Clean Energy Finance Solutions: Poland

Cambridge Programme for Sustainability Leadership (CPSL) in cooperation with the Regional Centre for Energy Policy Research (REKK) at Corvinus University, Budapest, Hungary

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I. INTRODUCTION

The Clean Energy Finance Solutions: Central & Eastern Europe project is the result of the Low Carbon Finance Forum in October 2011 initiated by Gregory Baker, UK Minister of State for Energy and Climate Change in cooperation with Tamas Fellegi, Hungarian Minister for National Development. The Forum recommended undertaking analysis and establishing a group of experts to focus on unlocking private finance for low carbon investments area of renewable energy in the electricity sector (RES-E) in four initial Central and Eastern European countries : Bulgaria, The Czech Republic, Hungary and Romania. Once the first four countries were studied and the first Clean Energy Finance Solutions Report was released in May 2012, it was agreed that a second report focusing on Poland should be undertaken, and that capacity building workshops should be launched at the same time in the four initial countries.

The entire initiative is being run by the Cambridge Programme for Sustainability Leadership (CPSL), Cambridge, UK in cooperation with local consultants. This report has been undertaken by CPSL in collaboration with the Regional Centre for Energy Policy Research (REKK) at Corvinus University, Budapest, Hungary. We would like to thank the British Foreign & Common Wealth Office for their generous financial assistance for the project and the European Climate Foundation for their support of this Report focused on Poland.

The CPSL authors of the main report are Sandrine Dixson-Declève, Katherine Thoday, Tomi Numela, and Hendrik Jan Laseur with editorial assistance from Helen Spence-Jackson. The REKK authors of the country and regional summaries, and annexes are Péter Kaderják, László Szabó, Borbála Tóth, Lajos Kerekes, Zsuzsanna Pató, and András Mezősi. Péter Kotek, Aleksandra Arcipowska and Grzegorz Wiśniewski from the Institute of Renewable Energy (IEO) are co-authors of the report.

An Advisory Committee has provided high-level guidance to the project team. The Advisory Committee consists of senior representatives and experts from the private and public sectors:

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In addition to the Advisory Committee we would also like to acknowledge input from a wide range of sources including the following:

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- EUROS Polska
- PMG TECHNOLOGY
- SWIND Elektrownie Wiatrowe
- Green Power Polska
- E-Towers Famaba
- CELSA Huta Ostrowiec
- DR ZABER
- TAURON Ekoenergia
- DONG Energy Renewables Polska
- Zaklad Budownictwa Energetycznego
- Lima Lidia Poro
- LM Wind Power Blades
- E On Energie Odnawialne

II. SUMMARY OF OUTCOMES: FIVE COUNTRY ANALYSIS

The project's scope has initially been limited to exploring the opportunities that exist in renewable energy development in the power sector in Bulgaria, the Czech Republic, Hungary, and Romania now complemented by analysis undertaken for Poland. This report has been structured to focus on the main summary and conclusions first (Chapters I-V) with the more detailed analysis at the end of the report (Chapter VI).

The aim of this project is to highlight the opportunities that exist in renewables in terms of large-scale cross border cooperation, job creation and growth in order to enhance dialogue between Governments and the investment community when considering the future energy profile of the region. Detailed background checks and evaluations were undertaken for each country. Our analysis has been refined from more than 100 pages of comprehensive analysis.

The most important findings from our regional analysis clearly indicate that there remains significant potential for further renewable electricity generation in Bulgaria, the Czech Republic, Hungary, Poland and Romania that could generate employment and investment opportunities in these countries. To take advantage of these opportunities the previous report covering Bulgaria, the Czech Republic, Hungary and Romania as well as this report focusing on Poland come to similar general recommendations :

- **Improving the connectivity and distribution** of electricity generated by Renewable Energy Sources (RES-E) projects by investing in the up-grading and interconnection of transmission grids at national and regional levels,
- **Building capacity at the regulatory and industry levels** by strengthening skills in the public and private sectors to ensure sufficient professional competence to manage and profit from the employment and investment opportunities created by the sector,
- Despite their interconnectedness and joint EU membership, there is considerable scope to take a more **regional approach to market development**,
- Network connection quotas have been established in several cases, but **transparent and pre-defined queue management regimes to allocate connection rights** should be developed and published as soon as possible,
- Take **advantage of maturing technology and reductions in cost** (mostly in PV, and to a more limited degree, wind), particularly when taking longer-term time frames into consideration,
- **Developing more intelligent incentive schemes** to improve predictability and sustainability, reduce the cost of capital and stimulate development of domestic manufacturers,
- Foster a domestic RES-E industry by supporting local entrepreneurism and job creation,
- **Support public-private risk sharing for RES-E** andthe development of an investor / financier friendly environment from the legal and tax angles,
- **Avoid frequent modifications of policy,** existing regulations and RES-E support structures and streamline licensing procedures,
- Seize the opportunity of the turmoil created by the recession to **lay down a positive strategic path for a RES-E future** for when the credit conditions in general start to ease,
- **Focus on identifying the RES-E network integration** rather than generation related projects,
- **Coordinate infrastructure spending with high impact RES-E developments** and by fully exploring the opportunities provided by the structural funds,
- **Create a track record of positive investment case studies,**
- **Take a more holistic view and integrate the development of RES-E into a broader systems thinking, planning and legislative development** such as links with climate change, energy security, air quality and benefits on cities and tourist resorts from RES use and emission requirements. Further strengthen energy planning on the local level, by providing comprehensive solutions linking RES and energy efficiency programmes to meet local energy needs, local economic development and job creation.

However, it must be noted that to date continued policy uncertainty and un predictability, a distrust of RES-E from state incumbents, governmental preferences for fossil and nuclear energy sources, long and non-transparent licensing procedures, and ageing infrastructural issues do make RES-E development in the region and in Poland hugely challenging.

In addition, discussions on renewables in the five countries studied have often been limited by increasingly entrenched views around the nature of burden sharing to meet EU targets and as, in all countries across Europe, the challenge of engendering real system change in energy use and its generation, distribution and transmission.

The issue of cost and who bears it is central to this discussion. However indicators that show renewables expenditure as a percentage of GDP (figures sometimes considered in terms of EU burden sharing) miss the contribution that renewables can make to increasing energy security and lowering energy costs to consumers in the long term. The focus on cost also often ignores structural issues which can increase the attractiveness of investments, and little analysis is forthcoming in the region regarding real energy costs related to new nuclear or continued dependency on coal or gas from Russia. In addition, the complementary environmental, energy security and import reduction effects of long term energy diversification and energy demand management through energy efficiency and savings programmes have not yet been properly explored or fully costed.

It is important to note that the five countries studied suffer from over dependence on Russian gas flows coming from three major pipelines and severe inadequacies in gas transport infrastructure, reverse flow capabilities and insufficient integration of the gas network to Central Europe. As a result, the 2009 gas crisis hit the region's citizens the hardest across Europe. In order to increase gas security on its market, Poland is actively seeking ways to diversify its gas industry by investing into a new Liquefied Natural Gas (LNG) terminal at the Baltic Sea coast, encouraging exploration into its non-conventional gas reservoirs and by promoting the stronger integration of Central European gas markets. The region's energy security discussions also centre around nuclear. All of the studied countries either engage in nuclear electricity production or are exploring nuclear generation such as Poland. Therefore plans for new-build nuclear units currently compete with Renewable Energy Sources (RES-E) in the electricity sector for government support and funds in each country.

III. COUNTRY OVERVIEW SUMMARY: POLAND

The overall assessment of Poland has revealed that renewable energy development in the electricity sector is happening faster than predicted and in general the introduction of non fossil substitutes to power generation has worked as have the enabling mechanisms in place such as the *Green Certificates System* and *National Renewable Energy Action Plan (NREAP)*. In addition, investors seem to be more willing to invest in Poland than in some of the other Central and Eastern European countries due to its growing economy, capital flows and growing consumer purchasing power. Finally, some sectors in particular the wind energy sector has stimulated local employment and entrepreunorial activitiy.

Main Recommendations to Increase Investment Opportunities and RES-E development:

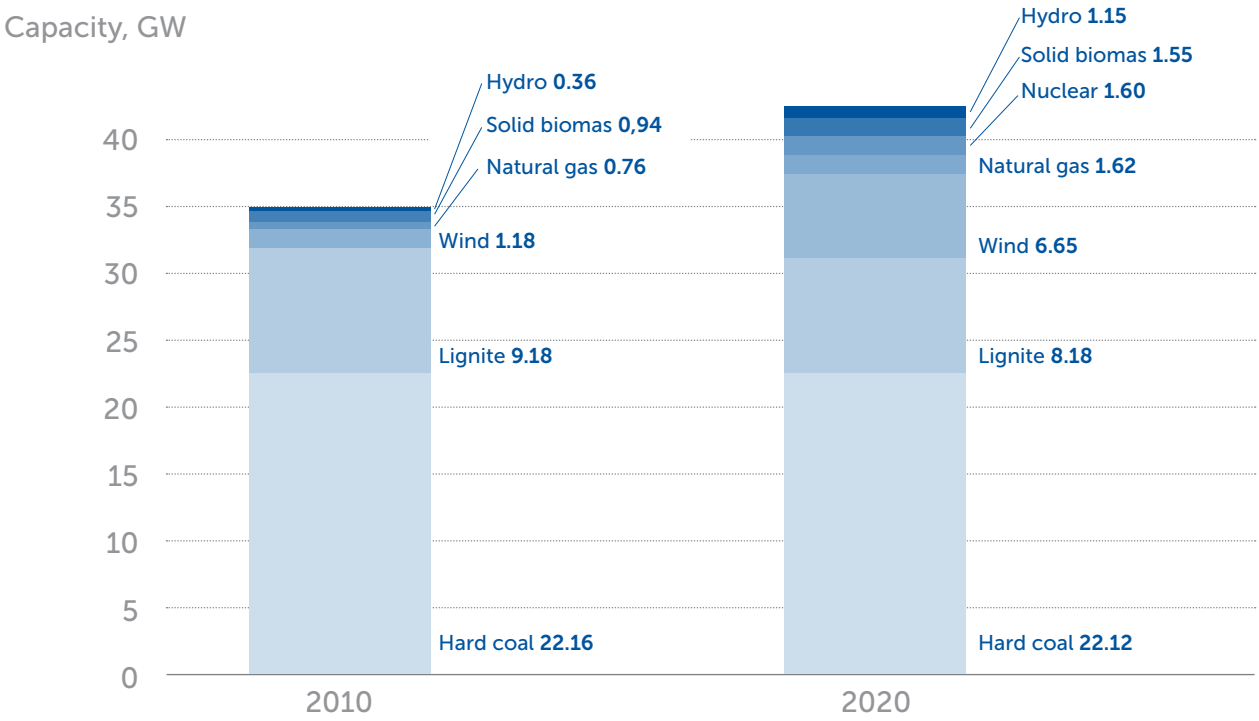
That said a series of specific recommendations for further RES-E development and investment growth in Poland have been made.

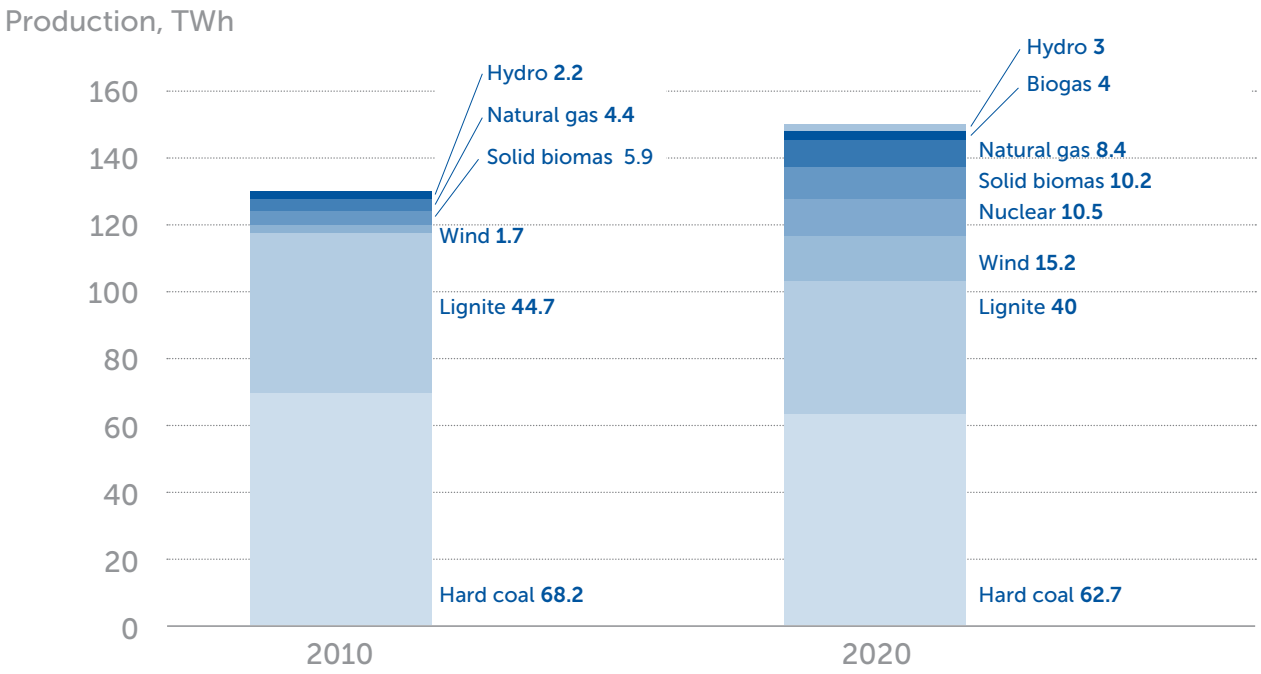
- Implement a clear country wide, interconnected, and embedded long term strategy for RES-E in Poland with a clear focus on development of domestic manufacturing and services sector.
- In addition to a national approach to energy diversification and maximising on Poland's strategic economic strengthPoland could gain fromdeveloping a pan-regional view of energy investments in particular in the area of grid infrastructure.
- While RES enjoys priority connection to the grid in Poland, independent power producers in particular have difficulties with integrating their capacity to transmission and distribution networks. Dominant publicly owned and vertically integrated energy companies, the poor technical condition of the network and complicated connection procedures add to the investment risk. This also has a negative impact on investment cash flows and reduces the investment willingness of potential local and foreign investors, as the companies and developments open for them are less able to negotiate the system operator conditions to gain grid integration. Commitment towards grid and network investment to build both RES-E strategy confidence and physical access is therefore fundamental.
- Poland should ensure that the Structural Funds during the period 2014– 2020 provide a maximum boost for Polish RES-E within the new programming framework for the Regional Operational Programme, which assumes a 6 per cent to 20 per cent minimum share of the funds to be spent on low carbon economy including RES-E and energy efficiency measures.
- Poland should seek to utilise every opportunity to address the development and efficiency of the electricity network. Network investment will build both RES-E strategy confidence and physical access and therefore address one of the key hurdles for RES-E in Poland.
- Increasing the lifespan of incentive structures to help fund longer term and dependable investments by broadening the mix of funding sources from the domestic and foreign private sectors, equity and institutional investors.
- Securing Poland's place in the global race for investment capital by demonstrating that Poland has an excellent and in some cases a better investment position than some of the previously studied countries for three reasons:
  - It has a higher growth potential and a better credit rating than most of the other countries in the region.
  - With over 38 million consumers, the size of the Polish market is much bigger than any of the other countries in the region.
  - A well-educated and skilled work-force offers a very good opportunity for development of local manufacturing and related services
- Seize the opportunity of the turmoil created by the recession to lay down a positive strategic path for a RES-E future when the credit conditions in general start to ease for the country.

Overview: Detailed Country Analysis (Full detailed assessment p27):

- In 2011, gross electricity production totalled 152TWh in Poland and was dominated by fossil fuels. Around 91 per cent of generation is based on fossil fuels (hard coal, lignite and oil). Power produced from natural gas is marginal (3 per cent of total production). Electricity from renewable sources accounted for 6 per cent production of which 2 per cent came from biomass co-firing, hydro and wind energy each (ENTSO-E 2011).
- Existing coal and lignite plants are ageing: more than half of Poland's coal capacity is over 30 years old. Most of this capacity is dispersed, with power plants usually having less than 300MW of capacity, making retrofitting and installation of CCS facilities an unlikely option (IEA 2011).
- According to Poland's Energy Policy Strategy, drafted by the Ministry of Economy and adopted by the Council of Ministers in 2009, production should be shifted gradually from the dominance of fossil fuels towards a more diverse mix including nuclear production and renewables. The strategy sets out the main capacity development targets for 2030. Generating capacities are expected to expand from 35GW in 2010 to over 42GW in 2020 and 49GW in 2030.
- Poland aims to shift its capacity mix from the dominance of coal and lignite to a more diversified blend. The share of hard coal is envisaged to drop to 52 per cent in 2020 and by as much as 37 per cent in 2030. The currently non-existent share of nuclear generation is planned to make up between 4 and 10 per cent of the power plant portfolio depending on the realisation of two potential scenarios (refer to figure 1).
- The share of renewables is expected to increase from 7.5 per cent up to 18– 21 per cent by 2020. Wind power is projected to reach a three-quarter share, while the remaining quarter will be covered by biogas, biomass and hydropower (refer to figure 1).

Figure 1: Net capacity (top) and generation (bottom) mix of Poland in 2010 and targets set by the Energy Policy Strategy 2030





Source: Energy Policy 2030 and NREAP

- The service sector is the most important driver of the increase in electricity consumption, followed by households, while industrial electricity consumption continues to decline.
- The Polish electricity market carries structural inefficiencies. Although liberalised, the market is relatively concentrated, with still limited presence from the private sector and multinational energy companies and no vigorous local competition compared to other countries in the region.
- Dominant state players exist in all segments of the value chain (generation, distribution, supply). These factors create a number of challenges for open and competitive RES-E market development.
- Electricity generation infrastructure in Poland is characterised by high air pollutants and high CO_2 emissions intensity due to Poland's hard-coal heavy energy mix.
- The relative lack of domestic and European interconnectivity contributes to lower than average wholesale prices and limited price volatility.

Opportunities:

- Due to lower than average disposable incomes, price sensitivity for electricity costs in Poland is higher than it is Western Europe. However, an increasing level of income in the country, as a result of growth, enhances the ability for households to absorb higher costs of electricity. Therefore, in relative terms, compared to its Eastern and Southern neighbours Poland is already in a better position from an affordability perspective to invest in RES-E and has the opportunity to execute a strong RES-E strategy to gain leadership in the region.
- Regardless of the less than ideal policy environment in Poland, the overall drive for RES-E and the establishment of moderate RES-E support schemes (via the Green Certificates and through dedicated funding programs from the National Fund for Environmental Protection and Water Management), have resulted in a slow but steady growth of the RES-E share in gross electricity generation and consumption in the country. Poland surpassed its RES-E target of 7.5 per cent set under Directive 2001/77/EC (with a 7.58 per cent achievement rate in 2010) but reaching the 2020 targets will need intensified efforts from the country.
- Although Poland has delayed the full implementation of the main body of legislation relevant for RES-E development, the country has set itself a challenging future indicative RES-E target of 19.1 per cent for 2020

under the National Renewable Energy Action Plan (NREAP) providing for a potentially healthy investment environment for renewable energy technologies.

- The proposed new RES-E law (Article 129) plans to introduce a Feed in Tariff (FIT) scheme for small installations, which would enable the increase of small scale production in the overal RES-E share once the law is accepted. High growth potential is foreseen in this segment of the sector, which to date has been lagging behind, due to proportionally higher cost burdens relative to size;
- The newly established RES-E Department of the Ministry of Economy and the increasing activity of the Regional Energy Agencies create the necessary administrative capacity for continued regulatory efforts and support for RES-E implementation in the country.
- There is a growing market of RES-E equipment producers in Poland (i.e. solar collectors and PV panels, biomass, wind turbines) and further opportunities should be seized.
- A significant percentage of Poland's territory – especially remote areas – does not enjoy reliable, quality electricity services that are available to customers in large cities. Therefore the development of decentralised RES-E could be very effective.

Limitations:

- Regardless of ambition, Poland is likely to find meeting its 2020 target highly challenging, due to a combination of factors set out in this document.
- Power generation in Poland is dominated by large-scale public facilities using conventional energy technologies and feedstock, with high sunk-costs, lowest price-to-market (as externalities are not correctly priced, e.g. ETS third phase derogation) and even excess capacity. This provides state run incumbents with a strong incentive to oppose new typically privatised RES-E investments when business as usual is profitable.
- Renewed interest in nuclear power and the development of Poland's first nuclear site combined with shale gas interests, contributes further to RES-E inertia in the country.
- RES-E investment and private sector interest is perceived to be predominantly foreign and hence government and consumers complain of little trickle down to the national and local economy.
- In order to meet the targets set by the EU Directives, RES-E generation in Poland has been assisted by the Tradable Green Certificate (TGC) system. As set out in the detail analysis part below, the current TGC system disproportionally favours cheapest-to-market solutions that currently drive the market flow towards solutions, which are not necessarily the most effective or innovative such as co-firing biomass and re-financing existing large scale hydro projects. Therefore it is not allowing diverse RES-E investments to emerge (refer to Detailed Assessment section below Figure 6).
- Poland has implemented RES Directive 2001/77/EC, while 2009/28/EC on the promotion of energy from renewable sources still hasn't been fully implemented. This delay in implementation has been on-going for the past two years. Delay has created a direct barrier for RES-E investment as investors are currently unsure as to Poland's real commitment to renewables.
- In reality, the delay in RES-E regulation implementation coupled with an ageing and weak electricity network infrastructure, causes uncertainty not only for domestic and international investors but also for RES-E developers and operators in the country.
- Bureaucracy and a lack of transparency has helped to create a market risk perception.
- A high cost of capital (identified as one of the crucial reasons for limited RES-E investment) combined with the economic and political determination to keep electricity prices low makes the investment case worse and cuts down investment flows.
- As in the case of the other countries studied, one of the key hurdles for RES-E in Poland is the aging and limited existing network, and the long cumbersome and expensive RES-E licensing process.
- The fact that some observers consider the cost of grid connection to be 30–40 per cent of the total wind generation investment makes it very clear why any uncertainty at this stage in the investment cycle will have a very significant impact on the palatability of overall risk and in particular disproportionate impact on the construction risk of any RES-E project. The predominantly equity funded period, developer driven and "less

bankable" construction risk are proving to be the most significant bottlenecks for RES-E development projects in Poland. Amplification of risk at this stage leads to abandonment of otherwise viable projects by driving up the already high cost of capital dictated by the ultimate return requirement and the inherent nature of RES-E being "high Capital Expenditure (CAPEX)/ low Operating Expenditure (OPEX)" compared to conventional energy generation which is "low CAPEX/ high OPEX" in nature.

IV. OPPORTUNITIES & CHALLENGES TO RES-E DEVELOPMENT IN POLAND

In the five countries studied, RES-E is at different stages of development, with a variety of specific possible routes to change the mix of traditional power generation and RES-E.

The following section compiles the main findings from the Polish analysis, compares it to the other four countries studied (Bulgaria, The Czech Republic, Hungary, Romania) and attempts to build a better understanding of the opportunities and the challenges from an economic, policy and finance perspective for Poland.

A. Economic issues

Increasing Demand:

- Demand for electricity is normally correlated with economic growth. Despite the present recessionary environment, the Central and Eastern European (CEE) region (Poland included) is expected to continue to experience strong economic growth over the next decade, and to further narrow the gap with the rest of the EU. Capturing and building electricity supply security via RES-E opportunities during the recession would give Poland a competitive advantage in the future to support its economic growth only if it manages to increase its domestic value added in RES-E technology manufacturing and installation.
- With the relative strength of the Polish economy, Poland should be favourably positioned to change the perception that the Central and Eastern European countries are all a "closed market" by utilising non-cost tools, such as enhancing clarity, transparency and implementing long term strategies relating to RES-E. This would release significant investment flows supported by the potential higher risk adjusted return available in Poland once contextual issues have been solved.

Shortfalls in Supply:

- The decommissioning of large, ageing facilities over the coming decade will lead to the need to replace capacity and requires significant capital expenditure (CAPEX). This provides both an opportunity and a risk for RES-E investments. By choosing to support investment in conventional generation, Poland may lock itself into high-carbon projects and a high carbon future for many years to come. On the other hand, if a framework encouraging RES-E generation exists at this crucial point in time when the bulk of energy infrastructure is being renewed, Poland has the opportunity to leapfrog and bypass other Central and Eastern European economies that for different reason are locked into conventional energy infrastructures.
- In Poland, healthy market competition has not been fully realised due to market design and the country's large incumbents. As a result, Poland has not been considered as attractive for European and international industry investors. Anecdotal evidence looking at how wind machine manufacturers (Vestas Wind, Suzlon, Siemens Wind) have established a commercial presence in the region in Poland's neighbouring countries rather than Poland itself, would suggest that Poland is losing out on the "supply push" created momentum in the RES-E sector present in other countries.
- Poland enjoys relatively good energy security but at the cost of environmental and climate impacts. The narrative for Poland to switch from a dependency on fossil fuels to a more balanced energy portfolio including RES-E will need to be encased in green growth and jobs argumentation and the development of a solid private energy sector as security of supply is less of a concern.
- Regarding the employment and growth narrative, the RES market has already shown a rapid growth in the number of Polish RES equipment producers and suppliers of various components, mainly for solar, biogas and wind energy generation (IEO data shows 340 RES-E manufacturing companies in 2010).

B. Policy developments

Political & Consumer Acceptance

- Overall, the political will in Poland to move into RES-E has been limited. Moreover, there is a noticeable trend to focus more on shale gas and potentially nuclear, possibly under pressure of the economic downturn that countries in the region and across the EU are experiencing.
- It also appears that climate change scepticism is on the rise in Poland, as well as in the other Central & Eastern European countries studied. This fact plus dramatically low public awareness of the full costs of fossil fuel dependency is worsening the appetite for RES-E.
- Due to lower than average disposable incomes, price sensitivity for electricity costs in Poland is higher than it is Western Europe. However, an increased level of income in the country, as a result of growth, enhances the ability for households to absorb any higher costs of electricity. Therefore, in relative terms, compared to its Eastern and Southern neighbours Poland is already in a better position from an affordability perspective to invest in RES-E and seize the opportunity to execute a strong RES-E strategy to gain leadership in the region and bring its customers along on the journey.

Government Incentives:

In Poland the existing Green Certificate System does not catalyse a competitive and heterogeneous RES-E market development. Instead of supporting new RES-E investments, it increases revenues for large scale and already amortized power plants. Between 2006 and 2012, more than 75 per cent of total revenues of the system have been distributed to biomass co-firing and hydro generation. However, in the proposed new RES-E law co-firing will only receive 1/3 of a green certificate with the aim to reduce its use. In addition in the last year 1/3 of biomass was already imported to Poland, which reduces its sustainability (refer to table 2 in the detailed assessmenet).

- A number of funding schemes are in place in Poland both at the national and the EU level (EU structural funds and its Regional Operational Programmes and the Operational Programme of Infrastructure and Environment). Poland should ensure that the Structural Funds during the period 2014–2020 provide a maximum boost for Polish RES-E within the new programming framework for the Regional Operational Programme, which assumes a 6 per cent to 20 per cent minimum share of the funds to be spent on low carbon economy including RES-E and energy efficiency measures. Importantly, Poland should seek to utilise every opportunity that opens within this framework to address the development and efficiency of the electricity network. Network investment will build both RES-E strategy confidence and physical access and therefore address one of the key hurdles for RES-E in Poland.
- Smaller sized actors in Poland don't have access to RES incentives and are likely to perceive risk differently from mainstream utilities. In addition they may have fewer buffers both operationally and economically to absorb risks and will respond to different stimuli than bigger owners of the installed capacity that rely on long term cash flow yielding better for the scrutiny of conventional financial analysis. Any policies and actions to support RES-E in Poland should therefore consider prosumers[1] as an important player in the overall RES-E ecosystem that are able to draw significant value from meta-level infrastructure development, as well as targeted funding schemes and a clearer policy framework. The new RES-E law proposal will give small scale producers simplified procedures and fixed tariff rates that will definitely help the deployment of this new model if the proposed law is accepted.
- The development of a simplified take-over and feed-in-tariff scheme is foreseen to help the expansion of micro generation. This policy action plus the current green certificate system should stimulate investment into both small and large scale renewable energy production.

1 Prosumers: those final consumers that also produce electricity in their building area (residential or commercial).

C. Financial aspects

- Poland needs to secure its position in the global race for investment capital by positioning the Polish RES-E sector in a similar way to its closest competitors. During the crisis, Poland has an excellent opportunity to bring about long term positive change regarding the relative attractiveness of the proposition of investing in Poland.
- As a consequence of the crisis, many projects in developed and emerging countries are underfunded and struggle to get off the ground. This is not specific to RES-E, Central and Eastern Europe, or Poland. While the timing to step up RES-E investment is unfortunate and hampered by the persistent European financial turmoil, investment opportunity in Polish RES-E is coming to the fore. Poland's ageing generation capacity needs significant overhaul, transmission and distribution infrastructure needs modernising and the threat of climate change needs to be addressed via low-carbon transition. Poland cannot delay RES-E investment without significant threat on locking-in uncompetitive carbon heavy infrastructure for the future. If replacement investment – the upfront capital expenditure for ageing energy infrastructure is now purely driven by conventional technologies, Poland runs the risk of losing its economic growth momentum. Poland has the opportunity to embrace RES-E development and seize the opportunity that otherwise will be lost for another 30 to 40 years (the length of the investment cycle in large scale energy generation and infrastructure investments) if the conventional route for replacement investment is chosen. Locking in a high carbon future will have a negative impact on the future investment environment in Poland if it is seen to depend on uncompetitive and obsolete infrastructure and technologies.
- As well as increasing the cost to final consumers and leading to higher risk premiums charged by investors, lower credit ratings of governments and state-owned companies may lead to delays in the overall investment execution for large scale projects to a time when financial confidence is high and investors are willing to take higher yielding assets into their portfolios. Against this backdrop it is important to note that the relative position of Poland in the turmoil has improved. For example, the well-known RES-E market in Spain currently holds a sovereign rating of Baa3 (neg. outlook) / BBB- (neg. outlook) compared to Polish rating A2 (stable outlook) / A- (stable outlook). Poland also enjoys a better sovereign rating compared to its immediate Central and Eastern European neighbours.
- Poland now has the opportunity to capture the relative attractiveness of a more stable investment environment and capitalise on the favourable conditions for Polish investments. Poland should seize the opportunity in the turmoil and lay down a positive strategic path for a RES-E future for when the credit conditions in general start to ease. This would allow Poland to upgrade its relative market status and increase access to funding for Polish developers, incumbents and projects.
- In Poland the key operators (PGE Polska Grupa Energetyczna S.A. (PGE; 'BBB+'/Stable), TAURON Polska Energia S.A. (TAURON; 'BBB'/Stable) and ENEA S.A. ('BBB'/Stable) may also have strained their balance sheets – for example by committing significant CAPEX to the 3GW nuclear project (costing EUR9bn-12bn according to Fitch's estimates). Currently the Polish government supports the construction of a nuclear power plant in order to reduce its significant exposure to CO_2 costs. "Buffering" the utility credit ratings via visible support may have an impact on the RES-E strategy in Poland as significant perceived funding capacity is earmarked for the project. It is therefore important for the government to execute and utilise the non-cost routes to encourage RES-E development in Poland in order to avoid a slump in RES-E investment due to the expected nuclear opportunity cost.
- Polish utilities currently have access to the corporate bond market based on their credit ratings buoyed by perceived government support. The government should view this as an opportunity to allow the incumbent energy sector to leverage based on its stand-alone strength and invest the released support and capital into the future diversity of its energy infrastructure.
- Sources of public stimulus may decrease in the future. The ability and appetite of consumers to absorb higher tariffs is reducing, and tax incentives may become less affordable as governments face budget squeezes. As a result of all this, in a "post stimuli" environment, the mix of funding sources will have to broaden, and more

will need to come from the domestic and foreign private sector. Pension funds and sovereign wealth funds are likely to continue their interest in the area of RES-E, providing an important source of debt funding, as well as increasing amounts of equity finance. An interesting development is where utilities work together directly with pension funds to preserve their own rating and allow for larger scale RES-E development and to capture Operation and Maintenance contracts (O&M). Key Polish utilities should be encouraged to develop such strategies and look beyond investment into nuclear in order to enhance their strategic resilience.

- Development of the "prosumer" will both boost private, small-scale entrepreneurship and unlock yet another source of funding through local/national banks and small loans to individual consumers. This also gives an opportunity to consumers to get more involved in the process and become producers.

V. FINAL RECOMMENDATIONS: THE INVESTMENT PERSPECTIVE

The analysis of RES-E challenges and opportunities in Poland, summarized above, reveal a significant opening is emerging for investment in the country. Positive investment signals such as economic growth, growing demand, the replacement of existing capacity, decreasing cost and public pressure all point towards an increasing momentum for the renewables sector in the country. At the same time as indicated previously a number of challenges to development exist, of a political, structural, administrative and financial nature. The question is how can these challenges be addressed, to unlock the true potential of RES-E in Poland?

From an investors' perspective, the following initiatives can be undertaken to improve the attractiveness of RES-E to investors:

BUILDING CAPACITY IN THE RES-E SECTOR

From an investment perspective Poland suffers from the same issues experienced in the other countries regarding the lack of capacity building in the RES-E sector both in terms of the industry itself, and in the government.

Building Capacity:

- Lack of interest in RES-E has corresponded to a lack of skills for managing RES-E investment and related support schemes inside the administration. This may contribute to longer approval procedures and, potentially, suboptimal policy initiatives and a lack of coordination. Therefore public administration capacity building is seen as essential in order to facilitate the large scale investment prospects for RES-E in the country.
- Lack of local-level energy planning. Involvement of local authorities in the design of workable legislation and systems.
- Knowledge and skills in the public and private sectors should be strengthened to ensure sufficient professional competence to manage and profit from the employment and investment opportunities created by the RES-E sector. To date the Polish government has argued in public and private for a transitioning from coal to lower carbon alternatives will have a huge impact on employment. It is therefore imperative that an employment transition plan is developed for the non RES-E energy sector to the RES-E sector that includes training of coal miners and utility personnel, personnel in large state owned enterprises, government staff and university students.
- Research and Development capacity building is essential to ensure that RES-E technologies become competitive and cheaper in electricity production but also to create greater buy in and local entrepreneurship. This entails the establishment of Centres of Excellence linking existing academic institutions and leading companies' both inside Poland, as well as across the region. Assistance for R&D capacity building can be given by international organisations and partner universities already undertaking similar work.
- There is an urgent need for capacity building of the system operator who does not see RES-E as a viable part of the system, but as a burden that is hard to balance. This also requires to build in incentive schemes for the system operator to actively participate in this process.

Broadening Stakeholder Engagement:

- Market structures and the historic weight of evidence tend to support the dominant players, making it difficult for independent power producers to originate projects and arrange commercial finance. By broadening stakeholder engagement to include a wider range of partners such as local government, academic institutions, various sectors of industry, finance and small entrepreneurs, more producers will be enabled to enter the market and build efficient competition to enhance the diversity of the market place and generation capacity.
- Associations and interest groups, involving all relevant players in the sector, should be supported so that an industry voice is created and the industries' interests can be heard by government under a single renewable energy banner.

- Providing space for the development of "prosumers" and decentralised energy will unlock RES to the general public, especially in rural/remote areas.

IMPROVE GRID & TRANSMISSION INFRASTRUCTURE

Grid Infrastructure Development:

- RES-E is critically dependent on grid access – particularly in light of RES-E's intermittent nature. Limited access and low capacity of transmission grids, networks, and interconnections are detrimental to RES-E. Therefore, a significant part of RES-E related efforts should focus on identifying network, rather than generation related projects in order for Poland to clear a strategic hurdle that is likely to impede future development of RES-E. Investment in the up-grading and interconnecting of transmission grids at national and regional levels is fundamental to improving the connectivity and distribution of electricity generated by RES-E, as well as by other forms of generation. Addressing grid infrastructure could act to scale up investment not only in Poland, but across the whole region by giving a clear signal to investors about the potential for large scale investment opportunities.
- Strategic level initiatives involving wide consensus (spatial planning, International Energy Agency (IEA), administrative decision making processes for environmental and local decisions connection) and full transparency would expedite and support sound investment decision making processes, as well as building a "RES-E friendly" Poland track record supporting the wider economy. The ability to make investment decisions in this positive context would in turn reduce the risk discounted into the cost of capital – for domestic and foreign RES-E finance in Poland.
- Poland could envisage becoming a RES-E exporter in a long term with higher installed interconnector capacity linking Poland to its neighbours. Poland has large untapped capacity and economic potential to bring such capacity on stream. An active stance at the European level on transmission network regulation in support of a shift away from grid arbitrage based models towards a regulated approach can boost the Polish RES-E investment over a longer time period with increased flow of inbound investment. In this respect, harmonised EU legislation regulating grid operation and the internal electricity market should be promoted.
- The higher cost of rural grid maintenance and relatively higher losses of energy on transmission and distribution) call for local RES investment (small scale wind, biogas, PV, etc.), to strengthen the grid stability, reduce losses and increase local energy security. Therefore the development of micro grids and Smart grid concepts is of the same importance as high voltage grid development.

IMPROVE THE PREDICTABILITY OF INCENTIVE SCHEMES AND REGULATION

Increasing the Lifespan and Reliability of Incentive Structures:

- Providing a stable and reliable regulatory framework for the Green certificate support scheme is an important factor for future RES-E. Any weakening of the support schemes could further direct investment away from Poland.
- A desirable Polish Tradable Green Certificate (TGC) system should create an attractive investment environment for a competitive and heterogeneous RES-E market. The TGC maintained "market failure" in biomass co-firing (higher local prices) should be re-assessed. While the current system utilises existing generation infrastructure via co-firing technology and may contribute towards short term social value, the low efficiency co-firing (max 26 per cent) may not in the long term prove competitive, nor fulfil the Polish RES-E ambition.
- Increasing the lifespan of incentive structures will help fund longer term investments and provide dependable incentives, lowering the cost of capital and hence prices for consumers. The short timeframe for the legal Green Certificate Scheme framework (originally valid only up to 2017 but now finally extended to 2021) has created uncertainty and prevented investment decision making. Designing incentive structures in a sustainable fashion will help to avoid the scheme becoming a victim of its own success if the uptake is so large that the incentives become

unaffordable and hence have to be revoked. This has been a general trend across the EU and can now be seen as one of the major flaws in the promotion of RES-E alongside the lack of grid development to enable RES-E uptake.

Increase Integration and Better Allocation of EU Funds:

- Efforts should be made at the EU level to promote better integration and use of existing and proposed EU funds as well as the EU budget. This is not necessarily about the creation of new funds but about better allocation of the existing funds under Cohesion Policy as well as under the EU's new Multi-annual Financial Framework for 2014–2020. Such finance could be targeted at increasing electricity transmission / distribution network capacity; increasing electricity interconnection capacity and implementing "Smart Grid Connection" and for back-up electricity generation capacities for RES-E projects.

DEVELOP A PAN-REGIONAL VIEW

Look at Potential Regional Investments:

- A key driver of investor interest in the renewable energy market is the availability of government incentives. A number of schemes are in place across the region, both on national and EU levels. As a further stimulant, EU environmental regulation supports replacement of environmentally sub-standard facilities, which provide a "push" factor for developing RES-E.
- Despite their interconnectedness and joint EU membership, there is considerable scope to take a more regional approach to market development. To date cross border projects in the area of hydro have created geo-political disputes rather than collaborative efforts.
- There is considerable scope for Poland to take an active role in a more regional approach to RES-E market development and to engage with its neighbouring countries to develop large scale transformational projects. For example, Poland's Baltic Sea coast wind resources on/off shore should be developed as part of a coordinated plan linking in generation and transmission with current offshore developments in the region.
- Potential developments regarding large scale grid investments at a regional level will also be highly beneficial to Poland and therefore the country should engage in regional discussions around grid infrastructure development and smart grid leapfrogging opportunities.

Consider the Role of Pathfinder Projects:

- First-of-a-kind projects may face significant barriers in execution. Promoting "pathfinder" projects (rather than just benchmarking projects) that help to establish a track record for a technology / investment structure in a market helps financiers and developers understand how to allocate risk between project partners, and promotes projects that find it difficult (and expensive) to otherwise access financing.
- Creating a positive track record for RES-E investment case studies for Poland to counter past negative precedents and indicating step change in the Polish RES-E investment environment is essential. Marketing campaigns and raising investor community awareness of the will and positive attitude to achieve RES-E targets and harness RES-E investment are important ways to generate investment interest for Poland.

FOSTER A DOMESTIC RES-E INDUSTRY BY SUPPORTING ENTREPRENEURISM

Recognise the Role of Entrepreneurs:

- RES-E development is not just about large scale, capital intensive investment schemes but also about small, entrepreneurial players who (particularly in the earlier stages of development) play a pivotal role in identifying opportunities, taking the first steps in licensing, land-use etc. The Polish wind industry has already seen a growth in SME's and employment opportunities.
- In Poland the wind energy sector has the largest potential for development, especially for the wind parks planned in the Baltic Sea. The impact assessment of the Ministry expects the biggest increase in employment is expected in

connection to the wind power industry, especially through the installation of new capacities. In the large scale wind turbine manufacturing sector operates few international firms who supply the majority of turbines, and some of them already have affiliates producing components (e.g. blades) in Poland.

- In the small scale wind turbine market there is local know-how, and a qualified labour force exists. The current market size for such equipment is small in Poland, but the potential for development of the market is large. The firms in this sector expect increasing export possibilities as well.
- The second largest potential for development of the manufacturing of RES-E technology in Poland is the biogas industry, as it is connected to the strong Polish agricultural sector. In the field of biogas there are Polish companies who can build complete systems, and one-third of the equipment installed in Poland is produced locally.
- The production and distribution of sun and heat collectors is well developed in Poland, and twice as much equipment is exported than imported. About half of the firms dealing with heat collectors sell their own domestically manufactured products, while the other half are licensed distributors of foreign products. The Ministry of Economic Affairs expects that the second largest increase in employment in the renewable energy sector will be in the industry connected to the production and installation of sun- and heat-collectors.
- These entrepreneurs can be helped in various ways, including the creation of a favourable investment climate, tax breaks, etc. Important in this respect is facilitating the sell-back of energy to the state by (small) private players, something that can be blocked by structural and energy company interests.
- There are other accepted methods to help the development of the local industry like providing tax reduction (VAT) or tax credit for locally produced components, or low interest rates loans to local companies producing wind turbines[2]. The Polish companies in the RES-E sector are not expecting rules and regulations which would require local production because it would go against EU directives. For the development it is rather expected to have low or subsidized interest rates for loans for projects in the renewable energy sector and stable regulatory environment and support scheme.
- In Poland, current economic policy is concentrating on supporting traditional industries to protect traditional jobs, and this method significantly reduced the available financial support for other upcoming competitive and sustainable industries, such as producing technologies for renewable energies.
- In many cases the potential impact of the central, regional and local public administrations' green activities seem to be undervalued. The biggest problem which can hinder the development in this sector is bureaucracy. The complicated legal system can delay investment and create difficulties for firms installing small scale wind turbines for example. To change this situation a new regulation is in preparation to help development in the sector. It is recommended that the new regulation is based on an active consultation with industry and input from stakeholders is taken into account in the final version of the regulation. The Ministry of Economic Affairs expects that the new regulation will create four times more jobs in the RES-E sector than the loss in the mining industry. It is expected that due to the big domestic market, several new foreign investors will base their production in Poland (Ministry of Economy, 2012. Research and development programs shall help the development of local know-how and the domestic industry supplying equipment for renewable energy. Finally, the export possibilities of the local RES-E manufacturing industry can be further improved by international certification of the locally produced equipment.[3]

Work with the Banking Sector:

- The banking sector in Poland is a significant potential investor in the RES-E sector including small scale loans for "prosumers".

2 Lewis, Joanna: Wiser, Ryan. (2005). *Fostering a Renewable Energy Technology Industry: An International Comparison of Wind Industry Policy Support Mechanisms*. Lawrence Berkeley National Laboratory: Lawrence Berkeley National Laboratory. Retrieved from: http://escholarship.org/uc/item/6cf1r3z5

3 Lewis, Joanna: Wiser, Ryan. (2005). *Fostering a Renewable Energy Technology Industry: An International Comparison of Wind Industry Policy Support Mechanisms*. Lawrence Berkeley National Laboratory: Lawrence Berkeley National Laboratory. Retrieved from: http://escholarship.org/uc/item/6cf1r3z5

SUPPORTING PUBLIC-PRIVATE RISKS SHARING FOR RES-E

Consider Ways of Risk Sharing:

- With the cost (and availability) of capital at its present high (low) levels, and subsidies and incentive schemes under pressure, other avenues for promoting investment growth should be looked into. Supporting alternative financing structures, and augmenting the risk capacity through public-private partnering, will help mitigate and/or reallocate risks and allow for a higher availability of funding resources and financiers. For example, Poland could explore the value of implementing a scheme replicating structures introduced by EIB for project bonds in the field of RES-E.
- Incentive schemes should be aimed at reducing and mitigating investors / financiers risks (lowering the need for higher return), rather than compensating for the risks taken by investors / financiers by providing higher return for their investments, in equity or debt. Examples of this could include inflation linked incentives, export credit type guarantees, minimum guaranteed payment provided that the capacity is installed (security of supply payment). These types of incentives have a proven track record in shadow-toll infrastructure sectors and can also be applied to RES-E projects.
- Development of "prosumer" model is an attractive offer for local/national banks who know how to deal with consumer loans.

Consider How Risks Are Evaluated:

- Banks and other investors could be supported in developing alternatives to discounted cash flow analysis (DCF) based on net present value (NPV). Real Options Analysis could better take into account the impact of price and regulatory changes in assessing the attractiveness of new renewable technologies.

Review Legal Frameworks and build robust clarity in administration:

- The investment environment for RES-E should be stabilised by focusing on transparency and long term strategic execution of Poland's RES-E ambition. Frequent modifications in policy, existing regulation and RES-E support structures should be avoided. Long term delays in legislation have a similar harmful effect.
- Poland should concentrate on designing incentive structures for long term success and not drive "rushes" to benefit from incentives that the market expects to be short-lived as has been seen in the other countries studied.
- A significant streamlining of licensing procedures would improve the investment climate and enhance the ability of investors to respond swiftly to market conditions, as would a one-stop shop licensing regime with obligatory deadlines for administrative procedures.

Stimulate Targeted Equity Funds:

- As markets recover, the creation of targeted equity funds could be stimulated, possibly building on grant money and guarantees from the public sector, or by providing tax breaks. The sector could also work on increasing the number of investible propositions attractive to impact investors, pension funds and sovereign wealth funds.

VI. DETAILED ASSESSMENT: INVESTMENT GAP ANALYSIS FOR RES-E IN POLAND

A. Description of the Polish electricity sector

In 2011, gross electricity production totalled 152TWh in Poland. Electricity generation in the country is dominated by fossil fuels (approximately 60 per cent based on hard coal, 33 per cent on lignite, and 3 per cent on natural gas). Electricity from renewable sources accounted for 4 per cent, 2 per cent of which was based on biomass co-firing, with the other 2 per cent on wind energy.[4]

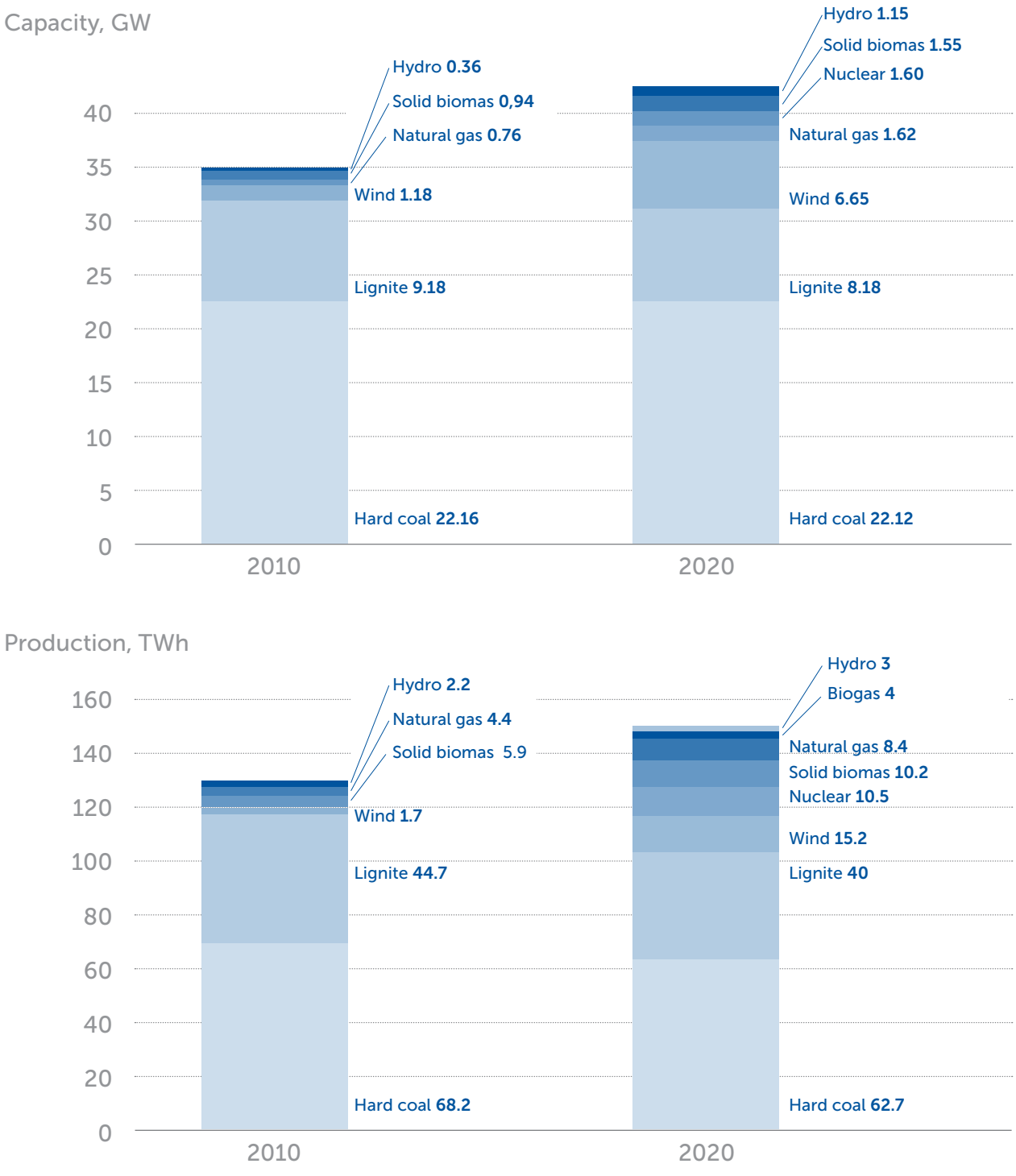
The Energy Policy of Poland (Energy Policy) was drafted by the Ministry of Economy and adopted by the Council of Ministers in 2009. Although there is currently no new official Energy Policy, this document is no longer applicable in many aspects. According to the text, energy production is planned to be shifted gradually from the dominance of fossil fuels towards a more diverse energy mix including nuclear production and renewables. Therefore, a relevant question in this area is if the presently on-going nuclear plans and the further increase in wind and other renewable generation plans are compatible options. They are not incompatible options from the electricity system point of view, however financing the construction of a nuclear power plant would reduce the chance of financing resources for further wind developments and it is important to take into account the high costs of new nuclear builds within energy portfolio options. Existing coal and lignite plants are ageing: more than half of existing coal capacity is over 30 years old. Most of this capacity is dispersed, with power plants usually having less than 300MW of capacity, making retrofitting and installation of CCS facilities an unlikely option.[5] Annual consumption – including network losses and self-consumption – reached 145TWh in 2011. The 4 per cent average annual growth of power demand was reduced by the 2008 economic crisis, but consumption already recovered in 2010, displaying a 5 per cent year-on-year increase. The service sector is the most important driver of the increase in electricity consumption, followed by households, while industrial electricity consumption continues to decline.

The Energy Policy sets out the main capacity development targets for 2030. Generating capacities are expected to expand from 35GW in 2010 to over 42GW in 2020 and 49GW in 2030. Poland aims to shift its capacity mix from the dominance of coal and lignite to a more diversified blend. The share of hard coal is envisaged to drop to 52 per cent in 2020 and by as much as 37 per cent in 2030. The currently non-existent nuclear generation is planned to make up between 4 and 10 per cent of the power plant portfolio in the two assessed scenarios. The share of renewables is expected to increase, up to 18–21 per cent. Wind power is projected to reach a three-quarter share, while the remaining quarter will be covered by biogas, biomass and hydropower.

4 ENTSOE databases. https://www.entsoe.eu/resources/data-portal/

5 IEA (2011): *Energy policies of IEA countries: Poland 2011 Review*.

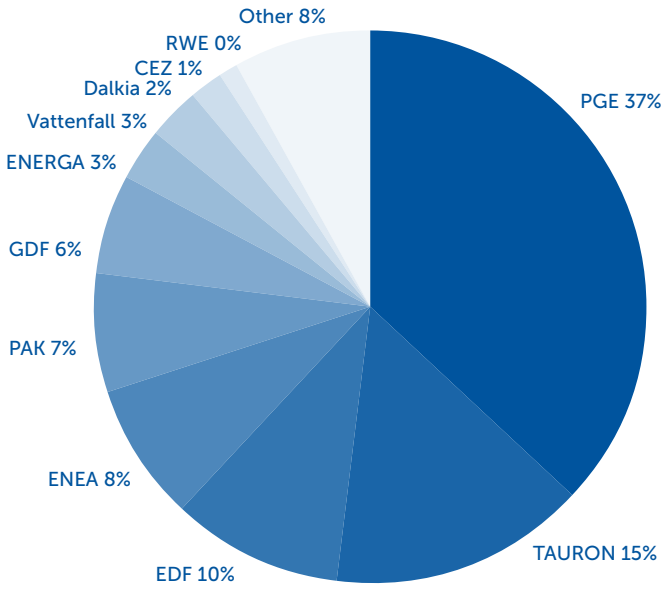
Figure 2: Net capacity (top) and generation (bottom) mix of Poland in 2010, and targets set by the Energy Policy 2030. (Source: Energy Policy 2030 and NREAP)



Source: Energy Policy 2030 and NREAP

In 2010, five players had generating capacities of over 5 per cent of the total stock. HHI indices 6 for both installed capacities and gross generation were at around 1800 (1620 and 1835 respectively), showing a less concentrated energy sector than was typical in the wider Eastern European region. One must take into consideration the fact that the majority of the market actors are state-owned companies. The three biggest generators account for 60 per cent of capacity. Wholesale markets are not concentrated on the country level, but since companies represent vertically integrated groups, concentration may be higher for specific regions. From 2010, legislative changes required major generators to sell 15–100 per cent of their production on the Polish exchange, resulting in a surprisingly high trading volume: 81.7TWh in 2010 (compared to the consumption of 143.6TWh; that is, half of the energy consumed was traded on the exchange). The other part of the consumption is governed mostly by bilateral contracts. Nevertheless, URE (The Energy Regulatory Office of Poland) reported that 70 per cent of the OTC trade was carried out within corporate groups, 91 per cent of which was for coal and lignite.

Figure 3: Share of corporate groups in 2010 generation (Source: URE Annual Report 2011; PGE, TAURON, ENEA and ENERGA are the state-owned groups.)



The retail market is controlled by seven incumbent companies which were created through unbundling – at the time the market was opened, these became the default suppliers. Around 20 other notable suppliers provide electricity to consumers, and 200 small industrial producers offer local services.

Poland has interconnections with Germany, the Czech Republic, Slovakia and Sweden. However, overall, Poland is not considered highly interconnected with its neighbours. An interconnector with 500MW capacity is planned with Lithuania, and another with Belarus, to be completed in 2015. The Lithuanian interconnector (LitPol) received considerable EU funding in 2011. A 750kV line linking the Ukrainian Khmelnitski NPP to Poland has been out of operation since 1993. PSE plans to reopen the eastern connections, allowing for 3000MW of imports from Ukraine. A third line of a capacity of 1000MW (GerPol) is to be put into operation with Germany.

In 2011, Poland was a net exporter of electricity, exporting 5.2TWh of power: around 8.2TWh were exported to the Czech Republic, and 3TWh to Slovakia. Imports from Germany made up 4.7TWh and another 1.2TWh were imported from Sweden.7 It also has to be mentioned that increased offshore and onshore wind farm production in

6 HHI: Herfindahl-Hirschman Index measures market concentration of firms within a sector, by calculating the market shares of the largest firm of the sector. Its value ranges within 0 and 10000, where values between 1500-2500 indicate moderate concentration, above it means high concentration and consequently higher possibility to exercise market power.

7 ENTSO-E data bases. https://www.entsoe.eu/resources/data-portal/

Germany generates considerable loop flows in Poland, inhibiting the utilisation of interconnections. Consequently, Polish wholesale prices are somewhat lower than the German prices and display lower volatility.

Transmission and distribution activities were unbundled from the incumbent player in 2007. The Polish government created four vertically integrated actors: Polska Grupa Energetyczna (PGE), Tauron Polska Energia, Energa and Enea. These players own generating capacities, distribution and suppliers. The German electric utility RWE Polska S.A. managed to enter the market in some regions (around Warsaw) with a large market share.

The transmission system is operated by the state-owned PSE Operator S.A.. The transmission system is reported to be obsolete and requires modernisation.8 Generating capacities are located in the southern and central regions of the country, therefore historically the network is more concentrated in those areas than in the north. However, the potential wind sites of the country are located in the north, without sufficient network infrastructure. In 2009, PSE Operator reported that 2000km of new network line (around 15 per cent of the current transmission network length) needs to be constructed to ensure the connection of 8000MW wind capacities. High-scale utilisation of wind capacity should take into account the shortcomings of the network infrastructure, and plan accordingly.

B. RES-E production, existing policies and opportunities for investments

Existing Policy

- Poland transposed the relevant RES Directives (2001/77/EC and 2009/28/EC), although the implementation of the latter is somewhat delayed.
- Since 2005, Poland has had a Tradable Green Certificate (TGC) RES-E support policy, whereby generators sell RES-E production on the market and receive extra payment for their green certificates. Forthcoming regulation might support micro generation through a Feed In Tariff (FIT) system, creating more opportunities for the small-sized distributed RES-E systems that face entry barriers under the present TGC framework.
- In 2010 RES-E capacity reached 2.5GW, including 1.2GW of wind and 0.9GW of hydro generation.
- Poland has already planned to introduce a new Energy law and a new RES-E law, but their introduction has been postponed for two years, creating uncertainties in the investment environment.

Investment support

- The national RES-E Programs are mainly financed through the National Fund for Environmental Protection and Water Management (e.g. Green Investment Scheme). Moreover, European Funds, such as Structural Funds (e.g. Regional Operational Programmes) are an important source of funding for RES-E.
- An exemption from the energy excise tax is also available for RES-E generation, and this is to be maintained in the forthcoming regulation as well.

Targets, opportunities and potential

- The National Renewable Energy Action Plan (NREAP) set a 19.1 per cent RES-E indicative target for 2020. Presently the highest share is in wind, and according to the NREAP, future growth will take place mainly in wind and biomass capacity. The recent Ministerial regulation increased and extended the target level of the Polish Green Certificate system until 2020, creating a more harmonised regulatory framework and a significant regulatory push on the demand side of this market.
- The potential of further hydro generation is limited, while the country has high wind potential in the northern part, both for onshore and offshore generation. However, since the northern part of Poland has a rather weak electricity network, it needs to be upgraded first to accommodate higher wind penetration. The planned new Renewable Energy Act will put a limit on the present practice of biomass co-firing, which creates opportunities for new, more efficient biomass based generation.

8 IEA (2011): *Energy policies of IEA countries: Poland 2011 Review*.

1. RES-E financing

The main financing institution for renewables is the National Fund for Environmental Protection and Water Management. Between 1989 and 2009 this financed 647 renewable projects with a contribution of 211€ million, covering around 32 per cent of the total project costs.[9] For 2009–2012 the Fund earmarked 370€ million for the same purpose. The soft loans provided by the Fund can be as much as 1–12.5€ million per project, and cannot cover more than 75 per cent of the project investment costs. Up to 50 per cent of the loan may not be repaid. Wind (up to 10MW), biogas and hydro generation (up to 5MW) are eligible during the current programming period.[10] In addition to other sources, the Fund receives the 'compensation fee' paid by energy suppliers.

European Funds, most importantly the Structural Funds (e.g. ROP, Regional Operational Programmes and the Operational Programme of Infrastructure and Environment) have supported the long-term programme of financing renewable investments in Poland. Regional governments formulated their own priorities and action plans for the development of the RES-E sector for the first time (in a common and comparable way) during the 2007–2013 programming period for the use of EU funds. Sixteen ROPs were created, constituting the largest, most complex, longest-term nationwide programme to support renewable energy in Poland (with a total budget of 260€ million, or 1132 million PLN). In implementing the NREAP until 2020, ROPs could play a significant role in stimulating the implementation and promotion of new technologies for RES-E in Poland.[11]

Structural Funds could also become an important funding source for the period of 2014–2020. The new programming framework for the Regional Operational Programme assumes a 6–20 per cent minimum share of the funds to be spent on the low carbon economy, amongst them on renewable energy and energy efficiency (varying between the least and most developed regions). This would be a great opportunity for investments in both new RES-E capacities and network development (ie transition and distribution).

Emission Trading System (ETS) revenues could be used as additional financial support for RES-E development. As from 2013, under phase 3 of the ETS, auctioning will be the general rule for quota allocation in the electricity sector. Governments will receive significant income from the ETS scheme. As Poland applied for a partial derogation from this rule, the income for the country will be less for the first few years, but will significantly increase by 2020. The possible size of this income stream can be estimated, based on the energy use values published in the Polish Energy Policy Strategy and the present ETS carbon price around 6€/tCO_2. With 39 million tonnes of CO_2 emissions in 2020, the generated income could reach 273€ million per year by 2020.

2. Description of the Polish Green Certificate market

Poland introduced a Tradable Green Certificate (TGC) system in 2005 in order to promote RES-E production and to fulfil the obligations set by the 2001/77/EC directive. According to the Polish TGC scheme, all electricity providers must ensure that a certain percentage of the electricity sold to end consumers is from renewables. Electricity suppliers serving last-resort consumers are obliged to purchase renewable electricity produced in their service area. Electricity suppliers can fulfil the TGC obligation either through buying the certificates on the market (on the Polish Power Exchange or from RES-E producers), or through paying a 'compensation fee' determined by the URE President according to the Energy Law. In this system RES-E producers receive two sources of revenues:

- A guaranteed price for their production, which is set at the level of the average market price of the preceding year calculated by the energy regulator.
- A Green Certificate (GC) bonus, determined by the TGC market equilibrium price of the certificate.

There is no minimum price for the GC, however the compensation fee serves as an effective maximum cap on the certificate price. As a result, so far GCs have stayed close to this 'capped' level, within the range of

9 IEA (2011): *Energy policies of IEA countries: Poland 2011 Review*.
10 RES-Legal: *Country overview: Poland*. http://www.res-legal.de/en/search-for-countries/poland.html
11 IEO (2011): *Estimation of energy potential of Polish regions regarding renewable energy sources – conclusions for Regional Operating Programmes for the programming period 2014-2020*, Institute for Renewable Energy (in Polish: Określenie potencjału energetycznego regionów Polski w zakresie odnawialnych źródeł energii - wnioski dla Regionalnych Programów Operacyjnych na okres programowania 2014-2020 grudzień.)

55–75€/MWh (220–290 PLN/MWh). If all these costs are passed on to end consumers, the rate already makes up 7–8 per cent of the net final consumer price. The effective cap also indicates that the supply of RES-E production stayed below the planned level, as energy suppliers used the compensation option to fulfil their TGC obligations. The table below shows the TGC targets and the actual number of TGCs issued by the URE. The difference between the target and the actual share of TGCs shows that around 15 per cent of the target is fulfilled through the compensation fee option. In this way the operation of the Polish TGC is rather similar to a Feed-in Tariff (FIT) system.

The 14/08/2008 Ministerial Decree determined the GC targets until 2017, while a recent Decree (17024/MG of 18/10/2012) established the target till 2021 and reviewed the GC target values for the years 2013–2017. This revision resulted in a significant upward adjustment of the target values; for example, in 2017 the previous value 12.9 per cent value has risen to the present figure of 16 per cent. This modification creates a significant boost for the Polish Green Certificates market (see Table 1). The Decree also extends and regulates the minimum share of biomass and waste requirements in co-firing units until 2021.

Table 1. The minimum obligatory share of Green Certificates in electricity purchase (Source: ERGEG Polish national reports 2011, 2010, 2009 and *ENTSO-E)

Rok	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Year previous Target per cent	7	8.7	10.4	10.4	10.4	10.9	11.4	11.9	12.4	12.9				
New Target per cent	7	8.7	10.4	10.4	10.4	12.0	13.0	14.0	15.0	16.0	17.0	18.0	19.0	20.0
TGC share per cent*	4.5	6.3	7.6											

Electricity providers which do not fulfil the TGC obligations by purchasing the necessary GCs or paying the compensation fee are subject to a penalty.

Presently, there is no differentiation of GCs; all eligible technologies receive one certificate for each kWh of RES-E produced. Eligible technologies include hydro, wind, biomass, biogas, solar, and geothermal generation. Biomass co-firing is also eligible; however, the 2008 Ministerial Decree set minimum biomass shares according to the size of the plant, with a range of 20–55 per cent in 2012 and 55–100 per cent in 2017. The new 2012 Decree prescribes the minimum biomass shares for 2017–2021.

There is no differentiation between the rest of the technologies in terms of the prescribed share of generation, and GCs are not tradable internationally. An important risk factor regarding the TGC regime is that the eligibility period is not set, except for biomass co-firing, where the planned regulation limits the eligibility period to five years. Consequently, the RES-E technologies will be eligible until 2020 for the additional revenue generated from green certificates, but the subsequent period carries a risk.

The cost of purchasing TGCs is borne by the consumers. Production of electricity from cogeneration plants (since 2007), and mining gas and agricultural biogas (since 2011), are also subject to a tradable certificate scheme. Yellow, brown and purple certificates are issued for their production, and separate quotas are determined. If biomass is used in a highly efficient cogeneration plant, then both the green and yellow quota premiums are granted.

Most of the criticism concerning the TGC system points to the fact that the TGC price is determined mainly by the compensation fee and not by the induced demand and supply equilibrium for RES-E. As a result, only the cheapest options (biomass co-firing, large hydro generation and wind) are used: PV and other, more expensive types of RES-E have an almost negligible share. For example, in 2010 alone, 3640MW of 'promises of license' were issued for wind, and only 60MW for other sources.[12] Non-differentiation of the TGCs by technology also drives

12 Muras: *Support systems for the production of agricultural biogas and electricity... in renewable and co-generation sources in Poland*. In: Rynek Energii 2011.

the more expensive options out of the market. However, from the perspective of economic efficiency, this 'non-differentiation' leads to the least expensive RES-E portfolio.

An additional criticism relates to the eligibility of biomass co-firing. Critics argue that biomass generated in old, inefficient fossil plants should be excluded from the scheme. To answer this, the Polish government drafted new Energy and Renewable Energy Acts in 2010, but according to the latest information these are expected to enter into force only in 2013. The long delay in adopting the new bills has increased the uncertainty faced by investors over the past few years.

The main changes to be introduced by the planned RES-E regulation are summarised as follows:

- Differentiated TGCs will be introduced for the eligible technologies. TGCs will vary by o technology and also by time (refer to Table 2),
- Micro generators will be eligible for feed-in tariff (FIT) support, according to technology-specific size categories. (refer to Table 3 for details),
- Reviews of the FIT scheme will be conducted every three years,
- The contract term of TGC will be 15 years, with the exception of co-firing, where RES-E allows for a five-year term only. After five years of operation, co-firing will no longer be eligible for support,
- The FIT budget for micro generation will be limited to 49 million PLN (12€ million) for 2013.

The tables below also show the proposed differentiation of the TGCs for larger plants. The proposed RES-E law assigns the number of green certificates according to technology, fuel, and size of technology. The new law also lowers the GC factor over time. The highest number of certificates are assigned for solar power plants, while biomass co-firing will receive the lowest reward. Solar plants also receive the highest rate of support tariff for micro generation, slightly above the level of the present German FIT. This tariff could induce significant investment in PV technology, which could reach around 600MW capacity by 2020 according to the official forecast. According to the Polish PV Association, growth could be even more intensive. The Association claims that a very close collaboration between industry and the government is needed in order to avoid the 'boom and bust' scenario of Spain or the Czech Republic, where a rapid growth in the RES-E technologies was followed by sudden halt in RES-E developments, imposed by abrupt regulatory changes.[13]

Considering these planned changes, the most significant change is expected in PV if the new RES-E law is accepted. On the one hand for large installations the Green Certificate will almost be tripled, therefore promoting PV technology. With the present GC price, the subsidy will be close to the German or Italian FIT level. On the other hand small scale installations will also receive FIT, in addition it simplifies the administrative procedures, as they will not need connection license for the installations. As the RES-E manufacturing sector has already significant production capacity in Poland, significant portion of the increasing demand could be satisfied by them rapidly, helping to capture higher value added shares at the domestic market.

Table 2: Differentiation of TGC under the planned system

	2013	2017
I. Biogas (agricultural) 200–500kW	1.5	1.425
II. 500kW–1MW	1.45	1.375
III. >1MW	1.4	1.325
Biogas (landfill) >200kW	1.1	1.0
Biogas (sewage) >200kW	0.75	0.625
Biomass <10MW	1.3	1.2
>10 MW	0.95	0.875

13 Businessweek (2012): *Poland Renewables Bill to Forge New Solar Market as EU Cuts Back*. 28 October 2012. http://www.businessweek.com/news/2012-10-28/poland-renewables-bill-to-forge-new-solar-market-as-eu-cuts-back. See also the CPSL Gap analysis on the Czech Republic for more details.

Biomass CHP <10MW >10 MW	1.7 1.15	1.6 1.075
Biomass co-firing	0.3	0.15
Bioliquids	1.15	1.075
Solar >200kW	2.85	2.4
Wind 200–500kW	1.2	1.125
Wind >500kW	0.9	0.825
Offshore wind	1.8	1.8

Table 3: Proposed microgeneration tariffs, 2013

	PLN/kWh	€/kWh
Wind <200kW	0.65	0.16
Solar <100kW	1.1	0.27
Hydro <75kW	0.7	0.17
Biogas <50 kW	0.7	0.17
Biogas 50–200kW	0.65	0.16
Landfill gas <200kW	0.55	0.14
Sewage treatment gas <200kW	0.45	0.11

3. Potential for RES-E generation

Poland has a high potential for wind-based electricity generation compared to other countries in the CEE region (refer to the European wind map in the Extra Figures and tables section below). The most advantageous onshore and offshore sites are located in the northern territories close to the Baltic Sea, but the lower mountain region of Lower Silesia also demonstrates good potential. According to the NREAP, the market potential of wind power is 3.4GWe in 2015 and 6.6GWe in 2020 – the latter of which is more than four times the presently installed capacity. It means that the dynamic development of onshore wind could be continued in the future, if the grid capacity issues are carefully handled. The Baltic super grid concept could bring significant investment opportunities to the electricity sector in the long term, and could also impact on the cost of wind power.

There is also a relatively high potential with regard to biomass resources, due to the level of agricultural activities in Poland and the forest resources available (29.1 per cent of the country is covered by forests). A high proportion of Polish housing is also equipped with biomass heating. It is estimated that around one million homes use traditional or new biomass-based heating equipment.[14]

Regarding solar photovoltaic energy, the NREAP does not foresee any economic potential. This contrasts strongly with Germany, a country with similar levels of solar irradiation, where solar PV technology showed the highest growth rates in recent years.

4. Other supporting mechanisms for RES-E

In Poland, an excise tax is payable by all end consumers on energy products. The rate of the tax is 20PLN/MWh (around 5€/MWh). Energy consumed from renewable resources is exempt from this tax in Poland.

14 Eurobserver: *Interactive EurObserv'ER Database – Country Policy Schemes*, 2012

C. BARRIERS TO RES-E INVESTMENTS[15]

Cost-related barriers to RES-E investments

- Inadequate architecture of the present Tradable Green Certificates Scheme (TGC) to support the development of RES-E technologies. The scheme mainly generates revenue for the large and outdated power plants (e.g.. hydro generation and biomass co-firing in conventional units) – limiting the size of new investments in the RES-E sector.
- Lack of a strategic and effective approach to support RES-E investments. There is a lack of coordination and long-term vision for RES-E support. TGC mechanisms are not aligned with other instruments, such as subsidies from the National Fund for Environmental Protection and Water Management.
- High cost of RES-E investment financing, due to the risks related to TGC and the unstable regulatory framework.
- High, and still growing, cost of grid connection of larger scale RES-E, particularly wind farms.

Non-cost-related barriers to RES-E investments

- Lack of political priority given to RES-E development in Poland, and delays in the implementation of EU regulations – such as directive 2009/28/EC on the promotion of energy from renewable sources – are the main direct non-cost-related barriers to RES-E development.
- Regulatory uncertainty and a lack of transparency of the legislative process, highlighted during the on-going discussion on the proposed RES-E Act, are real investments risks.
- The poor technical condition of the energy infrastructure limits possibilities for RES-E integration with the transmission and distribution grid.
- Major social constraints to RES-E investments consist of spatial and social constraints to RES-E locations; the weakness of the local-level spatial planning system; a lack of transparent objectives for the Environmental Impact Assessment (EIA) of RES-E investments; and a time intensive process of administrative (e.g. environmental and location) decisions.
- Non-cost-related barriers also include the lack of a national information campaign on RES, and a lack of understanding of the economic benefits of RES-E development.

1. Inadequate architecture of RES-E support mechanisms

The main barrier to RES-E investment in Poland is the lack of long-term and comprehensive mechanisms to support green energy producers. The quota obligation and the Tradable Green Certificate Scheme (TGCS) focus only on renewable electricity generation, and do not differentiate between levels of support to be provided to various technologies. The fairly non-transparent and frequently amended Energy Law causes difficulties in the interpretation and application of regulation, and impedes green energy producers and manufacturers in determining long-term market strategies.

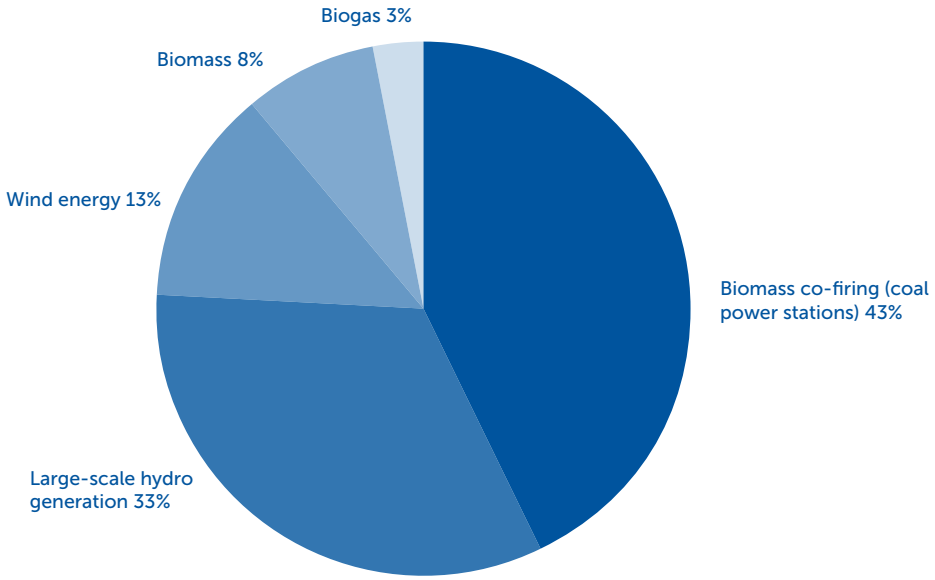
The existing Green Certificate System does not catalyse a competitive and heterogeneous RES-E market development. Instead of supporting new RES-E investments, it increases revenues for large-scale and already outdated power plants. Between 2006 and 2010, more than 75 per cent of total revenues raised by the system were distributed to biomass co-firing and hydro generation (Figure 6). The dominant position of co-firing in the green electricity mix has also substantially raised the demand for biomass to levels which cannot be met due to the low efficiency of these plants. Demand for biomass reached 7 million tonnes in 2011, showing steep increase in biomass use.16 This generated a substantial biomass import, and resulted in high biomass prices on the local markets, negatively affecting local consumers and municipal heating plants. Small and independent green

15 Chapter III has been drafted on the basis of the report entitled, *List of barriers in the energy sector* published jointly by The Association of the Employers of the Renewable Energy Forum (ZPFEO) and the Polish Confederation of Private Employers Lewiatan (PKPP Lewiatan) (ZPFEO 2011)

16 Wiśniewski G. et al.*The unsustainable use of renewable energy resources in Poland and pathology in the RES support*. (Org. O niezrównoważonym wykorzystaniu odnawialnych zasobów energii w Polsce i patologii w systemie wsparcia OZE. Propozycje zmian podejścia do promocji OZE i kierunków wykorzystania zasobów biomasy) Warsaw 2012

electricity producers (mainly photovoltaic, small hydro-, wind-, biogas- and biomass generation) that have higher unit costs within the Green Certificate System cannot use simplified procedures, such as net settlements.

Figure 4: Share of the total cost of the Green Certificate Scheme in Poland in 2006–2010



Another problem arises from target-setting under the TGC scheme. Targets for RES-E for 2010, 2011 and 2012 remained unchanged at 10.4 per cent, while generation from co-firing and wind has been expanding. This process could have resulted in an oversupply of RES-E. IEO analysis has shown that if on-going investments were taken into account (e.g. into the 200MW biomass power plant in Połaniec), oversupply would have most likely occurred as early as 2012, lasting until 2016.17 TGC prices have already dropped from approximately 290 PLN/MWh in March 2012 to 230PLN/MWh in October 2012. As a consequence of decreasing prices, the risk of investing in RES-E increases for investors and financing institutions. However, the 2012 Ministerial Decree will probably solve this issue, as the GC quota has been raised from 2013 on, increasing the demand for the certificates and reducing the risk of oversupply.

2. Regulatory uncertainty

An unstable regulatory environment and a lack of political priority given to renewable energy, are both real barriers to green energy market development. Poland has fallen behind in the implementation of European RES-E legislation. Directive 2009/28/EC on the promotion of energy from renewable sources has still not been transposed formally to Polish law. There are a number of elements yet to be introduced (e.g. the certification system for RES-E installers, and the system for the authorisation, certification and licensing of renewable energy) and revised (e.g. existing RES-E support mechanisms). Moreover, the newly established RES-E Department at the Ministry of Economy still has limited administrative and human capacity to manage RES. This might contribute to delayed decisions at the Ministry and also at the Council of Ministers.

Renewable energy investments face increased risks stemming from a number of sources:

- Low transparency and frequent changes of existing regulation (e.g. The Energy Law, and regulation on the presentation of certificates of origin and redemption for green energy);

17 Wiśniewski G. et al. *Analysis of the oversupply in certificate of origin impact on RES market* (org. Analiza skutków wystąpienia nadpodaży świadectw pochodzenia na sektor energetyki odnawialnej), Warsaw 2011

- Even though the government announced its intention to revise the RES-E support system in 2010 (within the 1st NREAP), to date the relevant decisions have not been made. The limited amount of analysis and assessment of the regulatory changes (ex-ante / ex post), the uncertainties surrounding the future architecture of the RES-E support system, and the less-than-transparent legislative process for the new RES Act (implementation of Directive 2009/28/EC) are direct barriers for investors;
- The limited visibility of the legal framework of the Green Certificate Scheme (valid only until 2021), and the inconsistent target-setting for the share of RES-E, also generate some uncertainty.
- Finally, there is a lack of official and publicly available information on long-term forecasts of energy prices and the level of support for RES, both of which are critical for business analysis.

3. Problems of RES-E grid integration

Problems related to RES-E grid integration appear to be the most important barrier for future RES-E development, especially for Independent Power Producers (IPP). The monopolistic electricity market, with a vertically integrated electricity sector, poses a real constraint for renewable energy investments in connection to transmission and distribution networks. The conditions set by the system operator (PSE Operator) for RES-E grid connection are complicated and non-transparent. The formal connection procedures are highly demanding and often costly. The criteria for distributing the costs of grid integration are also non-transparent, and often involve unequal treatment of energy producers, mainly disadvantaging medium and large RES-E projects developed by new entrants (including producers / investors, especially of wind power plants).18 Moreover, the Amendment of the Energy Law for 2012 introduced a non-refundable up-front deposit from energy producers in exchange for the grid connection. Due to changes in the regulation, around 90 per cent of all on-going RES-E investments have lost the legal consent they previously gained for provisions for grid connection, and investors have to apply again.

Grid integration is an obstacle for all kind of RES-E investments; however, difficulties also increase in proportion to the capacity of installations. The integration of large wind farms (to be connected to the 110kV voltage grids) appears to be the most challenging. Recently, the cost of grid expansion and the integration of RES-E investments for large wind parks have been calculated as 30–40 per cent of total investment costs (the average for a number of due diligence investigations performed by IEO). During the early years of wind installation, the average cost of grid connection was 5–10 per cent, which is close to the EU average. However, as the best locations had already been taken, in 2012, wind developers ended up at sites where high- or medium-voltage lines needed to be built as part of projects, significantly increasing the costs of grid connection. Even in the north, where the best-performing wind sites are located, the network is rather weak. Thus challenges around grid connection in Poland relate mainly to wind generation.

Moreover, renewable energy producers do not have open and equal access to information on network traffic specifications and plans for further development and modernisation of the distribution grid. An important barrier for RES-E grid integration is the poor technical condition and limited capacity of the distribution grid. In some cases, the grid connection on offer does not provide sufficient planning security. Grid operators have the right to refuse to take over the electricity produced until the necessary modernisation of the grid has taken place, and not agree to binding deadlines.19 The TSO and the DSOs have issued legal conditions and technical guidelines for 17GW of wind farm capacity to connect to the grid, but under the current technical conditions, even after taking into account the plans for grid reinforcement (8.2€ bn in 2012–2016 for TSO alone), a capacity of only 6GW might be connected.

RES-E grid integration might be seen as a barrier, but also as a great opportunity for future energy grid development (especially for RES-E micro generation). Investments in the distribution network could not only ensure better usage of the low-voltage grid, but might also promote the role that 'prosumers' play within the energy market.

18 A recent court decision revealed the impact of inarticulate guidance on the grid connection cost for RES-E producers, where the distribution company of PGE and the Regulator (URE) had a dispute on the connection of a specific wind farm, and the claimed sum ranged between 1 and 35 million PLN (0.25 vs. 8.5 million €). The distribution company won the case. (gramwzielone.pl, 2012)

19 Pobłocka A. et al. *Integration of electricity from renewables to the electricity grid and to the electricity market, National report: Poland*, Berlin 2011

4. Spatial, environmental and social constraints of RES-E development

Limitations of the spatial planning system in Poland influence decisions about the location of RES-E investments. A lack of local spatial management plans have caused increased administrative requirement for issuing permits for the investment locations. Investors need to satisfy numerous requirements in order to receive an environmental approval such as an environmental impact assessment, public consultation, etc. [20] .This means that administrative decision-making processes requires a significant length of time (2 years on average).[21]

The lack of uniform guidelines for environmental impact assessment reports on different types of RES-E technologies causes a number of difficulties when issuing permits. Environmental authorities' overly restrictive permitting and reporting approaches often results in unreasonable requirements for investors, which can impact the profitability of the investment and increase risks. While this mainly affects wind projects, biogas plants and small hydropower stations are also influenced.

Additional barriers related to the location of RES-E investments are often linked to social constraints. Due to a lack of public information campaigns, there are a number of protests against RES-E investments (mainly biogas and wind energy generation). Moreover, local communities do not fully understand the benefits of RES-E developments in their neighbourhood, creating the familiar 'NIMBY' ('Not in My Backyard') effect.

D. The effect of renewable energy on jobs and growth in Poland

Local production of equipment for RES-E in Poland – opportunities and challenges

- There is already a significant local production of equipment for renewable energy in Poland, although at different levels of maturity in various segments of the manufacturing sector.
- Even though the highest growth is expected in large-scale wind production, the local production components for large-scale wind turbines is weak. At present local production is focused on other areas, mainly on equipment for micro generation and on photovoltaic assembly plants. Moreover, the latter are produced by the subsidiaries of international enterprises for export markets, not for local implementation.
- The availability of local production and expertise seems to be an important factor in the investment decisions of small-scale RES-E developers. For example, the small-scale wind turbine market is currently limited, but has a high potential for growth. Planned FIT for micro generation could help to boost this segment.

1. Global vs. domestic context of RES-E technology manufacturing

Besides the significant job-creation effect of increased RES-E generation if coupled with increased domestic manufacture of RES-E technology, the competitiveness of the manufacturing sector in producer countries is also increased. These positive effects originate from increased R&D, and the rapid expansion of a market for the technologies produced. However, countries in the CEE region find themselves in a situation of asymmetric development, whereby in spite of an increasing share of RES-E generation they do not see the development of their RES-E manufacturing industry. Consequently, they do not point to or understand the manufacturing-side benefits of RES-E. Poland demonstrates the problem of this asymmetric development, where it is heightened by two further factors. In theory, due to the larger size of its market Poland should be particularly suited for manufacturing RES-E equipment, as many of the studies dealing with the issue point to the importance of the size of the domestic market in locating RES-E assembly units.[22] In addition, as the Polish electricity market is still dominated by large state-owned enterprises, the contrast between traditional domestic production and RES-E developments generally driven by foreign capital is even more pronounced than in other CEE countries with higher shares of foreign capital in their electricity markets.

In this section of our study we attempt to make a preliminary assessment of the present status of the RES-E manufacturing sector in Poland, and to collect together the instruments available for to the government to

20 Decision on environmental conditions for project implementation approval.
21 ZPFEO: The Association of Employers of Renewable Energy Forum (ZPFEO) and Polish Confederation of Private Employers Lewiatan (PKPP Lewiatan). *List of barriers in energy sector*, Warsaw 2011
22 E.g.: Ru et al: *Behind the development of technology: The transition of innovation modes in China's wind turbine manufacturing industry*. In Energy Policy 2012

support improved local manufacture of RES-E technologies. This short analysis could serve as the starting-point for a more detailed assessment of this field, with a wider regional coverage of the whole CEE region.

In recent years, three major studies were published in Poland dealing with the development of the industry for RES-E technology manufacture. In 2010, the Polish Institute for Renewable Energy (IEO) provided a very detailed description of this industry; in 2011, the OECD developed case studies on the effect of the economic and environmental policies of two voivodeships and in 2012, the Ministry of Economic Affairs issued an impact assessment of the new legislation on renewable energy. [23, 24,25, 26] To confirm and update the findings of these studies, for the purposes of this report a small survey was conducted among companies producing wind-generated electricity or providing wind-generation equipment. The survey focused on the domestic equipment supply and regulatory environment.[27]

In Poland the wind energy sector has the largest potential for development, especially for the wind parks planned in the Baltic Sea. The impact assessment of the Ministry expects the biggest increase in employment is expected in connection to the wind power industry, especially by the installation of new capacities. In the large scale wind turbine manufacturing sector operates few international firms who supply the majority of turbines, and some of them already have affiliates producing components (e.g. blades) in Poland. There are other Polish companies who can provide other components such as tower for these large wind turbines (transformators), but there is no complete large scale wind turbine production in Poland according to IEO. Although there are companies producing components locally, and almost all the technology is available by local production it has no importance in the investment decision of the electricity producers. Only small part of the investments in wind power plants (e.g. roads and connection to the grid) are made by Polish companies. The companies in the large scale wind power generation do not expect an increased proportion of local production of turbines.

In the small scale wind power equipment industry the majority of firms are importing and installing machines produced outside of Poland, only a small proportion have own production (IEO, 2010). In the small scale wind turbine market there is local know-how, and there is qualified labour force. The current market size for such equipment is small in Poland, but the potential for development of the market is large and plays major role in the investment decision. The firms in this sector expect increasing possibilities and they are looking for export possibilities by pilot projects in foreign countries.

The second largest potential for development of the manufacturing of RES-E technology has the biogas industry, as it is connected to the strong Polish agricultural sector. In the field of biogas there are Polish companies who can build complete systems, and one-third of the equipment installed in Poland is produced locally, based on the IEO study. The production and distribution of sun and heat collectors is well developed in Poland, and twice as much equipment is exported rather than imported. About half of the firms dealing with heat collectors sell their own domestically manufactured products, while the other half are licensed distributors of foreign products. The Ministry of Economic Affairs expects that the second largest increase in employment in the renewable energy sector will be in the industry connected to the production and installation of sun- and heat-collectors.

Photovoltaic energy production in Poland at the moment is negligible (3MW), in spite of the fact that several international firms have production capacities in the country producing solar panels for European markets. The proposed FIT for micro generation is expected to significantly change this situation.[28]

The regulatory environment plays an important role in the development of the renewable electricity sector for

23 IEO (2010): *Analiza możliwości rozwoju produkcji urządzeń dla energetyki odnawialnej w Polsce dla potrzeb krajowych i eksportu*. (Analysis of the development of production facilities for renewable energy projects in Poland for national consumption and export) 2010

24 Miranda, G. et al. (2011), *"Climate Change, Employment and Local Development in Poland"*, OECD Local Economic and Employment Development (LEED) Working Papers, 2011/22, OECD Publishing. http://dx.doi.org/10.1787/5kg0nvfvwjd0-en

25 A voivodeship is the largest administrative unit in Poland, similar in size to a Bundesland in Germany.

26 Ministerstwo Gospodarki, Ocena Skutków Regulacji dla projektu ustaw o odnawialnych źródłach energii, 2012, http://www.mg.gov.pl/files/upload/16573/OSR%20ustawa%20OZE%2026.07.2012%20wersja%20na%20konferencje%20w%20dniu%2027%20lipca%202012%20r..pdf

27 The wind energy sector was chosen for the survey because this is the sector where the largest development is expected in the coming years, and it had the largest impulse on employment in the impact assessment of the new proposed regulation on renewable energy.

28 Businessweek (2012): *Poland Renewables Bill to Forge New Solar Market as EU Cuts Back*. 28 October 2012.

the local industry supplying with equipment. In Poland there is no local content bonus applied in the TGC scheme. In other countries, like Turkey or Croatia a domestic component incentive scheme grants higher feed-in tariff if locally manufactured component is included in the RES-E installations.[29] Poland has no special standards like it was in Denmark which requires the use of a specific local technology. This support technique is often disputed in the World Trade Organization (WTO) as a technical barrier for free trade. Similarly for Poland, as a WTO member, it is not possible to use favourable custom duties for whole turbines compared to parts and components, because it is illegal for WTO member countries.[30]

There are other accepted methods to help the development of the local industry like providing tax reduction (VAT) or tax credit for locally produced components, or low interest rates loans to local companies producing wind turbines.[31] The Polish companies in the RES-E sector are not expecting rules and regulations which would require local production because it would go against EU directives. For the development it is rather expected to have low or subsidized interest rates for loans for projects in the renewable energy sector and stable regulatory environment and support scheme.

In Poland the current economic policy is concentrating on supporting old industries to protect old jobs, and this method significantly reduced the available financial support for other upcoming competitive and sustainable industries, such as producing technologies for renewable energies. In many cases the potential impact of the central, regional and local public administrations' green activities seem to be undervalued according to the Miranda study. The biggest problem which can hinder the development in this sector is the bureaucracy. The complicated legal system can delay investment and create difficulties for firms installing small scale wind turbines.

To change the situation a new regulation is in preparation to help the development in the sector. The new regulation is based on the consultation of the industry and shall be in line with the expectation of the stakeholders. It is foreseen a simplified take-over and feed-in-tariff scheme to help the expansion of micro generation, and keep the current green certificate system which is a major factor for the investment into the large scale renewable energy production.

The Ministry of Economic Affairs expects that the new regulation will create four times more jobs in the RES-E sector than the loss in the mining industry. It is expected that due to the big domestic market, several new foreign investors will base their production in Poland (Ministry of Economy 2012). Research and development programs shall help the development of local know-how and the domestic industry supplying equipment for renewable energy. Finally, the export possibilities of the local RES-E manufacturing industry can be further improved by international certification of the locally produced equipment.[32]

2. RES-E targets

Poland had a renewable electricity target of 7.5 per cent by 2010 set by the 2001/77/EC directive. The country has gone beyond this target and reached 7.58 per cent by 2010 (see Figure 6 for details). The overall renewable target of the country for 2020 is 15 per cent of the gross final energy consumption, imposed by the 2009/28/EC directive. This is a significant increase from the 7.2 per cent level in 2005. This overall target figure translates to a 19.1 per cent share of renewable electricity according to the official NREAP figures. Poland is on track to reach its target for 2020, indicated by the trajectory of the following two figures (see Figure 5 – 6), although the growth in RES-E penetration planned for the last few years is quite substantial. Wind and biomass have played and will continue to play the key role in reaching the RES-E electricity targets.

29 ERRA, *Country presentation*, 2011 and www.res-legal.eu Croatia country information.
30 Lewis, Joanna; Wiser, Ryan. (2005). *Fostering a Renewable Energy Technology Industry: An International Comparison of Wind Industry Policy Support Mechanisms*. Lawrence Berkeley National Laboratory: Lawrence Berkeley National Laboratory. Retrieved from: http://escholarship.org/uc/item/6cf1r3z5
31 Lewis Joanna; Wiser, Ryan. (2005). *Fostering a Renewable Energy Technology Industry: An International Comparison of Wind Industry Policy Support Mechanisms*. Lawrence Berkeley National Laboratory: Lawrence Berkeley National Laboratory. Retrieved from: http://escholarship.org/uc/item/6cf1r3z5
32 Lewis Joanna; Wiser, Ryan. (2005). *Fostering a Renewable Energy Technology Industry: An International Comparison of Wind Industry Policy Support Mechanisms*. Lawrence Berkeley National Laboratory: Lawrence Berkeley National Laboratory. Retrieved from: http://escholarship.org/uc/item/6cf1r3z5

Figure 5: Yearly projected installed RES-E capacity between 2005 and 2020 by technology

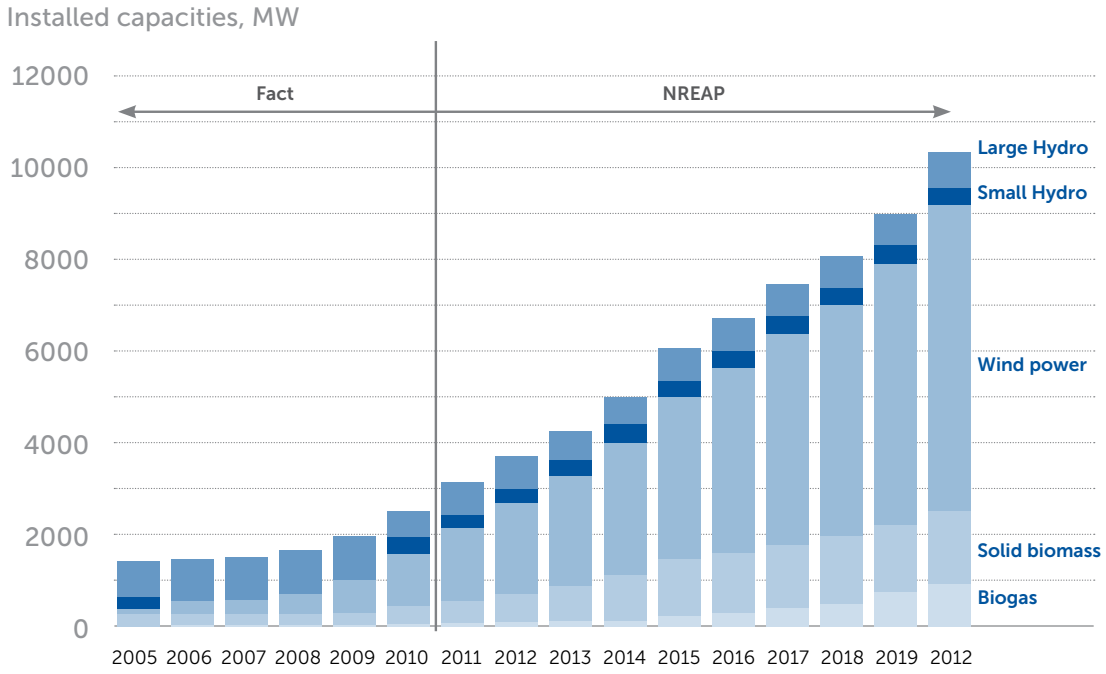
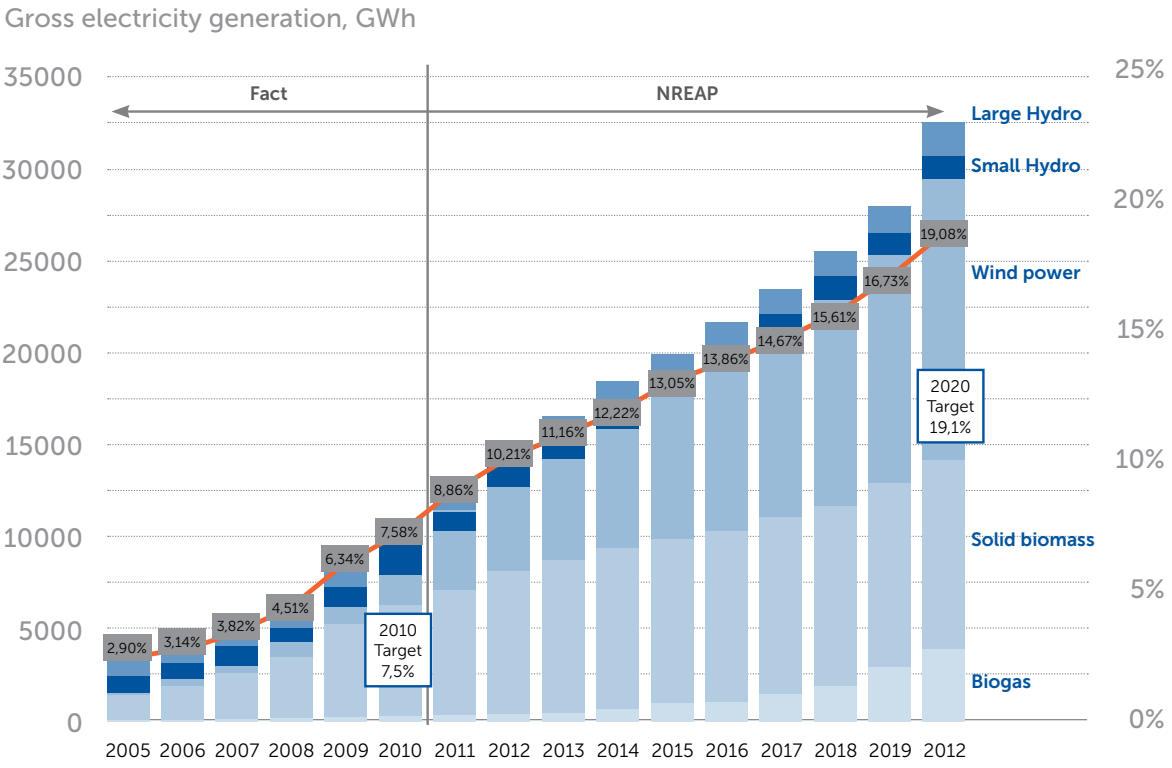


Figure 6: Yearly projected RES-E electricity generation between 2005 and 2020 by technology

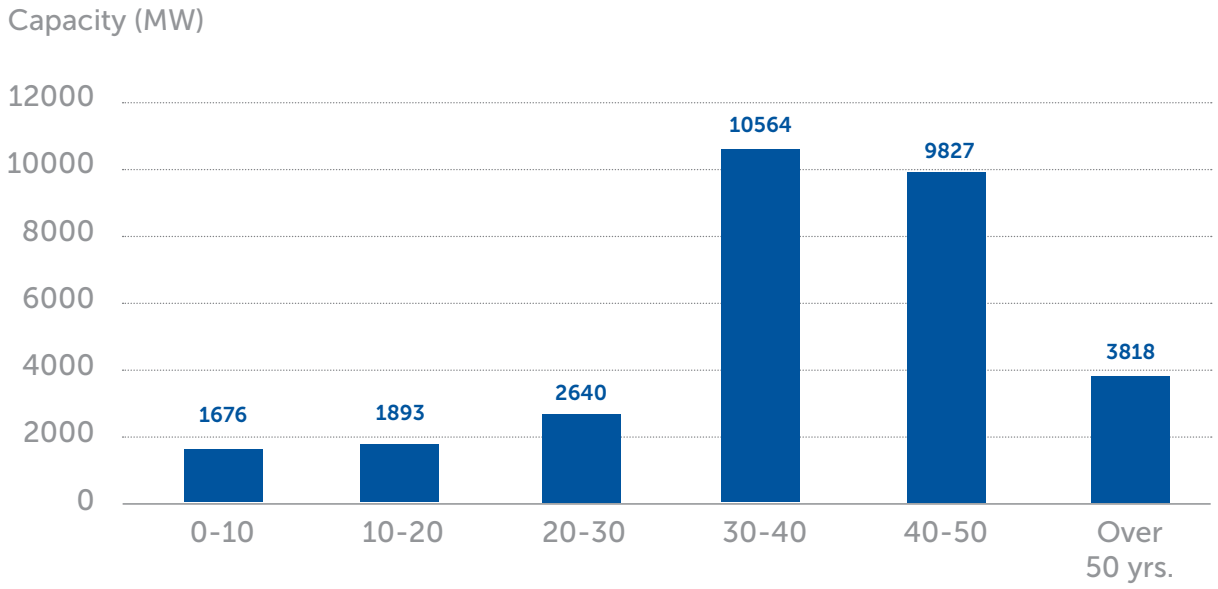


Extra Figures and Tables

Age distribution of Polish coal and lignite plants

As the following figure illustrates, Polish coal and lignite plants show an aging pattern. Two thirds of the capacities are over 30 years old, representing power plants where major refurbishing is dubious from an economic and technical point of view.

Figure 7: Age distribution of Polish coal and lignite capacities



Source: own collection, Platts

Transmission network and trade

Since 2010, Poland has been a member of the CAO: cross-border trade with Germany, the Czech Republic and Slovakia is conducted via the Central Allocation Office. Capacities to Sweden are allocated in an implicit manner.

Overall, Poland is not highly interconnected with its neighbours. Wholesale prices are somewhat lower than the German prices and display lower volatility.

	NTC value (MW)		Cross-border auctions				
	From Poland	To Poland	Type of auction	Yearly	Monthly	Daily	Intraday
Germany	450	200	common	CAO	CAO	CAO	CAO (FCFS)
Czech Republic	400	600	common	CAO	CAO	CAO	CAO (FCFS)
Slovakia	500	400	common	CAO	CAO	CAO	CAO (FCFS)
Ukraine	-	220	unilateral	-	PSE	-	-
Belarus	-	-	-	-	-	-	-
Sweden	600	600	implicit (market coupling)	Nordpool spot, POLPX			

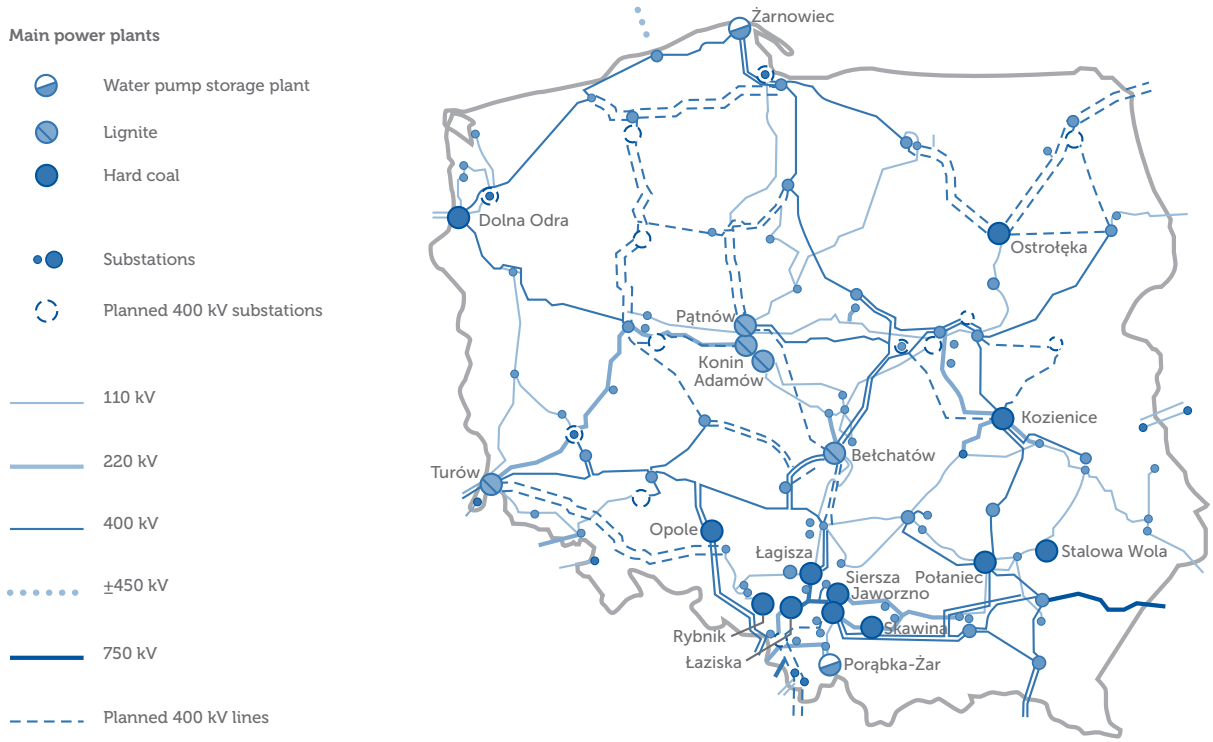
*(FCFS): First come, first served

Transmission and distribution activities were unbundled from the incumbent player in 2007. The Polish government created four vertically integrated actors: Polska Grupa Energetyczna (PGE), Tauron Polska Energia, Energa and Enea. These players own generating capacities, distributors and suppliers as well. RWE (around Warsaw) managed to enter the market in some regions.

Electricity infrastructure

The following map from IEA shows the network infrastructure of Poland. It illustrates that the network is stronger in the southern part of the country, while it is weaker in the northern part, where most of the wind installations are expected.

Electricity infrastructure

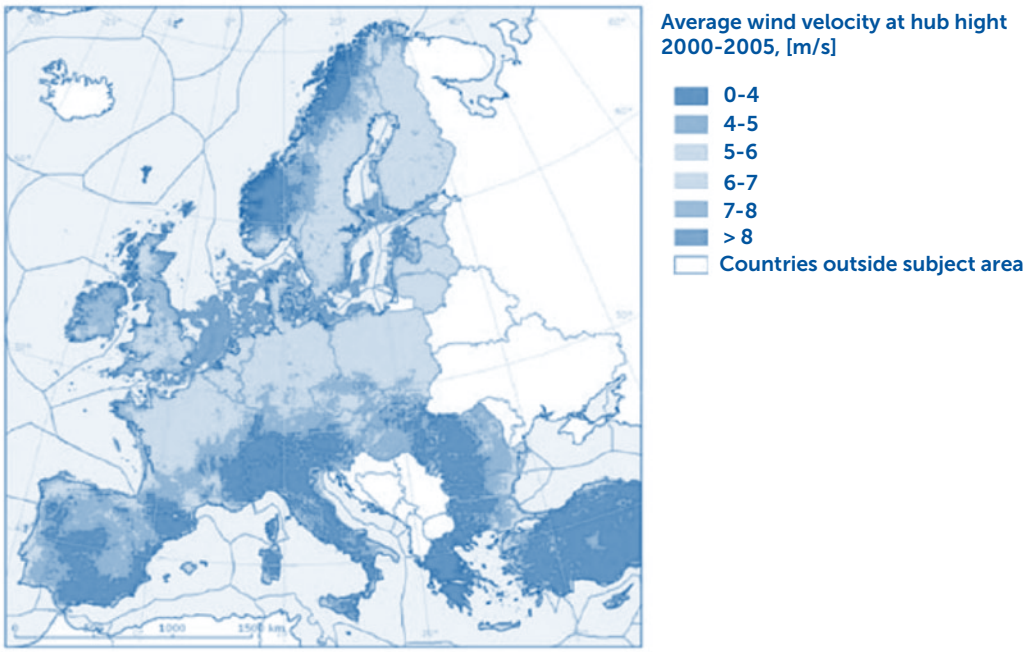


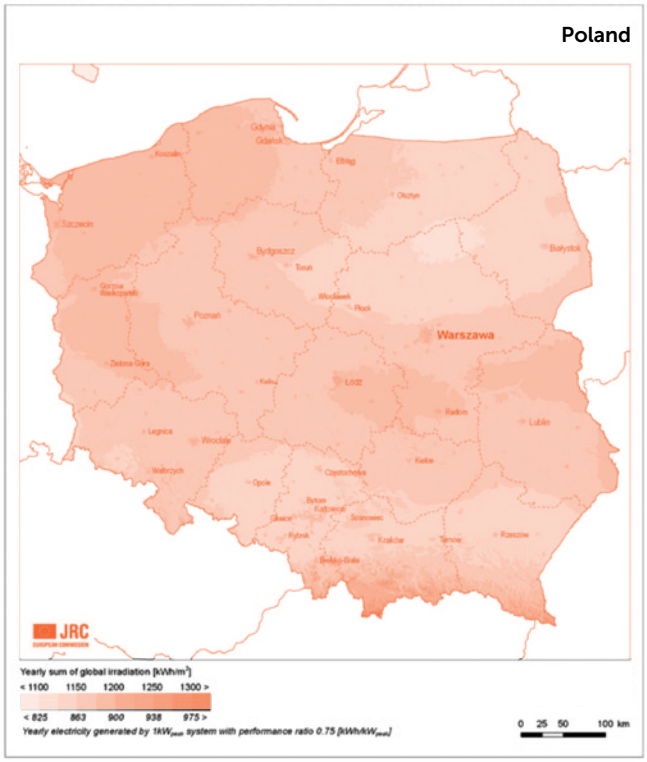
Source: Energy policies of IEA countries, Poland 2011, p. 73

Maps on the wind and solar potential

The following two maps show wind field data for the EU countries from EEA and solar irradiation data for Poland from JRC.

ECMFW wind field data after correction for ortography and local roughness (80 m onshore, 120 m offshore)





Source DG JRC, European Commission

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