the pace of changes is so great we are no longer able to adapt to it. "This causes us to limit the number of products we need and to virtualize consumption. How many things did we cease to manufacture just because we developed the smartphone?" – he asked. Moreover, as he remarked, some processes, such as climate change, are so rapid they can be clearly seen within the lifespan of a single generation. So, as a community, we are capable of reacting to them. "In my opinion, circular economy is starting to climb a steep growth curve. Past experiences suggest we will be able to master that new model" – Tworóg assessed.

Education or regulation?

The panel participants also considered the moderator's question about the effectiveness of education versus regulation in Polish conditions. "It will not be possible to convince large numbers of people to participate in circular economy without some coercive instruments. Naturally, education is also very important, especially when it comes to explaining the need and rationale for certain behavioural patterns. We also need to show good examples – **Leszek Drogosz, Director of Warsaw's Infrastructure Department** explained. He noted that market mechanisms are the best. He recalled that in 2005 60% of Warsaw's sewage was discharged untreated into the Vistula while today 100% of the sewage is treated in modern treatment plants. "Sewage sludge used to be disposed of in various places and now we digest it to get biogas which is used for making heat and electricity. And starting from 2017 we plan to use some of the biogas surplus to produce biomethane to fuel cars owned by Warsaw Waterworks and, with time, also those of other city-owned companies" – Director Drogosz said.

On the other hand, **Halina Bownik-Trymucha** said what really matters is ""intrinsic motivation", based on awareness of what surrounds us. Good examples strengthen it while bad ones are the worst turnoff that makes all coercive measures futile" - she added. According to her, it is the residents who have the most say about the functioning of urben communities. "For example, are we prepared to share our car? Such car-sharing businesses are beginning to pop up. And they are driven by intrinsic motivation. And if regulations coincide with such areas of intrinsic motivation, we get synergy" – she argued.

Małgorzata Mika-Bryska of Veolia noted on her part that today it is impossible to force residents of apartment blocks to switch from group heating substations to individual substations that would

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allow to optimize heat management. “But in 2018 regulations will change and this will likely be an example of a positive impact of regulatory coercion”- the Director said.

The **conference audience** was also in favour of greater regulation. When asked “what to do in order to fully utilize combustion by-products?” the majority of the poll participants opted for new regulations that would give priority to reused materials and for more research and development in this field. On the other hand, they pointed to the discouraging practice whereby preselected wastes are mixed together during collection, as the main reason why the quality of waste preselection is not good. “This is a typical bad example” – **Director Drogosz** admitted. “The problem is that the preselection structure is not always consistent with the collection structure” – he explained.

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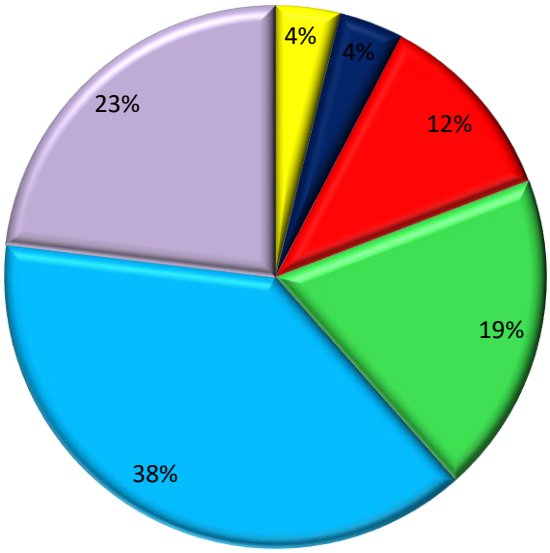
Remaining conference audience polling results

What is the main thing to be done to encourage the use of urban public transport:

- stop the urban sprawl through proper land use planning to allow public transport to reach most city residents
- continue to develop „park and ride" systems
- improve travel comfort by modernizing the fleet so that it is better suited to transporting disabled people, baby carriages and bikes
- improve time schedule information through i.a. apps that allow to track trams and buses in real time
- improve connectivity between different means of public transport
- offer better ticket prices



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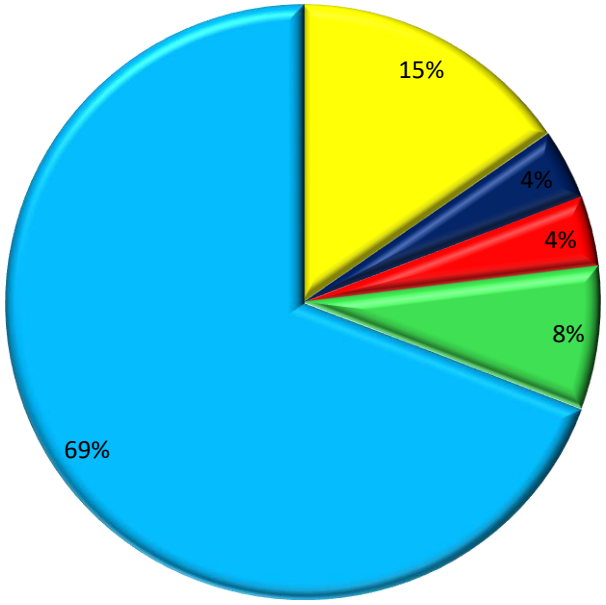
Whet is the main single reason why residents do not fully preselect wastes in their households:

- problems with finding enough space for several waste bins
- lack of a uniform nationwide waste categorization and container labelling
- incomplete information or inadequate access to information on waste categorization
- poor bulky waste collection system
- widespread practice of mixing preselected waste during waste collection



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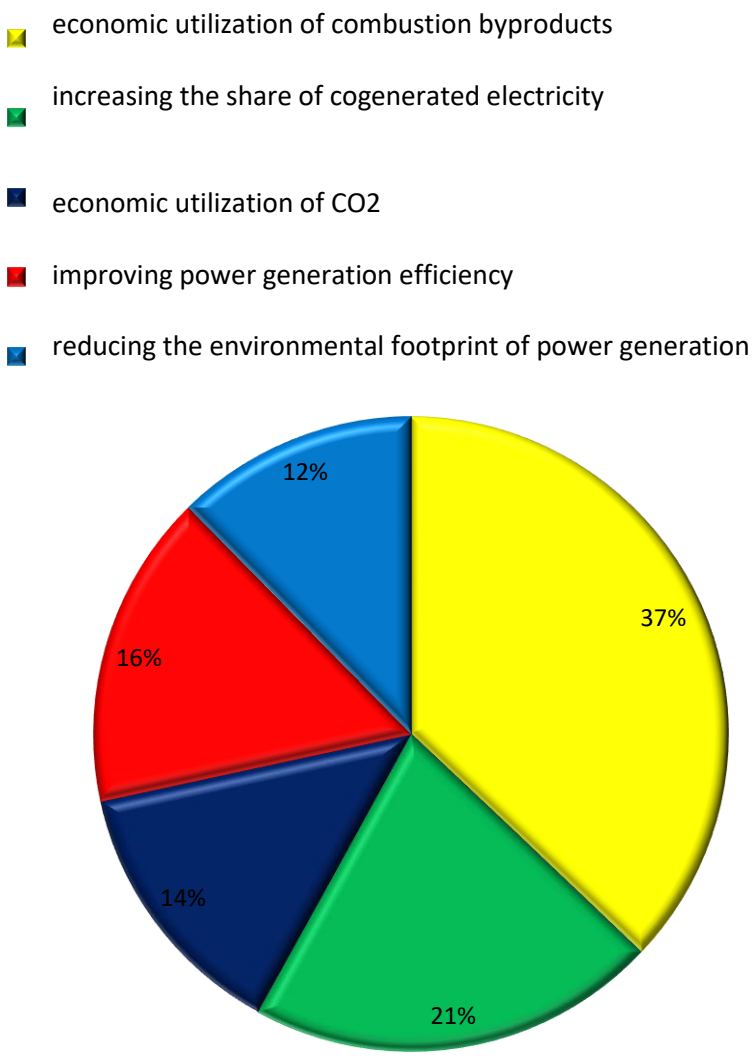
Which fields of activity in the energy sector contribure most to circular economy:



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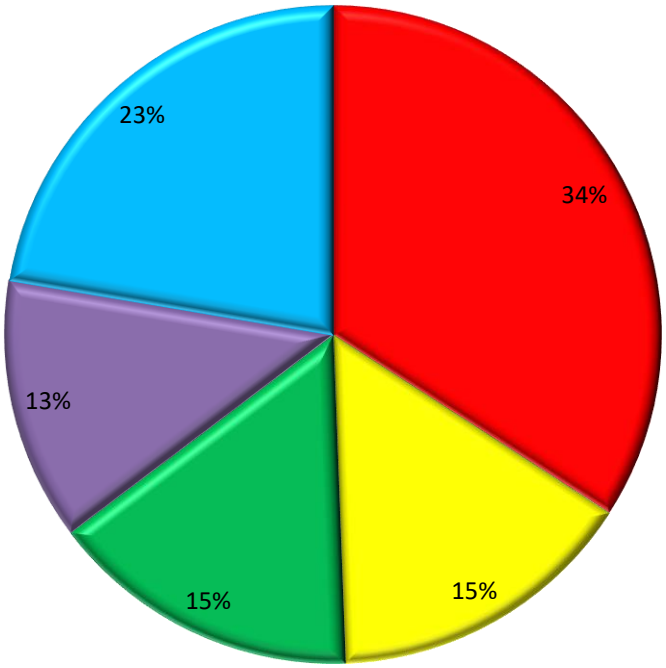
Will the transformation towards low-carbon economy in Poland result in:

- a minor increase in electric energy demand
- a very significant increase in electric energy demand
- a slight decrease in electric energy demand
- a major decrease in electric energy demand
- no change in electric energy demand



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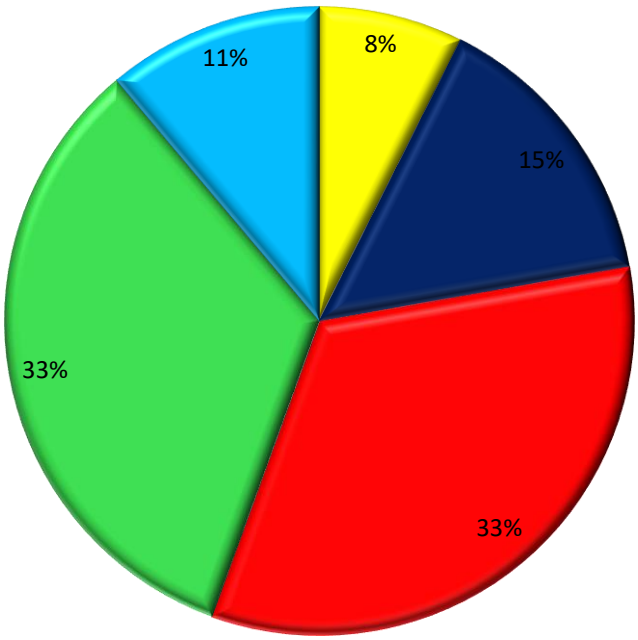
What to do in order to ensure that combustion by-products are fully utilized by the economy:

- ensure high quality of combustion by-products by modifying heat and power generation technologies
- eliminate combined burning of coal and wood
- introduce legislation that gives priority to recycled materials
- put more emphasis on the subject in research and development programmes
- convince the public through awareness building that combustion by-products can be a valuable resource



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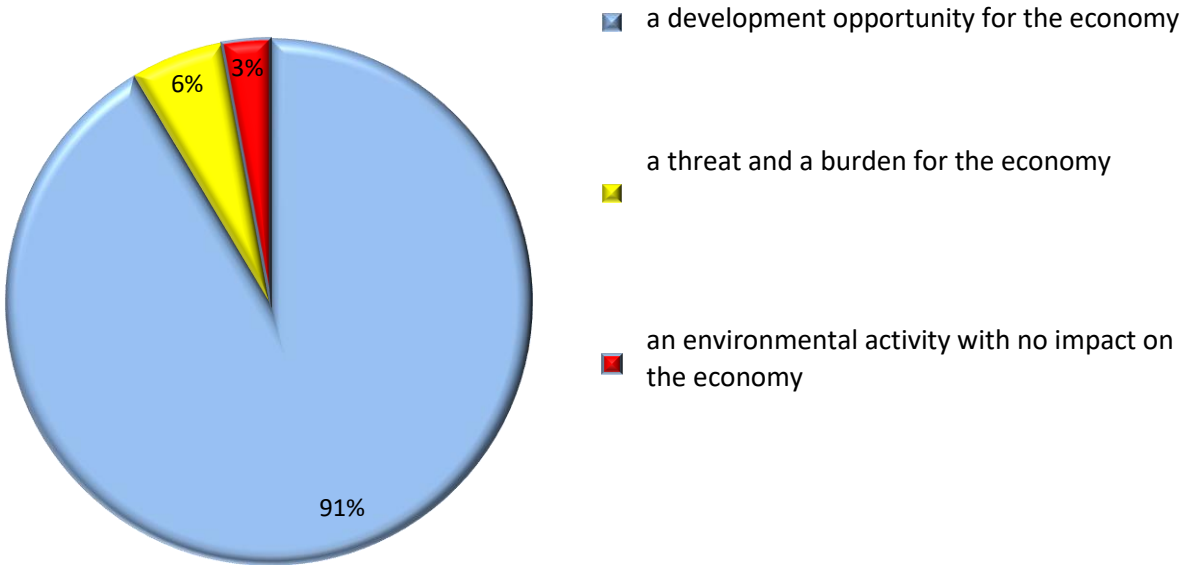
RECOMMENDATIONS OF THE „INTEGRATED CONFERENCES RELATED TO POLAND'S TRANSFORMATION TO LOW-CARBON ECONOMY AS A KEY TO DEFINING ITS ENERGY MIX"

These recommendations have been developed on the basis of presentations, discussions, as well as polls conducted among the audience prior to the conferences and audience votes during all four events comprising the integrated conferences. It should be noted that the polls and votes allowed all members of the audience to play an active part and have a say in the drafting of the recommendations from individual events and from the integrated conferences as a whole. The proceedings and recommendations of the first three conferences are presented in reports handed out to all participants and published on the Procesy Inwestycyjne website.

1. There is no doubt that low-carbon transformation is an opportunity, and not a burden for the economy. It provides a huge impulse for strengthening the competitiveness and innovation of Poland's economy, as most low-carbon projects are innovative. It will allow to open up and develop new fields in manufacturing and services, creating new businesses and jobs. Low-carbon solutions based on Polish research and technology can become our export hit. This assessment is strongly supported by the results of a vote according to which more than 90% of the audience perceives low-carbon transformation as an opportunity for the economy. The development of a programme for Poland's shift to a low-carbon economy is an extremely important and urgent matter.

What will low-carbon transformation mean for Poland's economy:



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2. Low-carbon transformation should always be considered in the context of the economy as a whole. This is because low-carbon projects in various sectors are interrelated. The above-mentioned Government programme should cover all socio-economic areas, such as energy, mineral resources, wastes, manufacturing, construction, agriculture, transport, as well as issues related to sustainable consumption, education and modifying public behaviour.

3. The philosophy of circular economy is very much in line with the low-carbon transformation, as it increases the efficiency of many projects and activities and highlights new transformation areas. This means that low-carbon initiatives should always respect the principles of circular economy.

4. In order to ensure that low-carbon transformation is not a burden to the economy we should only implement measures that are beneficial to the economy. Naturally, the benefits should be assessed from a very broad perspective that includes all so-called external costs, such as health-related costs. This calls for the development of an entirely new method of assessing the economic feasibility of low-carbon projects.

5. The scope and scale of emission reduction projects should be determined by analysing the benefits for Poland's economy and not simply limited to the compulsory minimum required by the European Union. This means that Poland can and should strive to be a leader in selected fields of the low-carbon transformation, proposing more ambitious goals and more stringent standards. These could concern improvement of building thermal performance, construction of zero net energy buildings and waste recycling.

6. It must be accepted that both conventional and renewable energy sources are necessary for securing proper electricity supply. The proportions between the two, or the so-called energy mix, will in the long run depend on the energy production costs associated with the different technologies. It is highly likely that the current downward trend in the costs of generating electricity from renewable sources will continue. This means that the share of renewable energy will grow steadily. In these circumstances, it is better to limit the construction of new coal-fuelled units and focus instead on revitalizing and increasing the flexibility of existing coal-fuelled units so that they can work in tandem with RES.

7. There can be no doubt that an increase in the share of distributed power is necessary in order to improve energy security and reduce power transmission costs. This share should be adjusted to Polish conditions and in particular to the electricity end user structure. Therefore, it makes sense to determine the desired share of distributed power for Poland.

8. Cogeneration is a very effective way of reducing emissions. Measures should therefore be taken to eliminate heating plants. Public funds should by no means be spent on the construction of new or modernization of existing heating plants if modernization does not involve switching to cogeneration. There are no technical or economic counterindications to cogeneration even in small and very small installations.

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9. The electromobility programme launched by the Government is fully justified as it will act as a lever for economic development, reduce air pollution, stabilize the functioning of the electric power system and create new opportunities for the development of renewable energy.

10. Radical changes are needed in land use planning in order to prevent “urban sprawl”. The current situation makes it difficult, and sometimes impossible, to provide public transport to all residents and greatly increases its costs. In effect, many residents feel uncomfortable, as they are forced to rely on private transport.

11. Building Management Systems (BMS) should become a standard solution that both reduces energy consumption and improves living comfort. Wider use of intelligent lighting in the building sector is desirable. Poland has great potential in this area, both in terms of research and development and manufacturing, and this potential should be utilized to a far greater extent by the domestic market.

12. Car sharing, whereby a single car serves a much greater number of people than in the case of privately owned cars, should be developed, as it is a solution consistent with the circular economy concept.

13. It is important to definitively sort out the legal and organizational aspects of municipal waste management. An improvement of the situation in this regard will be vital for ensuring that all residents consistently and properly preselect wastes in their households.

14. During consultations with the young generation, very critical views of education in the field of low-carbon economy were expressed. It was noted that the education system today offers but very narrow knowledge and does not encourage students to ask questions and come up with answers concerning the need for a low-carbon economic transition. Thus, the system needs far-reaching changes in order to meet expectations in this regard.

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