Chapter X

TECHNICAL AND REGULATORY APPROACHES TO ENHANCE THE RENEWABLE ENERGY CAPABILITIES TO TAKE PART ACTIVELY IN THE ELECTRICITY SERVICES MARKETS – DRES2MARKET

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Abstract

The transition of energy sector towards more sustainable electric energy production increases the importance of distributed generation from renewable sources (RES), including photovoltaics (PV) and wind energy. A high integration of PV and onshore wind energy into the EU distribution grid is a key to a successful energy transition. Despite the achievement of significant progress in the regulations of the use of energy from renewable sources, especially the implementation of the RED II Directive, the development of photovoltaics and onshore wind energy is slowed down by a number of formal restrictions existing in the European Union countries. These are various types of market, regulatory, administrative, technological and social barriers.

The aim of this chapter is to discuss the main barriers inhibiting the development of distributed generation from renewable sources, such as photovoltaics and wind energy, in order to increase their share in the electric energy market of the EU countries. There are regulatory, technological, administrative, financial, social and environmental barriers, which inhibit the integration of a large number of PV and onshore wind energy sources into the distribution network in some European Union countries.

The authors present the results of work done within the project on the impact of a large amount of photovoltaic and onshore wind energy on the operation of the distribution grid as well as the grid limitations.
The presentation and text are based on the work carried out as part of the European Commission's project in the H2020 Programme: DRES2Market: Technical, business, and regulatory approaches to enhance renewable energy capabilities to take part actively in the electricity and ancillary services markets. Grant number: 952851.

Keywords: photovoltaics, wind energy, energy market, barriers to the development of PV and wind energy, grid limitations, flow analysis, energy storage, simulations

Introduction

Moving away from fossil fuels and developing renewable energy for a safer, more competitive and sustainable European energy system is one of the biggest challenges facing the European Union countries.

As a result of actions taken by the European Union, the use of energy from renewable sources, especially photovoltaic energy, has increased in all member state countries. The regulations of the European Commission and national legislations as well as significant technological progress have contributed to this. As a result, in most European Union countries we observe a steady increase in obtaining energy from photovoltaic installations and a rapid increase in the capacity installed in RES.

Despite significant progress in the field of RES regulation, especially the implementation of the "RED II" Directive, the development of photovoltaics and onshore wind energy is slowed down by many formal restrictions existing in the European Union countries. These are various types of market, regulatory, administrative, technical and social barriers.

1. Barriers to the development of renewable sources of energy

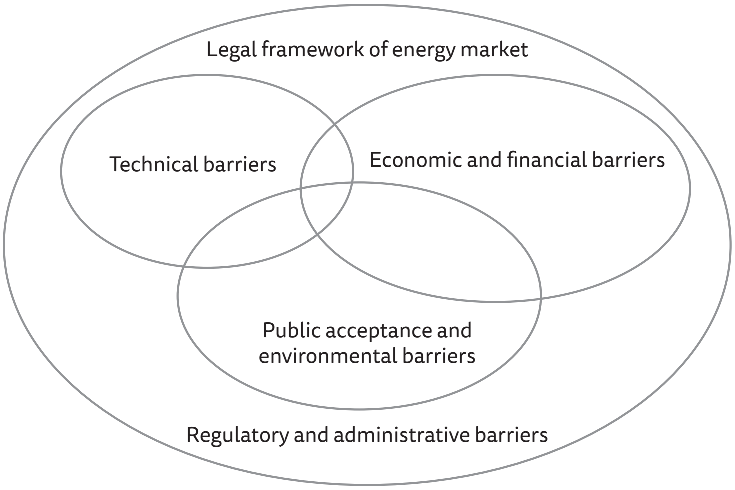
There are many market, regulatory, technical, administrative, financial and social barriers that contribute to a slowdown in the development of photovoltaic and onshore wind energy sectors in the European Union countries.

A proper design and implementation of each investment working in the grid system requires meeting many formal and legal requirements related to the functioning of other energy market users.

We can distinguish the following main categories of barriers that are related to the operation and organisation of the energy market [Felsmann, Vékony, 2021]:

- regulatory barriers – result from the general regulatory framework of the retail and wholesale electricity market. They refer to the impact of price regulation, regulatory burdens (grid charges, taxes), regulatory unpredictability and access to innovation. Uncertainty about the future direction of the regulatory framework, changes in digitisation and new technologies, as well as environmental obligations and generation capacity, slow down the development of photovoltaics and onshore wind energy;
- energy market architecture barriers – result from the entity and ownership structure of energy companies on the market. The dominance of large, vertically centralised energy companies may lead to a competitive advantage for these market players and an unequal playing field for other market participants. If market rules do not regulate this, they can use their market power to treat other market participants in a discriminatory manner, restricting access to information, discouraging new entrants from investing and participating in the market;
- operational and procedural barriers – result from differences in national/regional standards and procedures, concerning, for example, procedures related to connecting photovoltaic installations to the distribution system and medium voltage lines and to the 110 kV grid. The lack of developed procedures hinders and prolongs the entry of new entities into the energy market and activities on it;
- unequal access to innovation, innovative pilot projects launched on the market and information on the development of innovative products.

Figure 1. **Identification of barriers to the development of photovoltaics and onshore wind energy**



Source: OECD, IEA, 2011.

Regulatory and legal stability is crucial for all investments in renewable energy sources. The complexity of regulatory and administrative procedures as well as the scope and stability of support for the development of renewable energy affect the attractiveness of these investments.

Regulatory and administrative requirements for new installations may limit the possibilities for expansion of these sources in many European countries. Frequent legal changes cause difficulties in the interpretation of provisions and increase the risk when implementing long-term development strategies.

In addition to support in the form of a stable regulatory framework, an important role is played by the possibility of obtaining financial support, including the possibility of obtaining credit funds for the construction of new installations.

The main obstacles delaying the development of photovoltaics and onshore wind energy in European countries related to administrative and legal procedures are:

- variability of legal regulations, including changes in the basic mechanisms of support for photovoltaic installations;
- uncertainty about the future shape of the market;
- interpretative ambiguities related to the newly introduced regulations;
- insufficient spatial planning, delays and limitations in planning or insufficient integration of RES in spatial planning;
- environmental permits and related issues, mainly the time taken by administrative formalities;
- long time taken by permit granting process for connection to the grid.

Administrative requirements and related legal procedures have a major impact on the sustainable development of photovoltaics and wind energy in many European Union countries. Most of the Union member countries have set maximum deadlines for permit granting procedures, as well as simplified procedures for micro-installations, including the possibility to submit applications online. However, bureaucracy and lengthy administrative procedures, both on the part of the authorities and grid operators, continue to be the main barriers to the rapid implementation of new installations in many EU countries, e.g. Poland, France, Spain and Greece.

Regulatory instability causes uncertainty for investors as to the conditions of support in the coming years and the level of current costs of their operations.

In France, the most significant administrative obstacle is the length of time it takes to install photovoltaic systems. The procedures take up to several dozen weeks depending on the location of the installation (whether for residential buildings or above-ground facilities), between the start of the project and the introduction of the first kilowatt hour into the grid. This period may be extended to approximately four years due to additional procedures for connecting the installation to the grid. Public consultation is required for any above-ground photovoltaic power plant with a capacity of more than 250 kWp (Articles L123–1 to L123–2 of Code de l'Environnement). Urban planning permits may also extend the deadlines given[1].

Regulatory barriers are currently key barriers to the development of RES despite the actions being introduced at the European, national and local levels.

1.1. Technological barriers

In most European countries, there is technical potential and infrastructure for the development of photovoltaics and onshore wind energy. The state of the electricity grid infrastructure is not perceived as a barrier to their growth, but the barrier is the grid capacity.

Photovoltaic and wind systems are already so well developed that there are basically no technological barriers to the systems themselves, and the limitations relate primarily to the integration of these systems into the local grid. The technical condition of distribution networks and infrastructure limitations are the basic factors determining the development potential of photovoltaics and onshore wind energy, and network capacity limitations may affect both the output power and the technical design of new installations.

In many countries, difficulties in obtaining conditions for connection to the grid result from the lack of adequate distribution infrastructure, including overloading of power grids.

The basic factors determining the development potential of photovoltaics and onshore wind energy include:

- technical condition of distribution networks;
- limited number of energy storage units;
- insufficient growth rate of smart grids and meters;
- limited capacity of cross-border connections.

The development of smart grids in all European Union countries will allow for optimal use of distributed energy systems, reducing network load, minimising power failures and emergency threats.

Currently, technical barriers are not the dominant group. PV technologies on a small and medium scale enable reliable and trouble-free operation of devices with fairly high efficiency.

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1 Barriers to large scale integration of renewable energies on the electricity and ancillary services markets. Deliverable D2.3. 2021. Technical, business, and regulatory approaches to enhance renewable energy capabilities to take part actively in the electricity and ancillary services markets. Horizon 2020-LC – SC3–2020 – RES-IA-CSA. July 2021.

1.2. Economic barriers

Relatively high initial costs of PV and onshore wind installations, long payback times, as well as insufficient fiscal mechanisms constitute an economic barrier to new installations.

Financial limitations, a high cost of obtaining a loan or lack of creditworthiness limit the development of photovoltaics and onshore wind energy. Capital limitations occur mainly in the case of micro-installations and small and medium-sized enterprises. Prosumers cannot always cover the investment costs from their savings, they may also have problems with showing a sufficiently high own contribution to apply for an investment loan. Currently, a rising inflation and a higher cost of obtaining a loan or lack of creditworthiness also significantly limit the investment opportunities of prosumers.

In 2015, the Consumer Federation conducted a survey on a sample of 1,597 consumers [Consumer Federation, 2016]. The research shows that the biggest barrier to installing RES in Poland was the financial barrier, i.e. high installation costs, which was indicated by over 70% of respondents. Other important barriers were: a long payback period, lack of information about the operating conditions of the PV system, problems with reaching information, lack of co-financing of the investment.

The results of the Consumer Federation's survey was confirmed by a survey conducted on a sample of 2,000 households from Lower Silesia [Ropuszyńska-Surma, Węglarz, 2017]. The majority of respondents (52.9%) indicated economic factors as the main barrier, i.e. the lack of financial resources to implement the investment.

Also, a survey conducted in Norway on photovoltaics indicated that for 34.6% of respondents, a high cost of installation, as well as limited financial support, were the main barrier [Yan, Lindkvist, Temeljotov-Salaj, 2021].

It should be emphasised that the policy of the European Union and member states has unequivocally supported projects in the field of building renewable energy sources. In order to increase the number of recipients willing to take their interest in prosumer activities, various types of incentives, subsidies, low-interest loans were introduced, which shortened the payback period.

1.3. Social and environmental barriers

At present, the most important and difficult problem on a global scale and in Poland is to stop climate change of the earth by reducing CO_2 emissions, which in recent decades have been growing rapidly.

The level of investment in renewable energy sources is directly influenced not only by political, legal, economic or technological determinants, but also by social factors, ecological and energy awareness of society, attitude to energy saving and ecological development.

The attitude of societies to photovoltaics is created by the ecological and renewable nature of this form of energy, i.e. clean energy, the use of which in the local and global dimension brings a number of social and environmental benefits. Photovoltaic systems are environmentally friendly, do not emit gases into the atmosphere, noise, vibrations, do not adversely affect the landscape. Photovoltaic systems are also perceived by societies as more environmentally friendly than wind farms.

PV investments are generally accepted by local communities, and social protests related to planned investments are rare.

Public acceptance of wind energy is a potential barrier to faster expansion of onshore wind energy, despite significant technological advances reducing the negative environmental impact of wind farms. In most European Union countries, wind farm projects are accompanied by strong local protests. There is also a lot of public opposition to the development of energy infrastructure and transmission lines in most European Union countries.

The European Union has adopted ambitious and binding targets for reducing greenhouse gas emissions, transforming energy systems and achieving climate neutrality. Moving away from fossil fuels and developing renewable energy, including photovoltaics and onshore wind energy, towards a safer, more competitive and sustainable development of the European energy system is one of the biggest challenges facing the European Union countries.

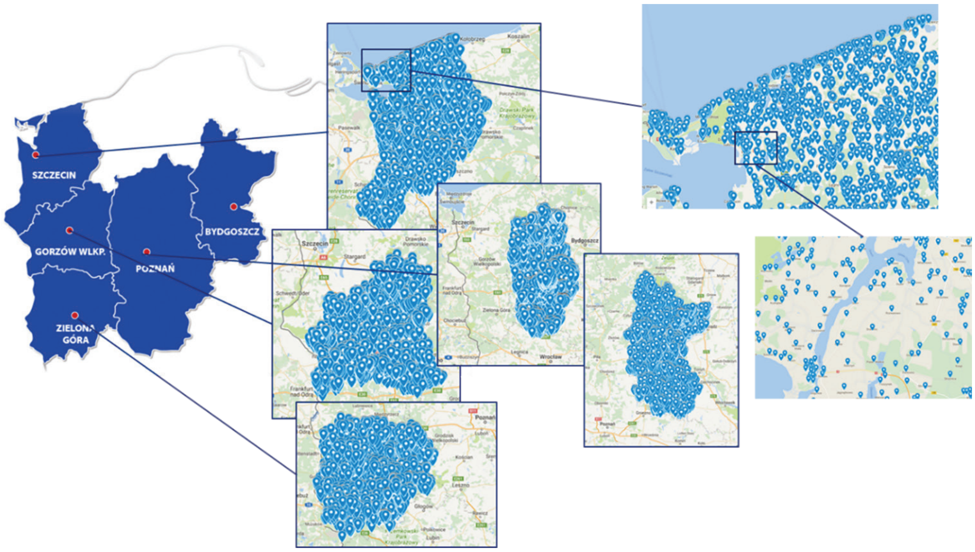
Photovoltaics and wind energy are the key to achieving the assumed environmental and energy goals, aimed at the sustainable development of the European Union countries, ensuring an energy-efficient model of energy management, and significantly contributing to the reduction of CO_2 emissions, and to increasing energy security.

Photovoltaics and wind energy are an opportunity for societies to actively participate in the energy market, the opportunity to use technological progress to improve the quality of life, environmental protection and energy security. An incentive to build a PV and wind installation may be a possibility of partial independence from the electricity supplier, reducing interruptions in energy supply, minimising transmission losses, as well as reducing the cost of purchasing electricity from the grid.

2. Company infrastructure

Enea Operator Sp. z o.o. covers the area of north-western Poland of nearly 60,000 km^2. With the help of over 120,000 km of power lines and over 38,500 transformer-distribution stations (Figure 2), it supplies at least 20 TWh of electricity to 2.7 million consumers of distribution services.

Figure 2. **MV/LV transformer substations in the company area of operation**



Source: Authors' own material.

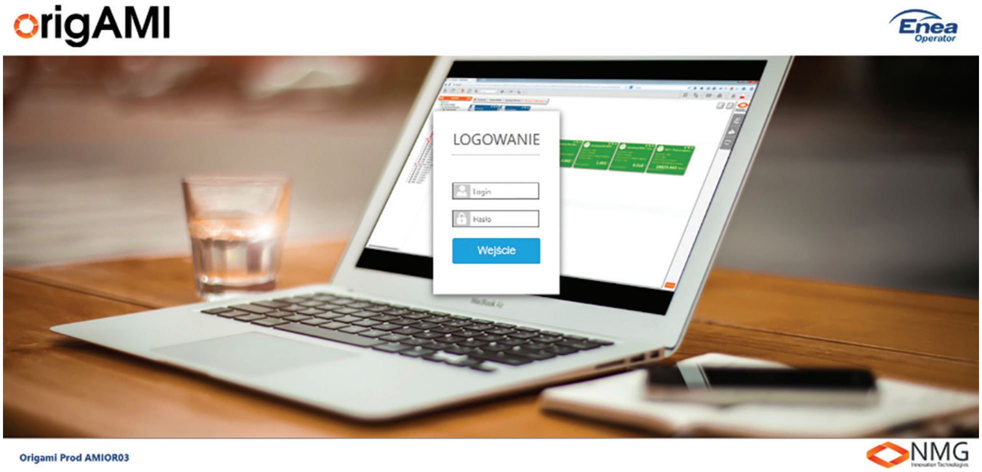
Nearly 98% of MV/LV balancing substations are equipped with remote reading meters, the so-called AMI (Advanced Metering Infrastructure – Figure 3).

Aggregation and analysis of data in the OrigAMI system (Figure 4) enables viewing the network parameters in a mode close to *real-time*. The system allows for an easier control of the process of settling end users and implementation of a number of technical algorithms such as: algorithm for selecting the tap switch, transformer selection algorithm, aggregate selection algorithm, optimal substation shutdown algorithm, etc.

Figure 3. An AMI meter with installation at MV/LV substations

Source: Authors' own material.

Figure 4. OrigAMI login interface

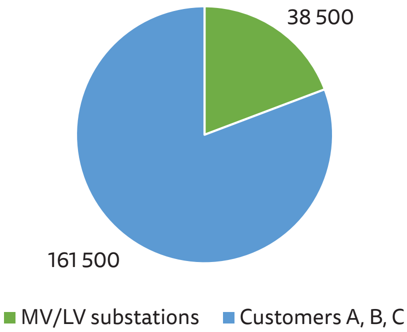


Source: Authors' own material.

According to the amendment to the Energy Law of 3 July 2021, the company is obliged to install AMI meters at customers up to 1 kV according to the following schedule:

Currently, the best equipped group of customers with remote reading meters are customers in tariff groups A, B, C and prosumers in tariff group G (Figure 5).

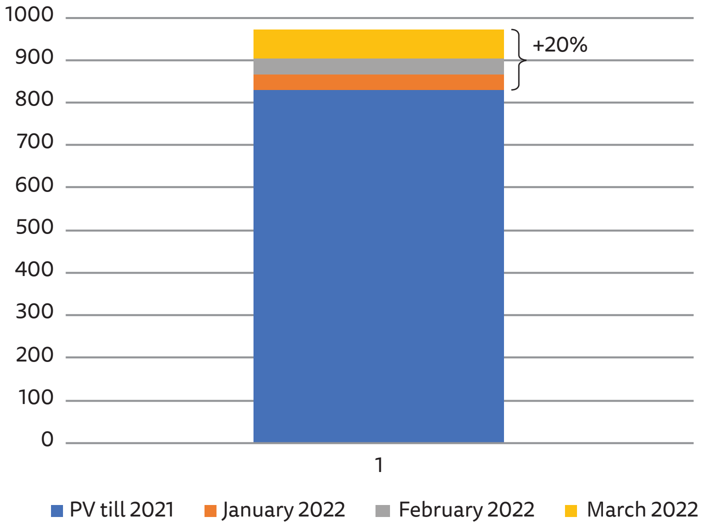
Figure 5. Distribution of installed AMI meters



Source: Authors' own material.

Some of the biggest challenges faced by the Distribution Network Operator is an unprecedented pace of development of distributed energy resources installations in the medium and low voltage networks. As of 31 March 2022, Enea Operator had 124 849 micro-installations with a total capacity of over 970 MW (Figure 6). This capacity is slightly lower than the largest power unit in Poland, owned by Enea Wytwarzanie, i.e. the coal-fired power plant in Kozienice.

Figure 6. Installed capacity (MW) of RES in the Enea Operator network

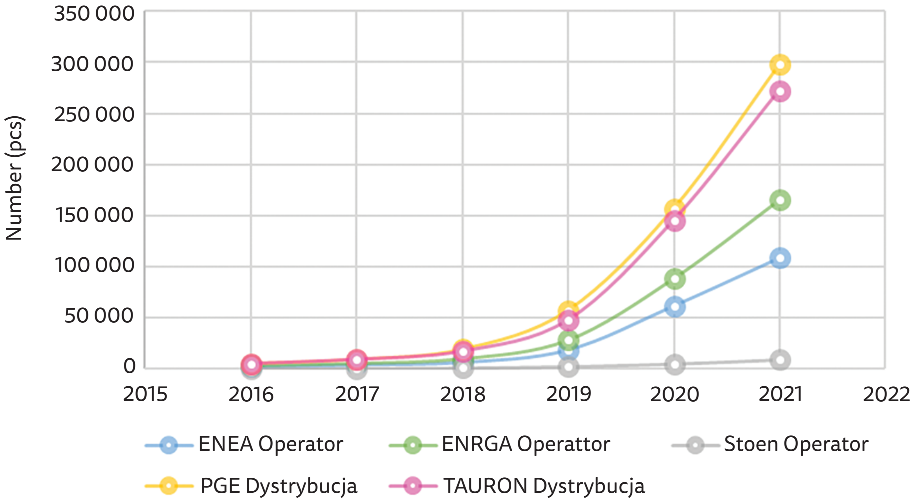


Source: Authors' own material.

The issue of a significant increase in micro-installations in Enea Operator's distribution networks is not an isolated case. This trend is also maintained throughout Poland and even Europe. The average percentage growth of micro-installations in Poland compared to the level of 2016 amounted to 5,127% (Figure 7).

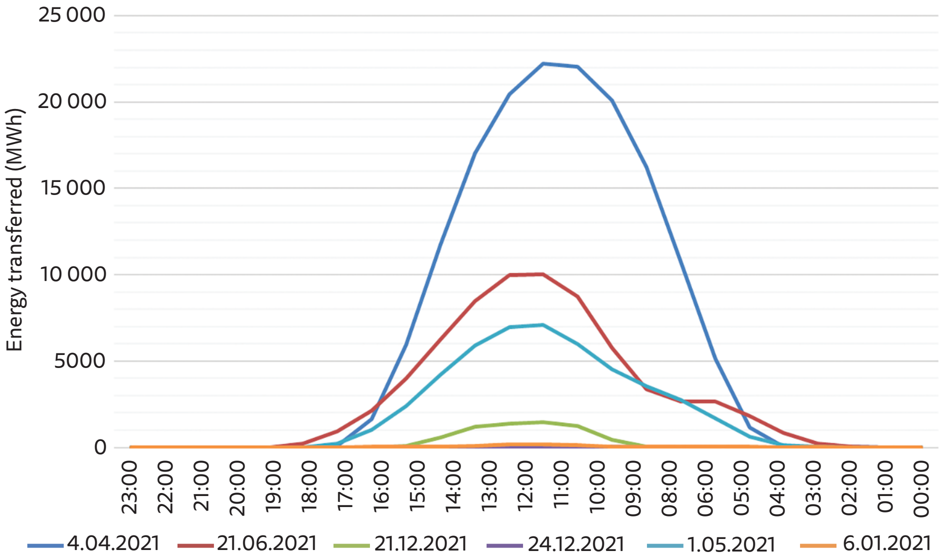
The number of connected prosumer sources, and consequently their power, causes significant balance differences in electric energy along with the co-occurring reverse flow of electricity from the low-voltage networks to the medium-voltage networks, and sometimes even to the highest voltage networks. Indeed, a noticeable difference in energy exported to the grid by micro-producers is definitely cyclical in nature daily and seasonal. Consequently, in the extreme case of the sunny summer south, production from photovoltaic sources is maximum and electricity consumption by end users is minimal (Figure 8). This results in balance differences, which directly translate into qualitative parameters of electricity, such as voltage and frequency fluctuations in the network.

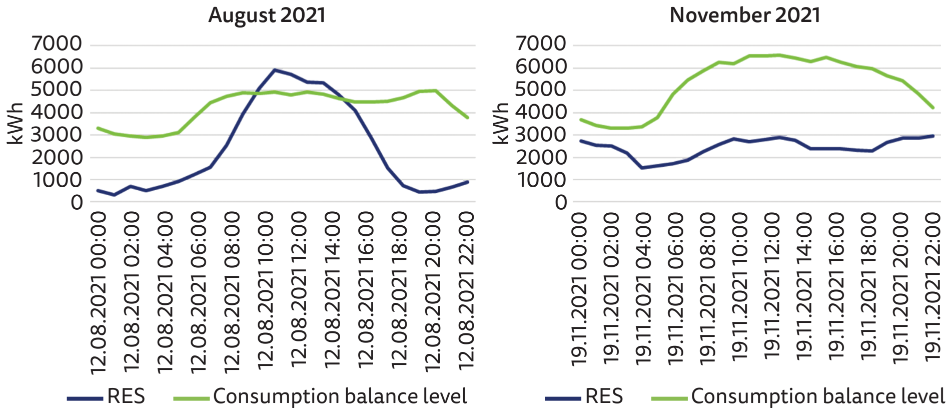
Figure 7. **Growth (in numbers) of micro-installations connected to the DSO network in 2016–2021**



Source: ENEA, 2022.

Figure 8. **Characteristics of energy transferred by micro-installations in the selected days of the year**





Source: ENEA, 2022.

3. Analysis in PowerFactory (digSilent) – Test Case 1 – Analysing the impact of RES large penetration for grid congestions

The following factors were used to perform the simulation in PowerFactory,:

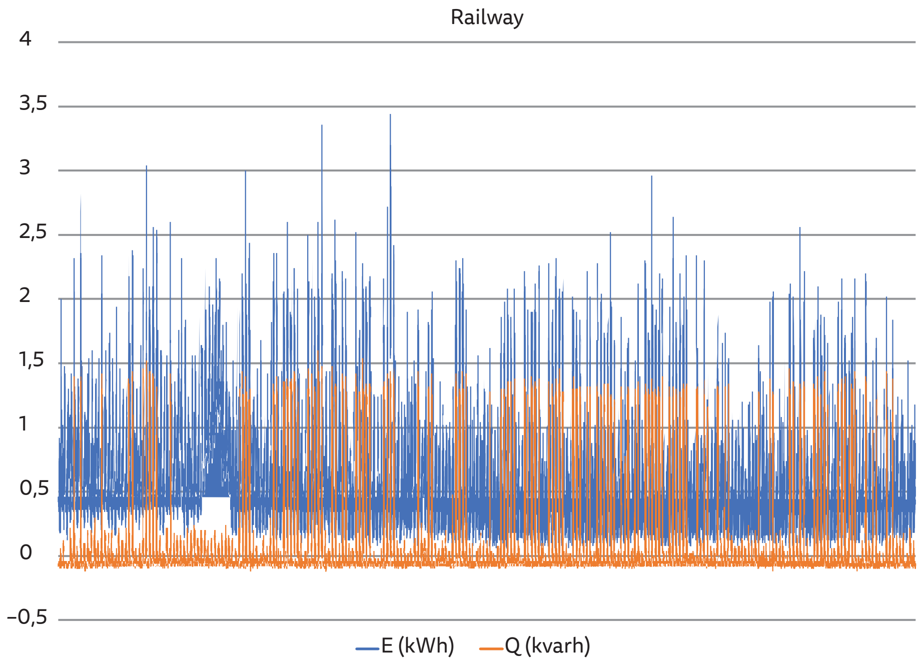
- CIGRE Network,
- OrigAMI Software,
- 15-minute active and reactive energy profiles (Table 1).

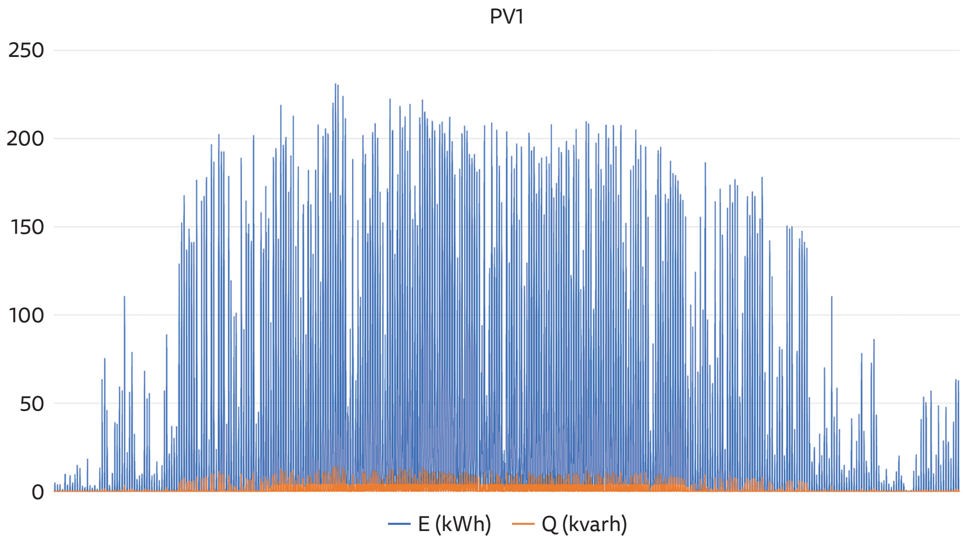
Table 1. List of characteristics used for the analysis with examples

		Active power				Reactive power			
Type	Object	Max *E* (kWh)	Max *P* (kW)	Percentile 95% *E* (kWh)	Percentile 95% *E* (kW)	Max Q (kvah)	Max Q (kvar)	Percentile 95% Q (kvarh)	Percentile 95% Q (kvar)
Wind	Wind 1	1533	6131	1170	4679	138	554	88	354
	Wind 2	1472	5856	1313	5252	117	468	1	4
	Wind 3	1456	5825	1390	5558	69	277	1	4
	Wind 4	1118	4474	932	3730	187	746	124	497
Solar	PV 1	231	924	150	600	14	57	6	25
	PV 2	195	782	141	562	15	59	9	38
Load	Bus charging station	131	524	74	295	1	6	0	2
	Industrial 1	20	81	8	34	5	19	1	4
	Industrial 2	15	61	11	44	6	25	3	12

cont. table 1

Type	Object	Active power				Reactive power			
		Max *E* (kWh)	Max *P* (kW)	Percentile 95% *E* (kWh)	Percentile 95% *E* (kW)	Max *Q* (kvah)	Max *Q* (kvar)	Percentile 95% *Q* (kvarh)	Percentile 95% *Q* (kvar)
	Substation MVLV Farm	39	157	8	33	29	116	1	3
	Substation MVLV Estate Modern	10	42	7	29	–2	–8	–2	–7
	Substation MVLV Estate 2	51	205	30	121	–18	–73	–17	–67
	Substation MVLV Mall	100	400	81	322	29	114	18	74
	Substation MVLV Railway	3	14	1	6	2	7	1	3
	Substation MVLV1	15	61	11	44	6	25	3	12
	Substation MVLV2	23	93	13	52	8	31	3	10
	Substation MVLV3 rural	18	72	11	42	4	16	2	7
	Substation MVLV4 rural	3	10	1	5	1	5	0	1
	Substation MVLV5 rural	9	38	5	21	3	14	1	3
	Substation MVLV6 rural	32	128	23	94	11	45	4	17
	Substation MVLV7 city	51	205	30	121	18	73	17	67
	Substation MVLV8 rural	23	93	13	52	7	28	2	10





Source: Authors' own material.

The basic assumptions used in the analysis are:

- application of PowerFactory tools: Load Flow Analysis and Quasi Dynamic Simulation;
- use of annual electricity profiles (1 value per 15 min = 35 thousand values per year);
- assuming a rated power of a single PV source at the level of 1,000 kWp, and a wind source at 6,000 kW;
- using the scaling factor parameter to select different scenarios of the amount of installed power of sources;
- concept of multi-scenario analysis – each scenario is built on the basis of different configurations of installed capacity of generated sources (Table 2).

Table 2. Excerpt from the list of scenarios used for scenario analysis

Scenario	Scaling factor		Power peak (kWp)					
	PV	Wind	PV	PV quantity	PV total power	Wind	Wind quantity	Wind total power
s25	1	1	1000	7	7000	6000	3	18 000
s26	0.75	0.75	750	7	5250	4500	3	13 500
s27	0.5	0.5	500	7	3500	3000	3	9000
s28	0.25	0.25	250	7	1750	1500	3	4500
s29	0.1	0.1	100	7	700	600	3	1800
s30	0.05	0.05	50	7	350	300	3	900
s31	0.1	00.5	100	7	700	300	3	900

cont. table 2

Scenario	Scaling factor		Power peak (kWp)					
	PV	Wind	PV	PV quantity	PV total power	Wind	Wind quantity	Wind total power
s32	0.15	0.05	150	7	1050	300	3	900
s33	0.1	0.06	100	7	700	360	3	1080
s34	0.1	0.07	100	7	700	420	3	1260

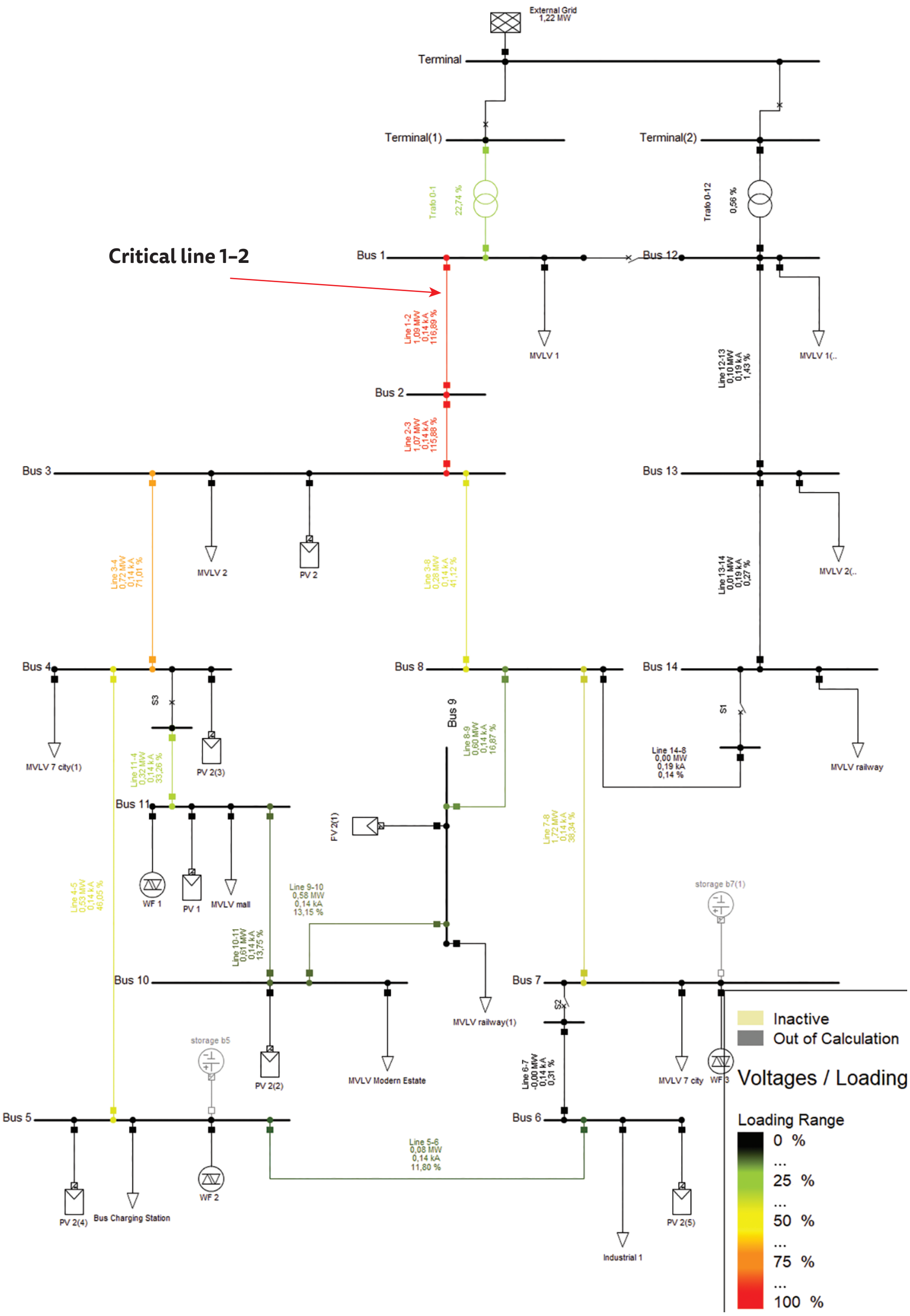
Source: Authors' own material.

The main result expected in the analyses is to obtain line loads (%) for each of the programmed scenarios. The load level of 100% should be interpreted as the maximum permissible value for long-term operating current. The topology of the CIGRE network used for the analysis and the distribution of receptions and generation determines that the most loaded line in each scenario is Line 1–2, consequently identified as a critical line from the point of view of the power supply path of this network (Figure 9).

The analysis leads to the following conclusions:

- for each scenario, the maximum load occurs for Lines 1–2 (Figure 10);
- loads on individual lines differ due to the location of RES generation units and receiving units as well as due to their profiles;
- comparison of different scenarios shows that the more RES generation, the higher the value of the maximum load during the year (for specific 15-minute values);
- the dates in a given scenario are different for the analysed lines (the maximum values occur at different times for different places in the network). This is due to specific RES locations and loads in the network topology and their work profiles.

Figure 9. Example of a load distribution view in the PowerFactory programme



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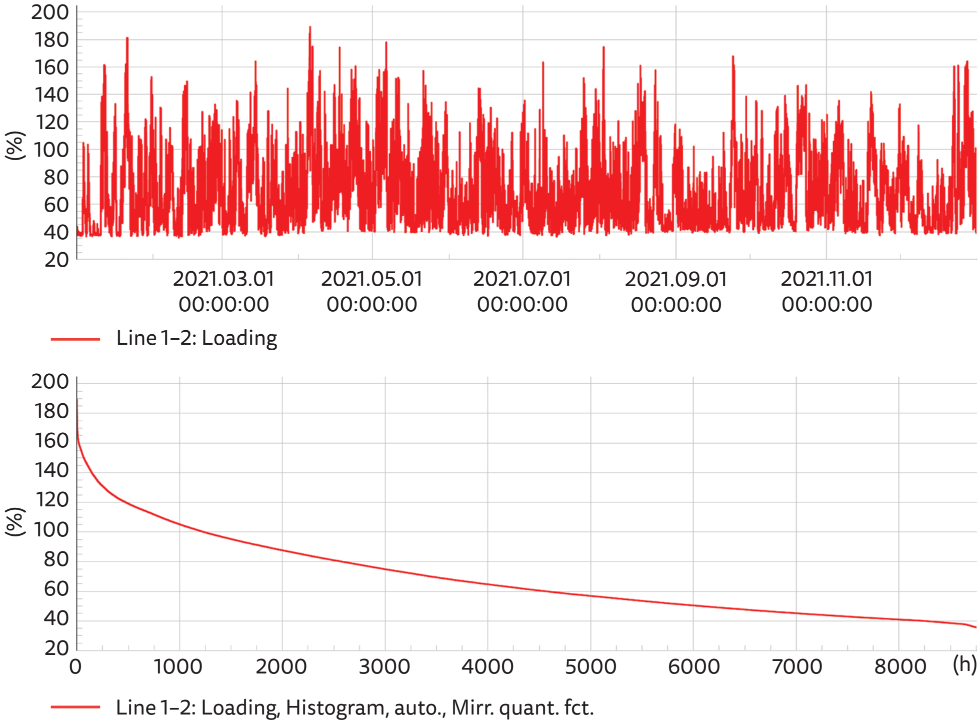

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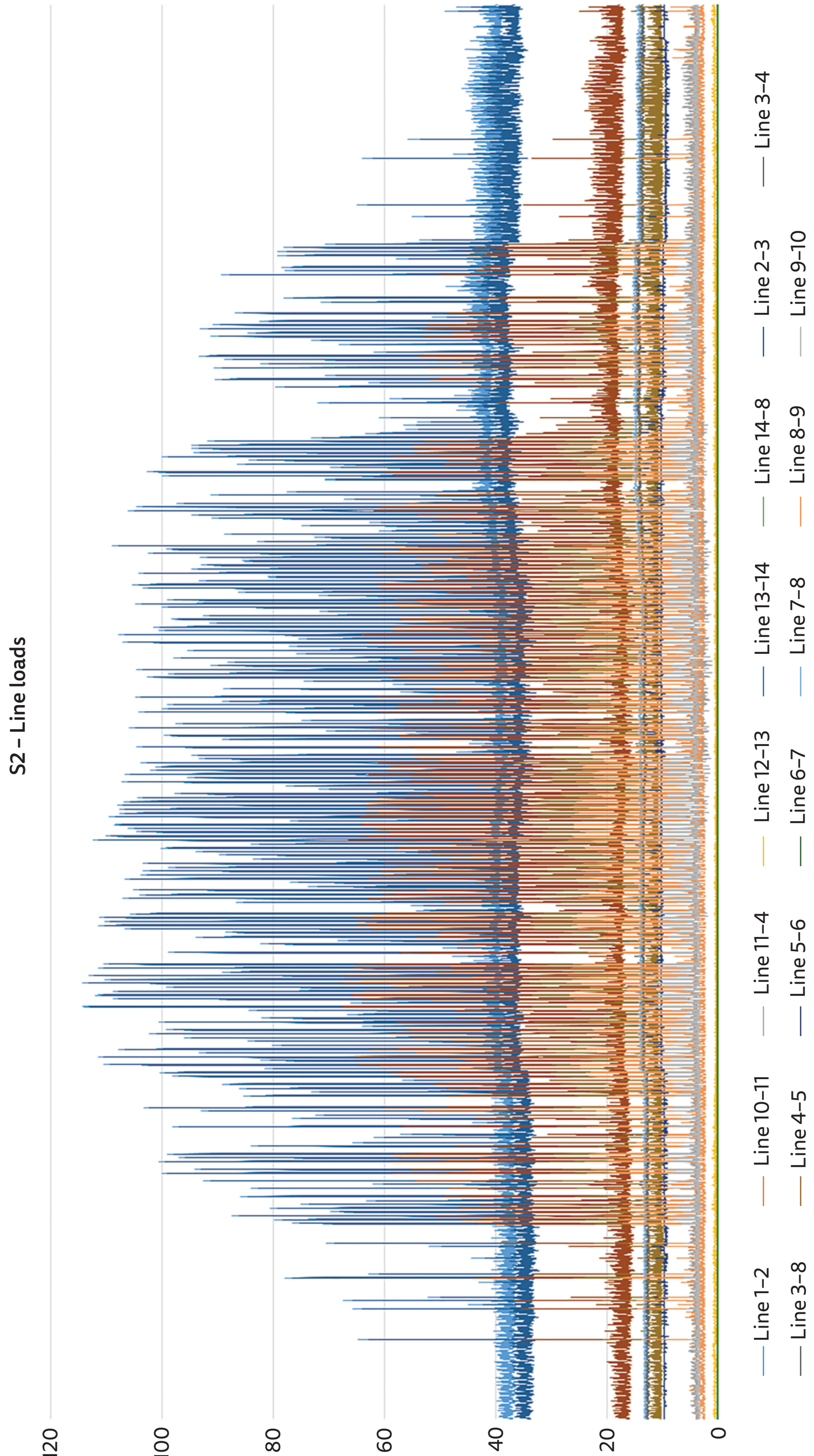
Figure 10. Annual load characteristics of all lines in the analysed network



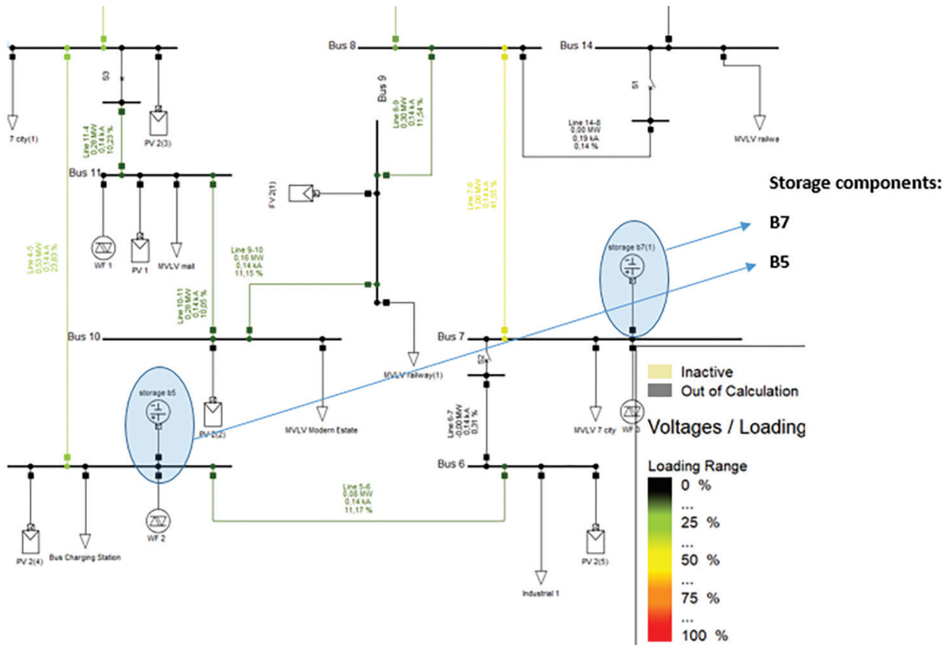
Source: Authors' own material.

4. Analysis in PowerFactory (digSilent) – Test Case 2 – Analysing the impact of self – consumption and storage on grid congestions

As a result of this analysis, profiles were collected for the most significant variables, i.e.:

- load (%) of each line, including the most critical Line 1–2,
- active power (MW) of working storage facilities,
- state of charge (SoC) (%) – charge level for each of the modeled storage facilities (Figure 11).

Figure 11. Locations of storage components in the CIGRE network



Source: Authors' own material.

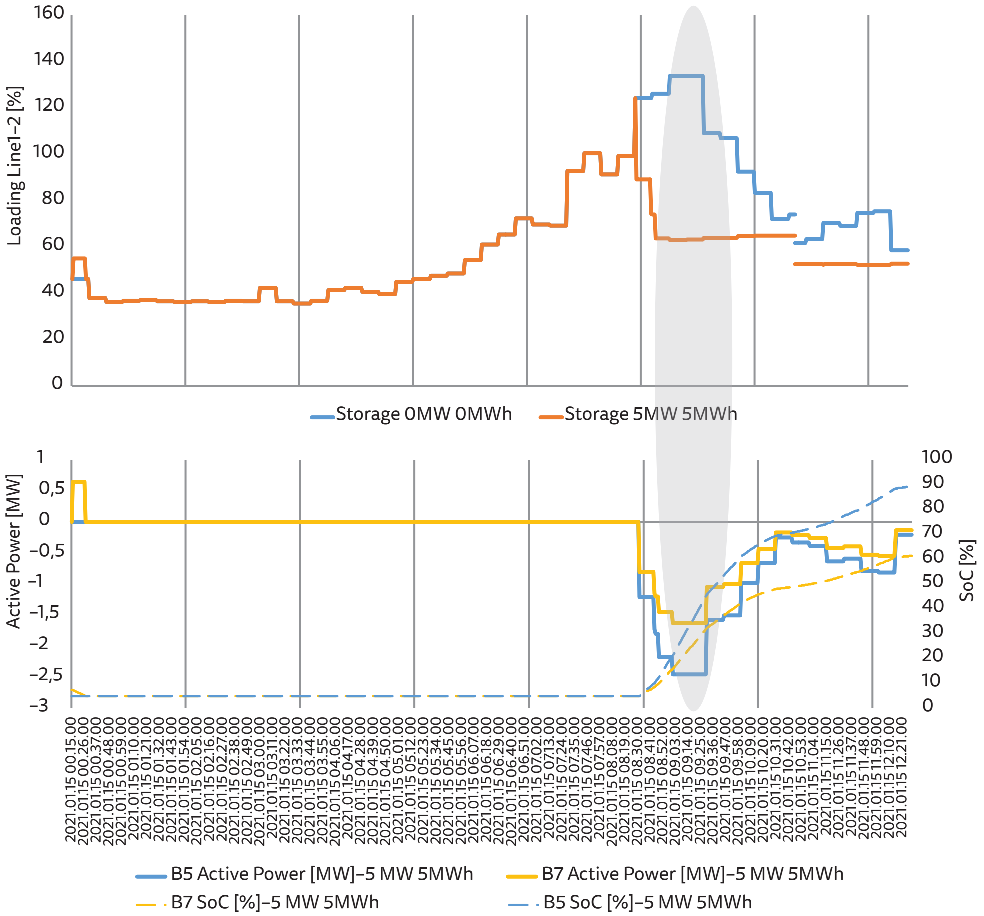
Three additional scenarios were performed within the analysis (Table 3).

Table 3. Scenarios of variants of storage operation

	Number of storage facilities	Power (kW)	Capacity (kWh)
Scenario 0 (reference)[2]	0	0	0
Scenario 1	2	5000	5000
Scenario 2	2	5000	10 000
Scenario 3	2	10 000	10 000

Source: Authors' own material.

Scenario 1



Source: Authors' own material.

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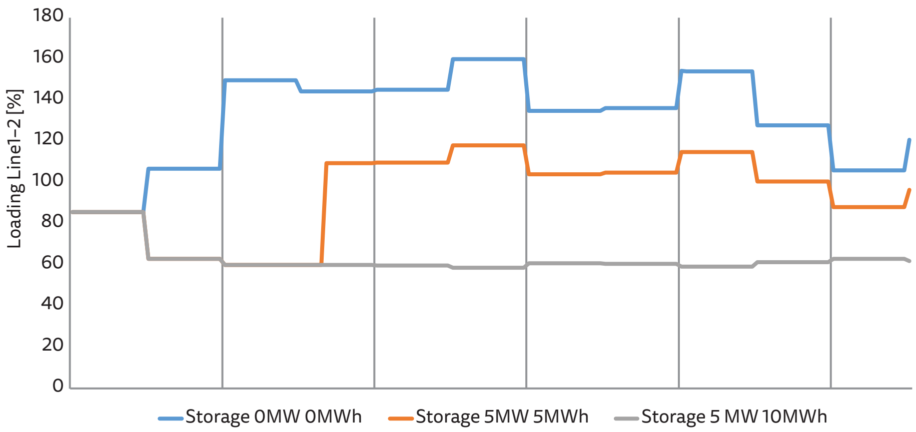
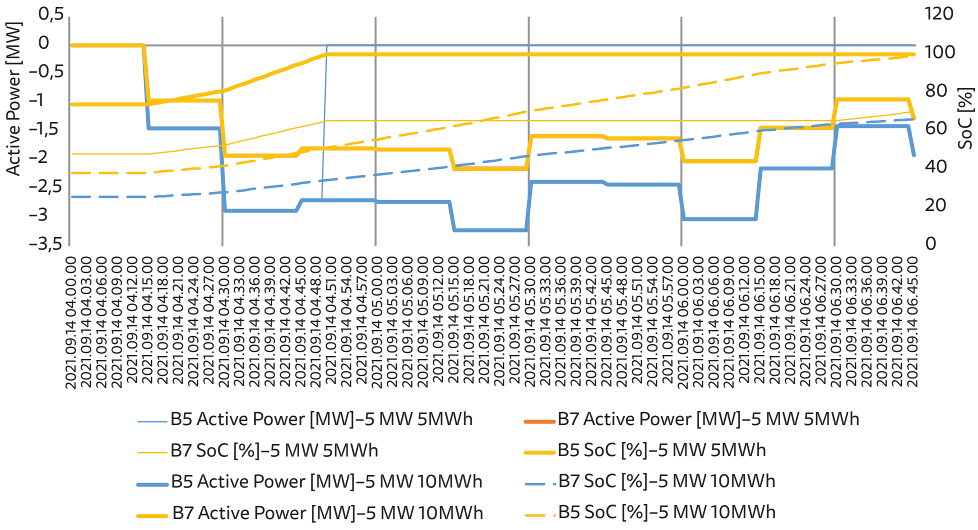
2 Scenario 0 is a reference scenario and is the same as the s25 scenario used earlier. All warehouse simulation results compared and related to the reference scenario. These lists enable showing the differences in the options under consideration.

Exceeding the 100% load level by the busiest line is a signal for the battery management system to start operation. Then the battery level (dashed line) increases sharply with a charging power of 1.5 to 2.5 MW.

It is obvious that in line with the decreasing load on Lines 1–2, the battery management system adjusts the charging power of the battery by gradually reducing the active power – a clear stepped characteristic.

Scenario 2

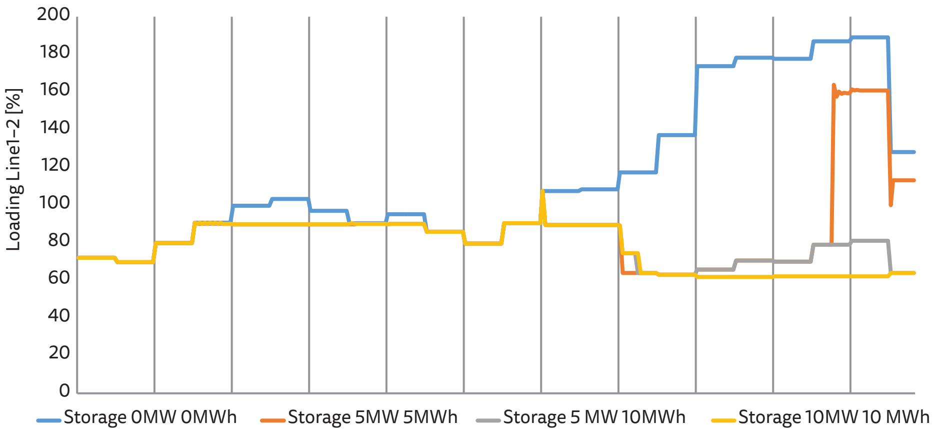


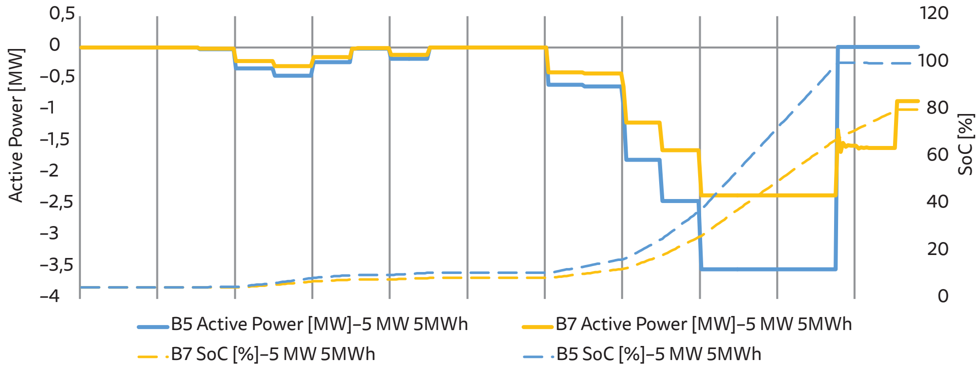


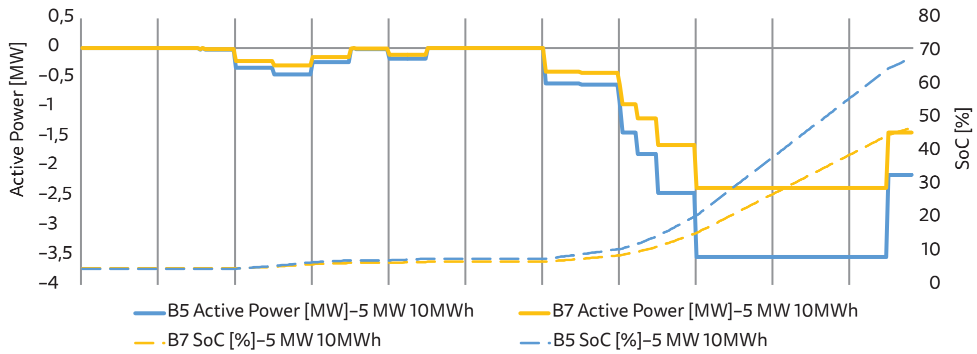
Source: Authors' own material.

The diagrams allow for the comparison of results of scenario 2 (5 MW, 10 MWh) with scenario 1 (5 MW, 5 MWh). The first graph shows the effect of the increased battery capacity reducing the load on the line over a long period of time (gray graph vs orange graph). While the B5 warehouse from scenario 1 reached 100% of the charge level (SoC – blue dashed line), the loading power of this magazine dropped sharply. From that moment on, only one warehouse continues to work. Doubled storage capacity reduced SoC levels (%) and allowed both storage facilities to work longer.

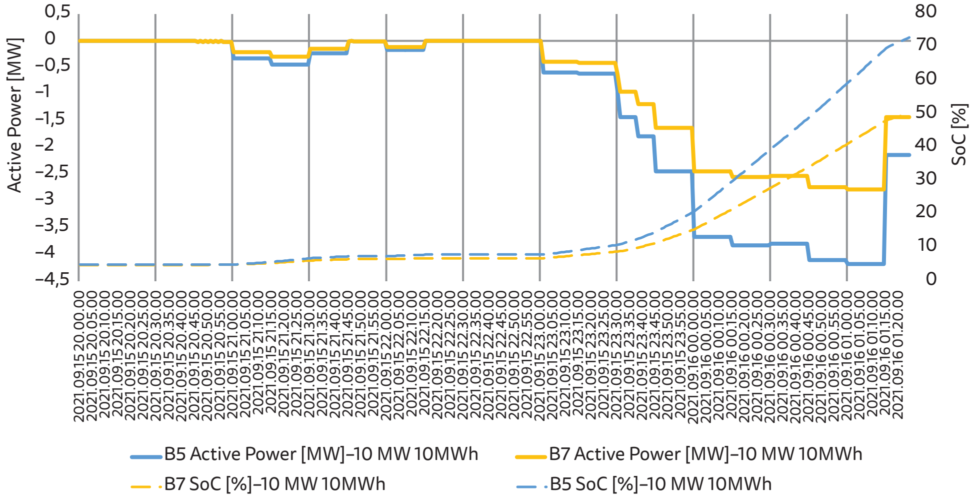
Scenario 3







cont. scenario 3



Source: Authors' own material.

Longer warehouse operation results in the same charge level as in Scenario 1. Doubling the power of the warehouse brings the least results. The reduction of the line load (%) is due to the increase in warehouse parameters:

- active power (MW),
- capacity (MWh).

Conclusions

- Simulated storage facilities allowed to relieve the critical line, and consequently the entire network.
- The use of energy storage allows for increased grid flexibility and greater network "capacity" for new distributed sources.
- Energy storage integrated into the DSO grid has a significant potential to increase the flexibility and resilience of the power grid. The growing amount of energy produced from RES must be mitigated through controllable and programmable energy storage systems – without this, unstable and unpredictable energy sources can be a source of accumulation of power significantly exceeding the transmission capacity of distribution networks.

5. Targets of the DRES2Market project

The presentation and text are based on the work carried out as part of the European Commission's project in the H2020 Programme: DRES2Market: Technical, business, and regulatory approaches to enhance renewable energy capabilities to take part actively in the electricity and ancillary services markets. Grant number: 952851.

The aim of the DRES2Market research project is to develop a comprehensive and economically beneficial approach to facilitate the integration of distributed generation based on renewable energy sources – RES in the power system and to enable the provision of balancing and backup services according to market criteria by these sources. The project activities are in line with the European Union projects aimed at building a sustainable energy system and a low-carbon economy, at the same time they are part of the global trend of reducing energy dependence on fossil fuels. The DRES2Market project consortium consists of fifteen partners from five European countries: Austria, Spain, Greece, France, Poland and Norway actively participating in the development of RES technologies, from research institutions, academia and distribution companies.

Conclusions

Currently, the most important and difficult problem on a global scale is to stop the Earth's climate change by reducing CO_2 emissions. The European Union has adopted ambitious and mandatory objectives to reduce greenhouse gas emissions, transform energy systems and achieve climate neutrality. The transition of the energy sector towards more sustainable electricity production increases the importance of distributed generation from renewable sources, including photovoltaics and onshore wind.

The achievement of the EU energy and climate objectives requires overcoming the existing barriers and regulatory frameworks. Despite significant progress in the field of RES regulations, especially the implementation of the RES Directive, the development of photovoltaics and wind energy is still slowed down by various types of market, regulatory, technological and social barriers. It should be stressed that a transparent, unambiguous and stable regulatory system favours the development of renewable energy sources. For their rapid development, regulatory changes are also recommended to increase the flexibility of the distribution system, adapting it to a larger share of distributed generation. The analyses of case studies indicate that the development of energy storage systems and the use of flexibility, i.e. *Demand Side Management* and *Demand Side Response*, reduce the grid load.

Distribution system operators must get prepared for a further dynamic development of distributed generation. The technical condition of distribution networks, which should be stable, safe and with high capacity, is the basic factor determining the production of large amounts of electricity from renewable energy sources. Network management must be carefully planned, with an accurate attempt to predict RES generation. The increased level of RES has a positive impact on the local decarbonisation of distribution networks and local markets. Simulations and detailed analyses of fragments as well as the whole networks may allow for a realistic assessment of connection possibilities or indicate the need for investments to increase the availability of the network for distributed energy sources and enabling its free flow.

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