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LOCAL RENEWABLE ENERGY ACTION PLAN TATRA SUN POWER STATION

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Summary

The promotion of renewable energy is an essential part of EU energy policy, and it significantly contributes to the implementation of the Energy Union Framework strategy. With a 17% share in final energy consumption in 2015, the EU and the vast majority of Member States are well on track in terms of renewable energy deployment. The proposal for an energy cluster based policy, together with the energy clusters pilot packages, now under examination, aims to tackle the barriers limiting further local renewable energy growth.

Keywords

innovative energy cluster model • National Renewable Energy Action Plan (NREAP) • renewable energy sources (RES) • special purpose district • photovoltaics • energy security

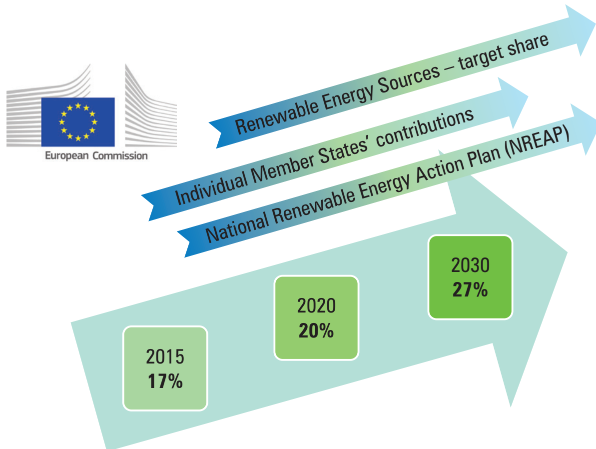
1. Introduction

In accordance with the Directive of the European Parliament and of the Council, the current 2020 framework sets a 20% target [Directive 2009], and in 2030, at least 27% target for the share of renewable energy consumed in the EU [Directive 2017]. It relies on legally binding national targets until 2020, and will be fulfilled through individual Member States' contributions guided by the need to deliver collectively for the EU (Figure 1).

In 2015, renewable energy sources [RES; OZE in the Polish language] share is estimated to be around 16.4% of gross final energy consumption [Report EU 2017]; therefore, efforts to keep on track will need to intensify.

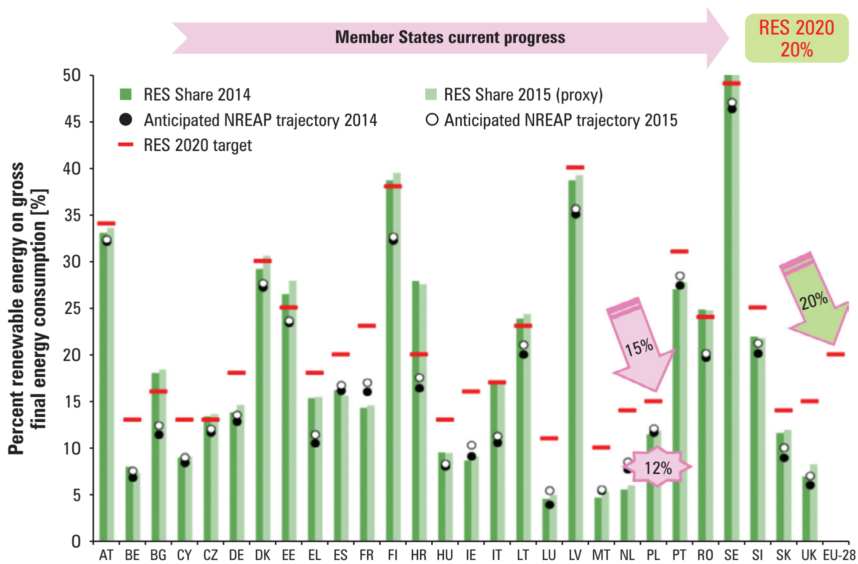
Poland's target for the share of energy from renewable sources in gross final consumption of energy in 2020 is set at 15%, while in 2015 it has reached 12% (Figure 2) [Report EU 2017].

In order to reach the targets, each Member State shall adopt a national renewable energy action plan. The national renewable energy action plans shall set out Member States' national targets for the share of energy from renewable sources consumed in transport, electricity and heating and cooling in 2020, taking into account the effects of other policy measures relating to energy efficiency on final consumption of energy, and adequate measures to be taken to achieve those national overall targets, including cooperation between local, regional and national authorities [Directive EU 2009].



Source: author's study

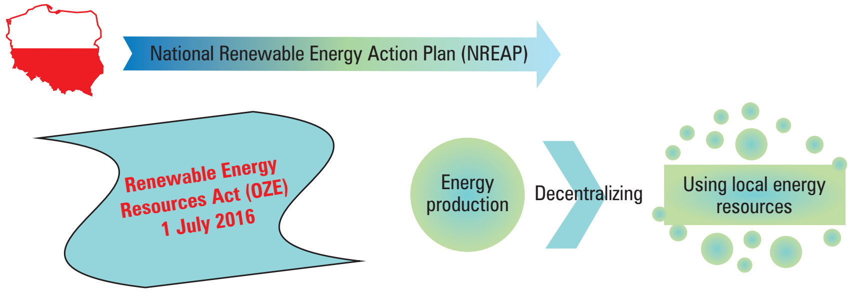
Fig. 1. Renewable Energy Sources – target share



Source: Öko-Institut, Eurostat [Report EU 2017]

Fig. 2. Member States current progress towards their 2013/2014 and 2015/2016 indicative RED targets

With regard to the EU strategy in 2016, new policy Renewable Energy Resources Act (RES; Polish: OZE) [Ustawa 2015] was put in place, creating incentives for decentralised energy. It indicates that decentralizing energy production would likely lead to using more local energy resources (Figure 3).



Source: author's study

Fig. 3. Polish National Renewable Energy Action Plan

An OZE-wide regulatory framework delivers the appropriate instrument for the promotion of local renewable energy, namely the energy cluster. With regard to the role of private and public entities in the electricity market, there is a strong support for empowering energy consumers and local authorities. One of the major problems that emerges is the lack of sufficient energy cluster based policy with adequate tools (Figure 4).

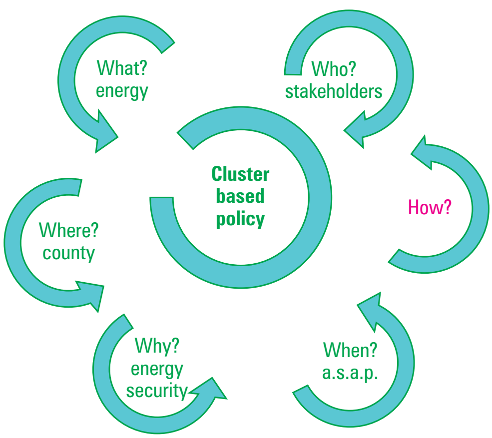


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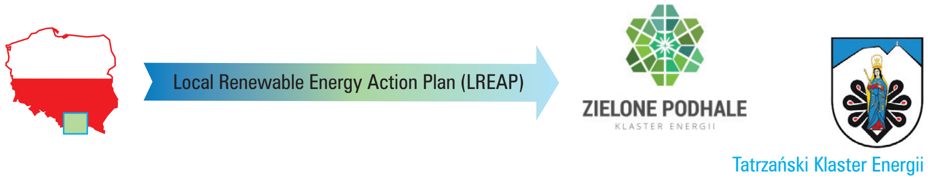
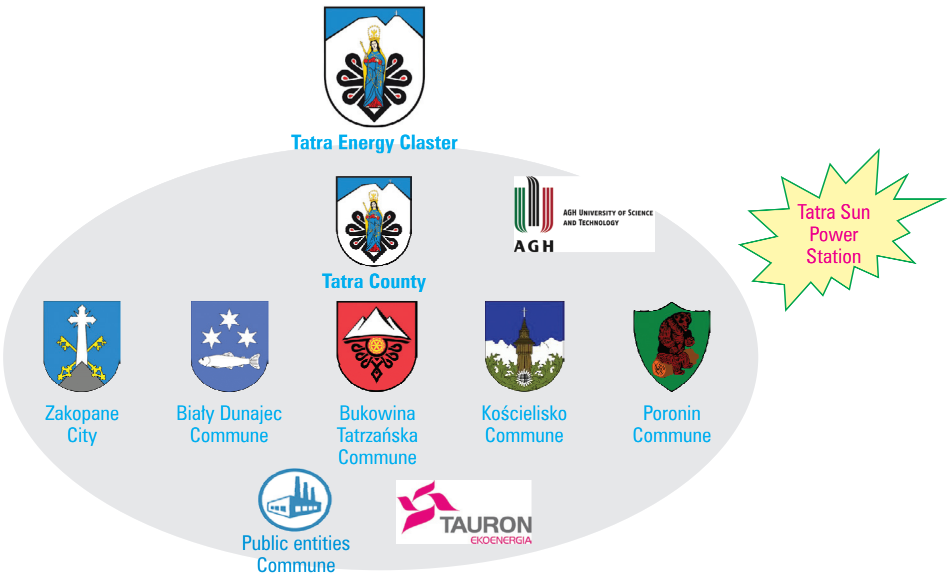
Fig. 4. Energy cluster's tools

2. Material and methods

This new policy resulted in the establishment of:



in the form of Energy Cluster of "Zielone Podhale" [Green Podhale Region]; and the creation of special purpose district called "Tatra Energy Cluster", implementing the "Tatra Sun Power Station" project (Figure 5).



Source: author's study

Fig. 5. Tatra Energy Cluster

The main role will be played by the Tatra County and municipality participants, in strong cooperation with the AGH University of Science and Technology. "Tatra Sun Power Station" will be a medium-scale photovoltaic system (PV system) designed for the supply of power to local users, or into the electricity grid. Energy installations will consist of PVs and small hydroelectric plants. Public entities will make available 85 public buildings on which PVs will be installed (Figure 6).

Photovoltaic wattage will be less than average consumption, in which case the consumer will continue to purchase grid energy, but in a lesser amount than previously.

In case of photovoltaic and hydroelectricity plants wattage, the electricity output will substantially exceed average consumption, providing 135% self-consumption in total, and therefore it will be much in excess of the demand. It means that it will be possible to feed-in the excess power to grid, and yield revenue by selling it.

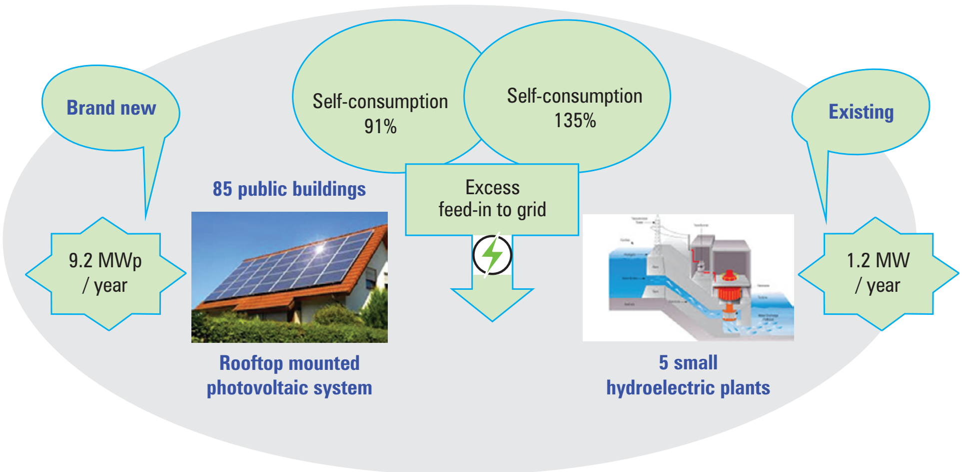


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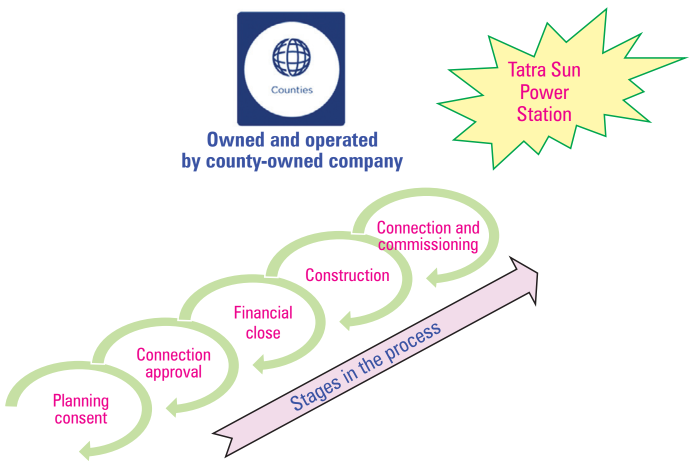
Fig. 6. Tatra Energy Cluster's installations

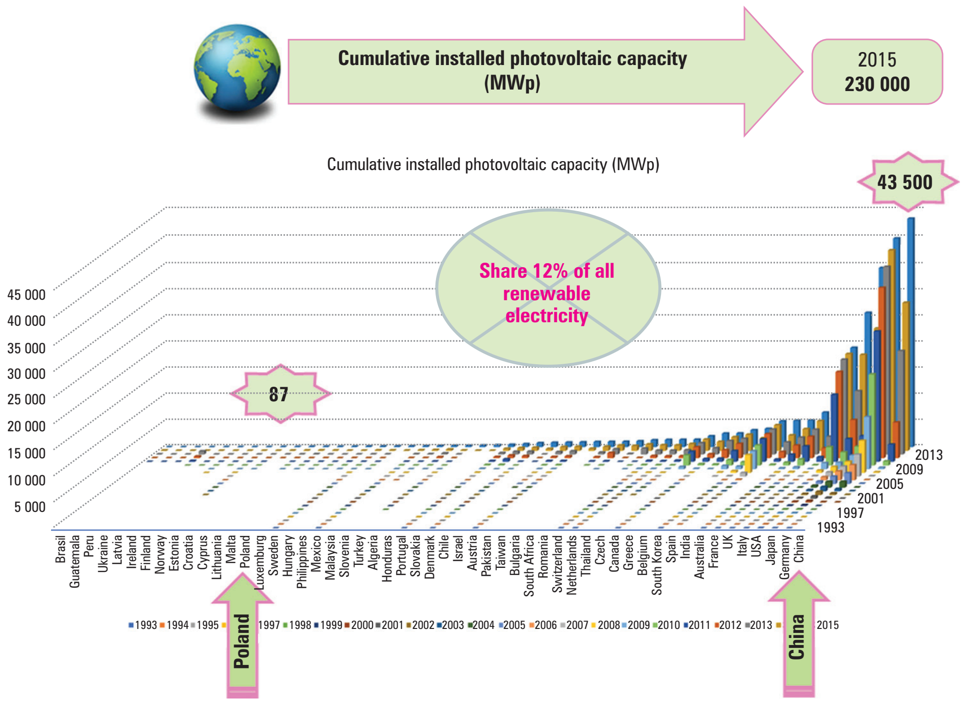
All installations will be owned and operated by county-owned company, which will be responsible for all stages in the whole process, from planning to connection (Figure 7).



Source: author's study

Fig. 7. Stages in the investment process

As shown below (Figure 8), solar photovoltaic (solar-PV) capacity increased rapidly and in 2015 accounted for 12% of all renewable electricity. In 2013 its deployment had surpassed that of solid biomass for the first time. In 2015, 38% of the solar-PV electricity in the EU-28 was produced in Germany, Italy and Spain. The considerable growth in solar-PV electricity has been driven by rapid technological progress, cost reductions and relatively short project development times. This has not only enabled a rapid and cost-efficient deployment, but it has also contributed to putting the consumer at the centre of the energy transition. By comparison, hydropower still generates the largest share of renewable electricity, while its share declined from 74% in 2004 to 38% in 2015 [Report EU 2017].



Sources: https://en.wikipedia.org/wiki/Growth_of_photovoltaics#cite_note-45 retrieved on 10 May 2017; "Global Market Outlook for Photovoltaics" at www.epia.org. EPIA – European Photovoltaic Industry Association; EUROBSER'VER "Photovoltaic Barometer – installations 2013 and 2014": www.energies-renouvelables.org; "Snapshot of Global PV 1992–2014": www.iea-pvps.org/index.php?id=32; International Energy Agency – Photovoltaic Power Systems Programme of 30 March 2015

Fig. 8. Global cumulative installed photovoltaic capacity

In 2014, the International Energy Agency (IEA) released the Technology Roadmap: Solar Photovoltaic Energy [IEA 2014]: "PV has been deployed faster than anticipated and by 2020 will probably reach twice the level previously expected. Rapid deployment and falling costs have each been driving the other. This progress, together with other important changes in the energy landscape, have led the IEA to reassess the role of solar PV in mitigating climate change. This updated roadmap envisions PV's share of global electricity rising up to 16% by 2050".

In 2015, Fraunhofer ISE did a study commissioned by German renewable think tank Agora Energiewende and concluded that most scenarios fundamentally underestimate the role of solar power in future energy systems [Parkinson 2015]: "Solar photovoltaics is already today a low-cost renewable energy technology and will soon be the cheapest form of electricity in many regions of the world. Financial and regulatory environments will be key to reducing cost in the future. However, inadequate regulatory regimes may increase cost of power by up to 50 per cent through higher cost of finance. It indicates that a fundamental review of cost-optimal power system pathways is necessary". It is expected that renewable energy investments will pay off economically in the long term [CFR 2012].

The obstacles to the widespread commercialization of renewable energy technologies are primarily political, not technical [Jacobson, Delucchi 2009], and there have been many studies, which have identified a range of "non-technical barriers" to renewable energy uses [NREL 2006; UNDESA 2005]:

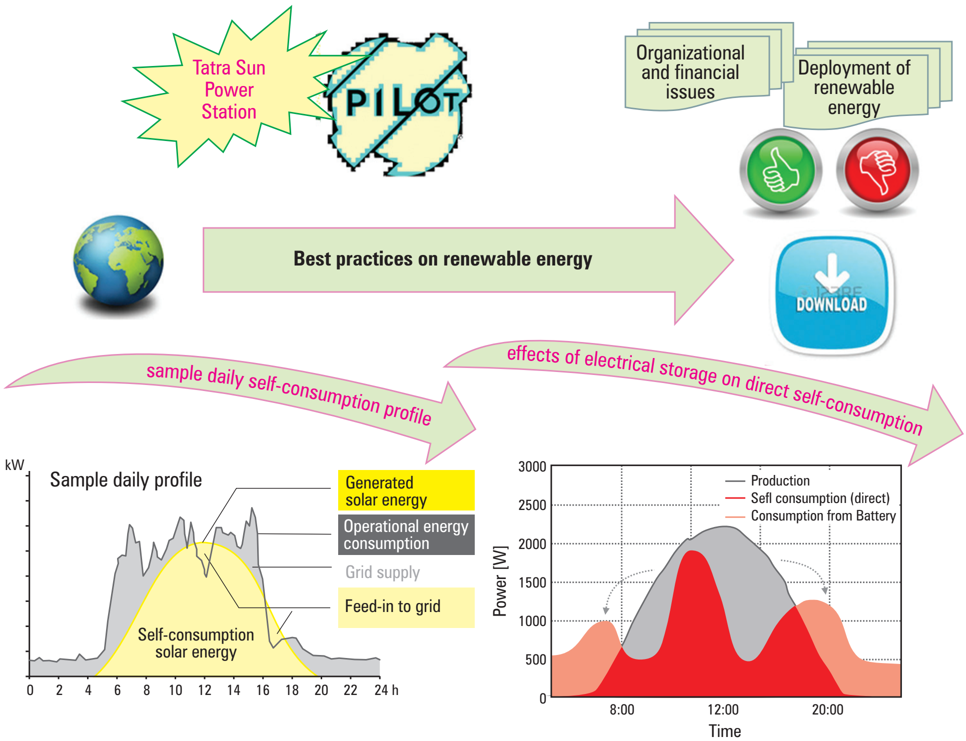
- "difficulty introducing innovative energy systems because of technological lock-in, electricity markets designed for centralized power plants, and market control by established operators;
- lack of government policy support, which includes the lack of policies and regulations supporting deployment of renewable energy technologies;
- inadequate financing options, imperfect capital markets;
- lack of adequate codes, standards, utility interconnection, and net-metering guidelines."

3. Results and discussion

In view of the above, the Energy Cluster of Tatra Sun Power Station will also act as a Pilot project, whereas, based on the best practises in the field of renewable energy, several different types of policy instruments will be tested, intended to complement each other and overcome different types of barriers. The best solutions will be implemented (Figure 9).

The example questions are "what to do with excess energy?", "what would be some possible solutions for energy storage?"

Because the point of grid parity is not easy to reach, solar generating stations need some form of financial incentive in order to compete for the supply of electricity [Wolfe 2013]. Many legislatures around the world have introduced such incentives to support the deployment of solar power stations [KPMG 2013], aimed at encouraging the PV industry to achieve the economies of scale needed to compete where the cost of PV-generated electricity is above the cost from the existing grid. Such policies are implemented to promote national or territorial energy independence as well as achieve the reduction of carbon dioxide emissions, which cause climate change.



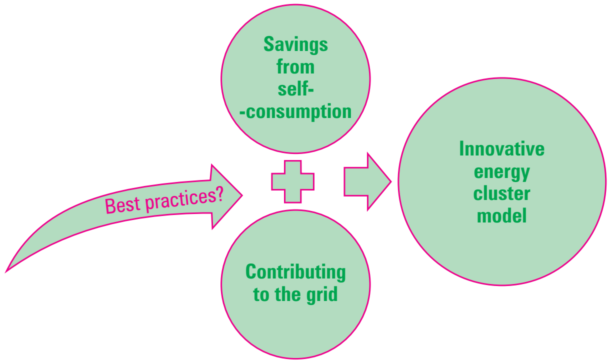
Source: author's study based on [Kraftwerk 2015, Q-cell 2015, Fronius, SMA 2015, Best practices EU 2015]

Fig. 9. Examples of best practices in the field of renewable energy

The best practises will be tested mainly in two components: self-consumption benefits for commercial consumers, and contributing to the grid (Figure 10).

The self-consumption model is based on the fact that in a growing number of countries renewable electricity – chiefly solar PV – has achieved grid parity, that is the situation where an expected unit cost of self-generated renewable electricity matches (or is lower than) the per-kWh costs for electricity obtained from the grid, i.e. the variable part of a consumers' electricity bill. Under grid parity, consumers can save money by generating their electricity rather than buying it from the grid [Best practices EU 2015].

Energy storage installed by consumers helps storing excess onsite renewable generation in periods of low demand (e.g. when residential consumers are not at home) for the use in periods when energy demand is high, and renewable production is low (e.g. peak-time in the morning and in the evening). Energy storage includes power-to-heat systems such as hot water boilers or more efficient heat pumps that can cost-effectively convert excess electricity to heat (typically, by heating water) to be stored for later use [Best practices EU 2015].

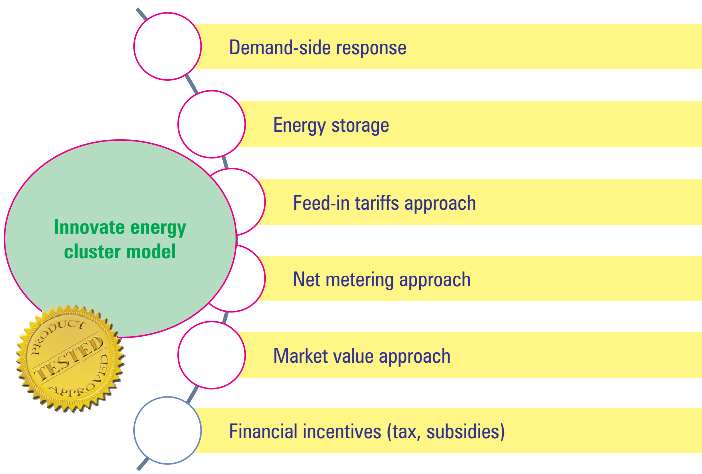


Source: author's study

Fig. 10. The main components of the best practices on renewable energy

The various grid tariff structures provide different incentives for energy consumers. For example a progressive volumetric tariff encourages self-consumption, as it increases the per kWh electricity price that can be substituted by self-consumed electricity. Furthermore, it provides the strongest incentive to save electricity, which is an important EU policy objective [Best practices EU 2015].

The best tested practices will include elements presented in the Figure 11.



Source: author's study

Fig. 11. The best tested practices on renewable energy

After the testing is completed, it will be possible to propose innovative energy cluster model with investment and capital incentives.

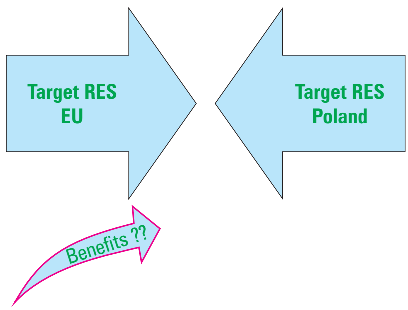
4. Conclusions

In Poland there is a need to implement regulatory policies creating incentives for decentralised energy as well as introducing support schemes for small-scale self-consumption system. This covers the creation of a systematic regulatory framework combined with energy cluster based policy tools, the introduction of which would significantly facilitate the wider use of renewable energy in Poland.

It is appropriate to conduct an analysis related to spatial planning, which can add precious information on the parameters of the area pertaining to the future energy investment project.

The rapid decline of renewable electricity investment costs is creating new opportunities for consumers to become energy producers, allowing them to profit from and contribute to the efficient functioning of the energy market. As grids and markets become smarter, this emerging model of self-consumption will set off on its way to playing a growing role in reducing consumers' energy bills, particularly of public or commercial consumers, and promoting market integration of variable renewable electricity.

Also, and most importantly, the objectives of Poland and EU will be met (Figure 12).

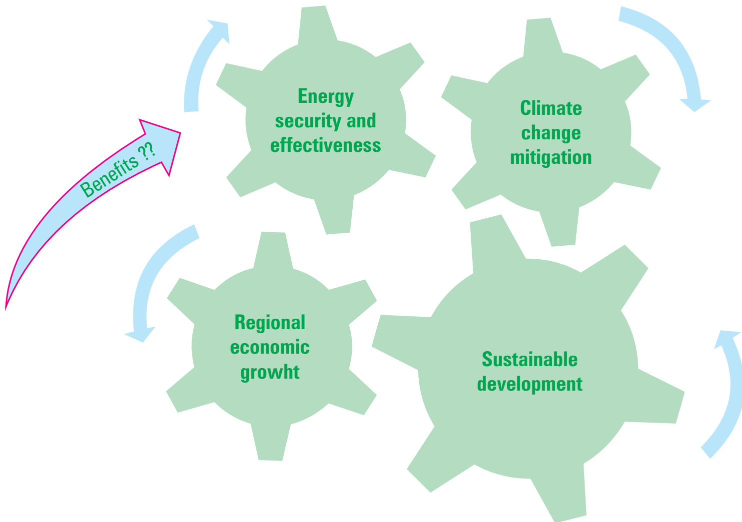


Source: author's study

Fig. 12. EU and Poland RES (renewable energy sources) targets

The new strategy will place consumers at the core of the energy policy, encouraging them to take full ownership of the energy transition, to benefit from new technologies to reduce their bills, and to participate actively in the market, while ensuring protection for the vulnerable ones.

Moreover, renewable energy will be also emerging as a driver of inclusive regional economic growth, climate change mitigation, and reinforcing energy security – as harmonised parts of sustainable development (Figure 13).



Source: author's study

Fig. 13. Harmonised parts of sustainable development

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