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CONTENT

1. INTRODUCTION

The project DanuP-2-Gas aims to advance transnational energy planning by promoting generation and storage strategies for renewables in the Danube Region by coupling the electric power and gas sector. The effective realisation of this project depends strongly on the legal and regulatory framework. During the work within the WP3 the legal and regulatory status concerning the construction and operation of hubs for coupling the electricity and gas sector was assessed and existing national barriers have been identified.

These assessments are the basis for the development of country specific strategic roadmaps designed to foster energy storage through specific recommendations on different levels - for adjustments of the legal framework, reduce social, technical barriers as well as giving special insights on the potential of the sector coupling hubs in every country. Further, these roadmaps will be combined to a durable strategy to enhance sector coupling in the Danube Region.

In order to obtain valuable results for the roadmaps from the legal analysis and identified barriers, it is imperative to identify which measures and steps are necessary to achieve the EU and national targets for decarbonization, increasing the share of renewable energies as well as increasing energy security in the region. It must be emphasized that there are some barriers that apply to all countries, however country-specific challenges with corresponding national climate targets will play an important role for the developed roadmaps. The roadmaps will be discussed during national stakeholder workshops and individual expert interviews and additional adjustments, based on the interviews, will be incorporated.

Deliverable 3.2.1 serves as a basis for all the above-mentioned objectives. The aim of this Deliverable is therefore to define the needed actions to promote and deploy the sector-coupling hubs in Danube Region countries.

2. METHOD

The objective of this Deliverable is to present the developed country-specific roadmaps, which are developed based on the conducted legal assessment in every involved country and, especially, taking into account the identified barriers. In the development of the national roadmaps work package the core team met twice to discuss the aims, timeline and needed actions. The roadmaps, which than were developed by the respective project partners were disseminated to the important stakeholders/political/policy representatives in each country and gained feedback was incorporated into the roadmaps.

3. GENERAL APPROACH

A roadmap is a strategic plan that describes the steps needed to take to achieve stated outcomes and goals. It clearly outlines links among tasks and priorities for action in the near,
medium and long term. A roadmap also includes metrics and milestones to allow regular tracking of progress towards the roadmap's ultimate goals. The IEA defines a technology roadmap as *"a dynamic set of technical, policy, legal, financial, market and organisational requirements identified by all stakeholders involved in its development."*[1]

The development of the roadmap in DanuP-2-Gas project relies on the general approach proposed by IEA in "Energy Technology Roadmaps. A guide to development and implementation", see Figure 1.

The results of analysis of biomass potentials, as well as infrastructural challenges made within the WP 2 are essential part of the roadmap, showing the existing situation with future scenarios. Evaluated use cases of sector coupling hubs within the WP2, highlight important findings for potential investors or other interested stakeholders, showing the possibilities and weaknesses of feasibility of such projects in every country.

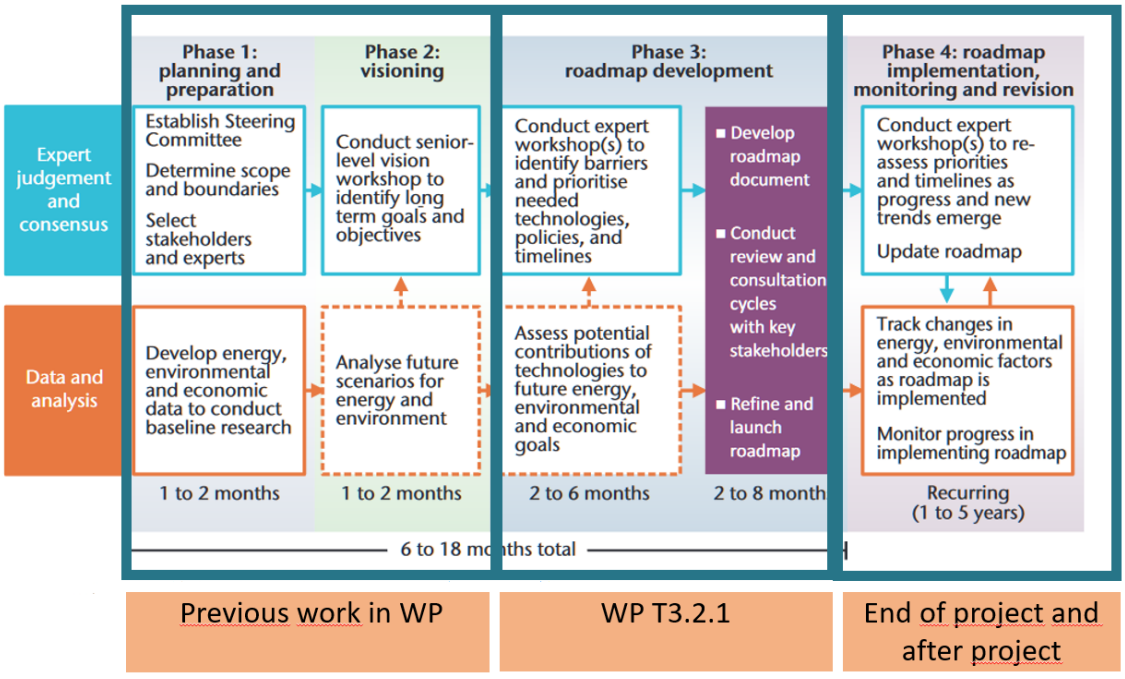


Figure 1. Roadmap process outline (Adjusted from IEA technology Roadmap Guide, 2014)

[1] Energy Technology Roadmaps. A guide to development and implementation. IEA, 2014 Edition

The analysis of the legal framework and identification of existing barriers is the core part of this roadmap. The further development of action items and needed steps to overcome the barriers, which are in line with the specific country goals, shows the step-wise plan to achieve the overall targets and aims of the roadmap.

4. THEMATIC SCOPE AND GOAL OF THE ROADMAP

The goal of the roadmap is to support the development towards increased energy security and efficiency in the Danube Region via storage of surplus renewable energy in the gas-grid and contribute to the EU climate-neutrality by 2050. The roadmap identifies needed actions to overcome existing barriers for wider implementation of sector-coupling hubs within the Danube region. The roadmap focuses foremost on adjustments of legal framework, however overall interdisciplinary barriers and challenges are shown and further steps identified.

5. ROMANIA

5.1 NATIONAL (SPECIFIC) GOALS

Regarding Romania's energy goals and objectives, they are aligned both with European directives but also take into account the national energy context. These can be found in 2 of the key strategies regarding energy and climate neutrality: the Energy Strategy of Romania 2016-2030, with the perspective of 2050, respectively the Integrated National Plan in the field of Energy and Climate Change 2021-2030 which also has important components and mentions about energy.

Among these objectives are

- The objective of reducing domestic greenhouse gas emissions by at least 40% by 2030 compared to 1990;[2]
- The objective regarding energy consumption from renewable sources of 32% in 2030;[3]
- The objective of improving energy efficiency by 32.5% in 2030;[4]
- The objective of interconnecting the electricity market at a level of 15% by 2030[5]

[2] Romania, Integrated National Plan in the field of Energy and Climate Change 2021-2030, 2020, (p.) 13, Bucharest
[3] Romania, Integrated National Plan in the field of Energy and Climate Change 2021-2030, 2020, (p.) 13, Bucharest
[4] Romania, Integrated National Plan in the field of Energy and Climate Change 2021-2030, 2020, (p.) 13, Bucharest
[5] Romania, Integrated National Plan in the field of Energy and Climate Change 2021-2030, 2020, (p.) 13, Bucharest

In addition to these objectives, the EU also made recommendations to Romania on various amendments from the national plans and strategies. The example would be the recommendation to increase the share of renewable energy to a minimum of 34% after the initially proposed share was 27.9%.[6]

Overview of the main objectives of PNIESC 2021 – 2030, at the level of 2030	
ETS emissions (% compared to 2005) -43.9%*	-43.9%*
Non-ETS emissions (% compared to 2005) -2%	-2%
Global share of energy from sources renewables i	30.70%
Share of SRE-E 49.4%	49.40%
Share of SRE-T 14.2%	14.20%
Share of SRE-M&R 33.0%	33.00%
Energy Efficiency (% compared to the projection PRIMES 2007 at the level of 2030)	
Primary energy consumption -45.1%	-45.10%
Final energy consumption -40.4%	-40.40%
Primary energy consumption (Mtoe) 32.3	32.3
Final energy consumption (Mtoe) 25.7	25.7

Fig. 2. Objectives from PNIESC, page 13.

At the national level, among Romania's objectives listed in PNIESC are:

- Rapid implementation of the legal framework necessary for final investment decisions in the exploitation of natural gas resources in the Black Sea area;
- The development of new capacities on the Romanian Energy System and the integration with other markets in the region as well as the promotion of the use of hydrogen;
- Development/optimization of the existing infrastructure of electricity and natural gas networks, with a positive impact on the capacity to take over energy produced from RES and on the level of interconnectivity;
- Development of storage capacities.

[6] Romania, Integrated National Plan in the field of Energy and Climate Change 2021-2030, 2020, (p.) 14, Bucharest

- Development of high efficiency cogeneration projects; High-efficiency cogeneration is a way of producing electricity and heat, which allows reducing polluting emissions
- Increasing the degree of interconnection plays an important role in the security of natural gas and electricity supply, as it will facilitate cross-border exchanges, especially in case of emergency
- The implementation of the provisions of the legislative package "Clean Energy for All Europeans" will have the effect of promoting the use of energy from renewable sources, as they presuppose the adaptation of market conditions to facilitate the integration of energy from renewable sources into the SEN
- The adoption of advanced technologies can contribute through the implementation of carbon capture solutions, the development of emission-free energy production capacities, new storage capacities. It will also facilitate the implementation of pilot and demonstration projects to promote the use of hydrogen in the production of electricity and in the industrial sector.
- Promoting clean energy and energy efficiency to support a low carbon economy. Specific objective 6.1 Increasing energy production from less exploited renewable resources (biomass, biogas, geothermal);
- Increasing the share of bioenergy, broken down by thermal energy, electricity and transport, and regarding the supply of biomass, broken down by raw materials and origin (distinguishing between domestic production and imports). For forest biomass, an assessment of its source
- Elaboration of new national strategies and objectives, including long-term or sectoral ones (for example, the share of energy from renewable sources in district heating, use of energy from renewable sources in buildings, energy from renewable sources produced by cities, energy communities and autonomous consumers , the energy recovered from the sludge obtained from waste water treatment)
- Promoting investments in new electricity production capacities, with low carbon emissions;

Regarding the strategic objectives strictly at the national level, Romania has 5 key orientation axes for the year 2030 and further for the year 2050:

- Energy security[7]

[7] Romania, Energy Strategy of Romania 2016-2030,with the perspective of 2050, Ministry of Energy, 2018, (pg.) 1, Bucharest

- Competitive markets[8]
- Clean energy[9]
- Modernization of the energy governance system[10]
- Reducing energy poverty and protecting the vulnerable consumer[11]

Therefore, consulting the two documents and reviewing the objectives, it can be said that Romania has an integrated and holistic view, aligning itself with the objectives of the European Union, but also establishing internal objectives adapted to the national context in the field of energy.

Analyzing Romania's strategy at the national level for the period 2016-2030 with the perspective of 2050, it can be said that the point 2030 is an intermediate point but with ambitious goals, following that until 2050 most of the values achieved in 2030 to be optimized or improved as much as possible.

5.2 OVERVIEW OF POWER-TO-GAS RELATED ACTIVITIES

At the time of this research and the writing of this document, there is no definition or mention of the concept of Power to Gas, or the principle by which gaseous fuel can be obtained from renewable energy.

This can be a problem for Romania, taking into account the energy progress that the state wants to make, taking into account the fact that Power to gas technology is not mentioned either legislatively or on the research and development plan.

Renewable sources are mentioned from which the gas is produced, among which we extract from the above definition the biogas, but also the gases obtained from the fermentation of other residues. It is also mentioned that the gas that can be obtained by introducing installations for its acquisition from landfills. However, there is no information on the further use of this gas, much less its use to produce electricity.

[8] Romania, Energy Strategy of Romania 2016-2030,with the perspective of 2050, Ministry of Energy, 2018, (pg.) 1, Bucharest
[9] Romania, Energy Strategy of Romania 2016-2030,with the perspective of 2050, Ministry of Energy, 2018, (pg.) 1, Bucharest
[10] Romania, Energy Strategy of Romania 2016-2030,with the perspective of 2050, Ministry of Energy, 2018, (pg.) 1, Bucharest
[11] Romania, Energy Strategy of Romania 2016-2030,with the perspective of 2050, Ministry of Energy, 2018, (pg.) 1, Bucharest

The conclusion is that the lack of legislative framework or at least R&D projects and initiatives regarding the concept of Power to gas make this type of energy production non-existent in Romania.

Chapter 5, which refers to "Promotion of electricity produced from renewable energy resources and high efficiency cogeneration" where renewable energy produced using hydrogen or the process of hydrogen production from other sources are not mentioned, but the law has an ambiguous point that where as renewable energy source is mentioned *"energy obtained from other renewable sources, not currently exploited."*[12]

The only positive aspect of the Romanian legislation and the R&D field that has some minor initiatives in the energy market is the hydrogen-based energy component. These things made the Romanian state prioritize the creation of a legislative framework for hydrogen-based energy in the National Recovery and Resilience Plan. Unlike Power to gas, the hydrogen component is already a step ahead in Romanian legislation, being already mentioned and having a dedicated law (alternative fuels law)[13]Hydrogen-based energy production is seen by the Romanian state in the medium and long-term energy plans and strategies as an important step in the decarbonization process. Moreover, when discussing hydrogen, the issue of biomethane and cogeneration is often raised.

It is a gratifying aspect that Romanian officials (politicians) and researchers have innovative ideas, but the real challenge that time will answer is whether these ideas can be materialized.

Romania signed the Hydrogen Initiative in 2018. With this, Romania is committed to continuing research and innovation into how it will use hydrogen as an energy source for the future. Hydrogen and its associated technologies are being explored for use in the electricity storage sector, the transport sector and in industry.[14]

There are already approvals and a legislative framework (insufficient, admittedly) that provides for approvals and licenses for hydrogen-based installations.

Given all these initiatives on several levels, whether public or private, we cannot doubt the fact that Power to gas will become more and more popular at the European level and will eventually be adopted on the Romanian energy scene as well.

[12] Law no. 123/2012 on electricity and natural gas

[13] Law no. 34/2017 on the installation of infrastructure for alternative fuels;

[14] [14] Raluca Diaconesa, Varinia Radu, Hydrogen law and regulation in Romania, CMS Expert Guide to hydrogen energy law and regulation, 2021

5.3 SECTOR-COUPLING POTENTIAL IN ROMANIA

Sectoral coupling is a phrase that encompasses several ideas including linking the electricity, heating and transport industries through infrastructure and energy suppliers with storage capacity; the practice of powering machines and devices that would normally rely on fossil fuels with electricity derived from clean sources; energy sharing between different sectors and decarbonisation of other sectors through renewable energy sources, to achieve the overall objective of climate protection.[15]

Among the measures promoted in the Romanian legislation and strategies are the promotion of investments in new electricity production capacities, with low carbon emissions or the implementation of the best available technologies (BAT), in order to reducegreenhouse gas emissions and increasing energy efficiency in industrial processes;[16]

However, there is an evolution in terms of mobility Promotion of electromobility in road transport (light vehicles andurban public transport). For the future, we also want to exploit to the maximum the possibility of bio-fuels.

Promoting electromobility by developing a plan for the implementation of public charging networks, as well as encouraging private investments for the development of infrastructure, through an incentive mechanism and the installation of recharging stations for electric vehicles. [17]

In the regulatory documents and strategies, the term sectoral coupling is seen as an important step for reaching the goal of energy efficiency. It is desired to connect these concepts and propagate them both at the industrial and residential level, but also to introduce them into the tertiary sector of the economy, so that the sectoral coupling takes place on all levels.[18]

Regarding sectoral coupling and energy efficiency in the industrial sector, energy from renewable resources is considered, by increasing the share of energy from renewable sources through the development of electricity production facilities by industrial consumers.[19]

The energy strategy of Romania 2016-2030 with the perspective of 2050 also aims at Investments in the retechnology and modernization of energy networks by introducing digitization and intelligent networks (smart grid), essential measures to support the

[15] Andrei Mihai, Sectoral coupling: What it means and what are the advantages; FM Magazin, 2020
[16] Romania, Integrated National Plan in the field of Energy and Climate Change 2021-2030, 2020, (p.) 87, Bucharest
[17] Romania, Integrated National Plan in the field of Energy and Climate Change 2021-2030, 2020, (p.) 87, Bucharest
[18] Romania, Integrated National Plan in the field of Energy and Climate Change 2021-2030, 2020, (p.) 102, Bucharest
[19] Romania, Integrated National Plan in the field of Energy and Climate Change 2021-2030, 2020, (p.) 102, Bucharest

process of sectoral integration and energy transition Investments in capacities of storage, taking into account the potential of hydrogen and new gases in the process of sectoral integration (without specifying what these "new gases" are, but with the mention that they are renewable gases)[20]

Therefore, sectoral coupling is not far behind in Romania, being a concept that the authorities and actors (both public and private) are aware of. From all of the above, it emerges that the Romanian state, through all the parties involved in the energy field, recognize these sectoral coupling measures as important steps towards achieving energy efficiency and increasing energy production, which is also renewable energy.

Based on another deliverable of the DanuP-2-Gas project and linking the sectoral coupling with possible investments and Power to Gas hubs that could appear in Romania, the result is that the most profitable Power to gas hubs can be linked to Industrial Plants, where investments is viable and durable, as shown by the calculations made with the Optimization Tool.

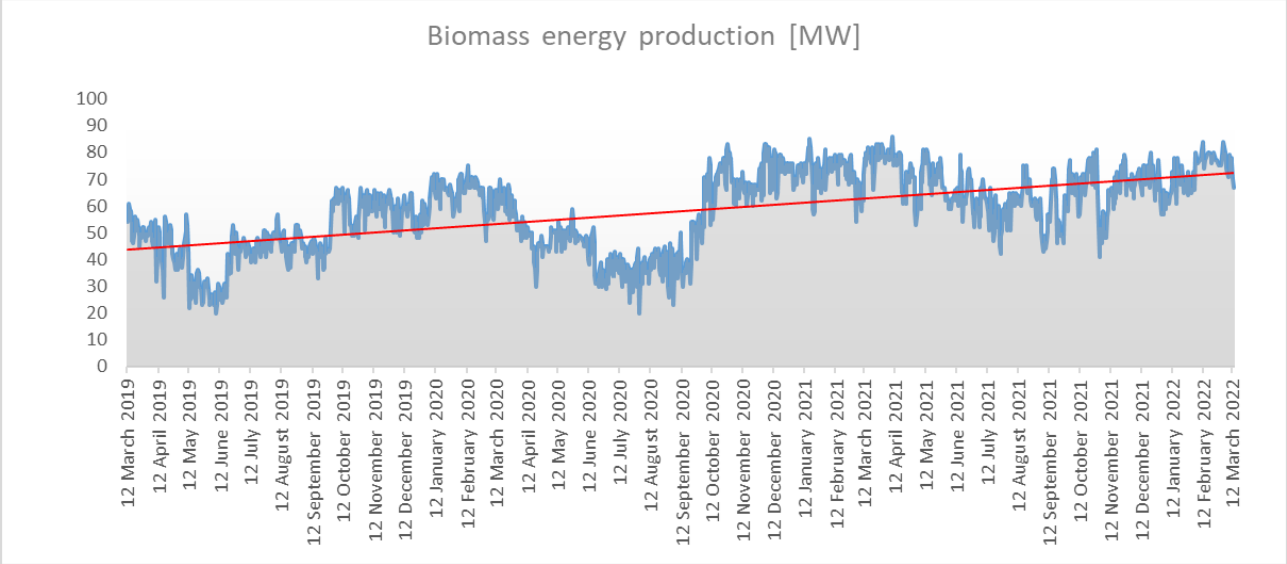
However, all this and any investment in energy depends on the price of energy.

[20] Romania, Energy Strategy of Romania 2016-2030,with the perspective of 2050, Ministry of Energy, 2018, (pg.) 17, Bucharest

5.3.1 BIOMASS POTENTIAL

According to ANRE - the National Energy Regulatory Authority on August 25, 2022 Biomass has a value of 106,896 MW installed power in the electricity production capacity.

Fig. 3. Biomass energy production (Source: data from SEN National Energy System portal)



According to the graph in figure 3, it can be seen that between March 2019 and March 2022, energy production from biomass increased. Figure 3 highlights organic growth, which, although it seems slow, is constant.

According to the data of the National Institute of Statistics or those provided by ANRE and the National Energy System portal, daily the energy produced from biomass occupies a weight between 0.7 and 3% of the total energy production. (see figure 4, as an example)

For Romanian energy, the negative part is that many times the production of energy from biomass is exceeded by the production of wind or solar energy, but a positive aspect is that both fall within the spectrum of non-polluting energies.

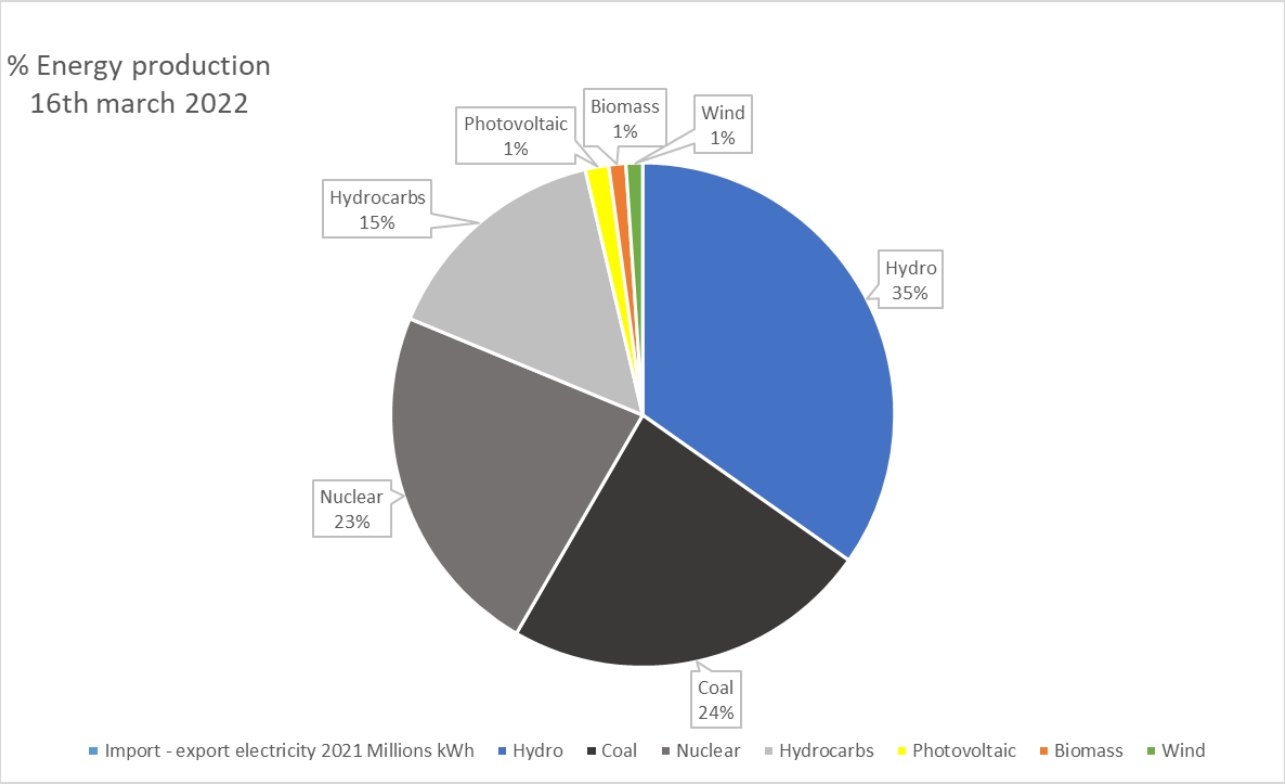


Fig. 4. Energy production (16th of March, 2022)

Another encouraging consideration would be that although the increase in energy production from biomass in the last 3 years is not a large one, this has occurred consistently and the share has very rarely fallen below 1% of the total energy production, the values of 0.7 percent mentioned above being isolated cases. In much more precise terms, the lowest daily values were 47...48 MW, while the highest exceeded 80 MW on certain days, but on most days they were around 65...73 MW per day , according to the SEN portal.

It can be considered that currently biomass has a period of stabilization and imposition as a viable source of energy production in the Romanian energy system. This may lead in the future to other investments and to the development of new installations so that the prime values increase.

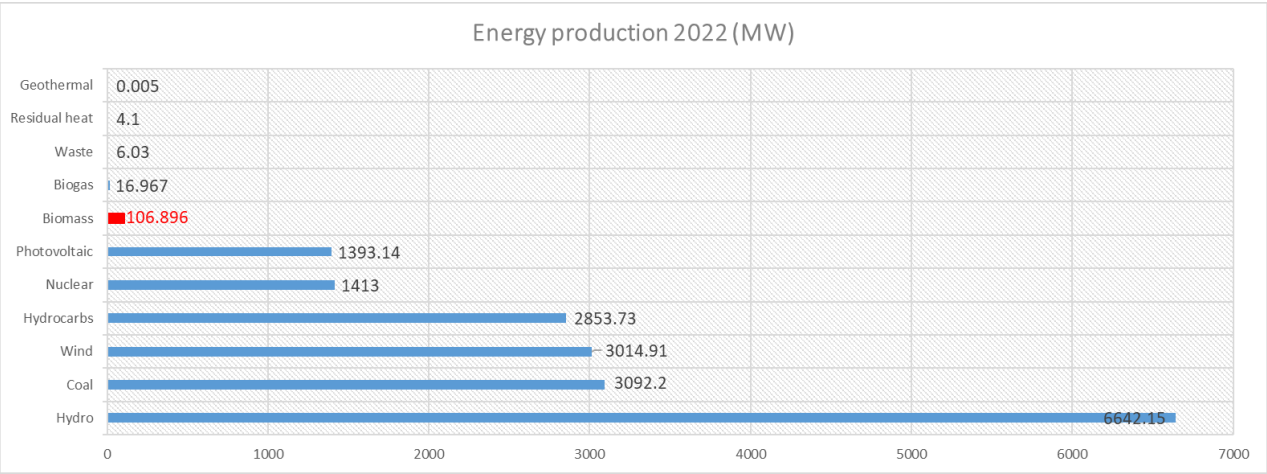


Fig. 5. Energy production (January – May 2022)

For the year 2022, biomass occupies the 7th place in the top means of production. In continuation of the above statement regarding future investments and the development of new biomass fruiting installations for energy purposes, we remind you that the production of energy from biomass depends to an overwhelming extent on the raw material, namely biomass. Which leads to Romania's biggest problem in this regard. Romania is a country with a large forested area, especially the Carpathian and pre-Carpathian areas and not only that, but also with large agricultural areas. Several times during the year, forestry and agricultural works take place, resulting in both agricultural and forestry biomass, but this remains, most of the time, unused or ends up being used in other means. The wood and brushwood from the forest are used for heating in stoves, especially in rural areas where there is no access to gas or for zootechnical purposes, agricultural biomass. These types of biomass were mentioned without mentioning the others such as Sewage sludge meat and manor etc.

Therefore, this is the biggest problem. Deficient or non-existent collection of biomass. If at the NUTS3 county level or at the locality cluster level there would be a centralized collection of biomass that would somehow be subsidized or rewarded, considerable biomass deposits would probably be collected.

From a legislative point of view, biomass is well regulated as a source of energy production and from the point of view of the potential at the national level (centralized or decentralized) Romania produces biomass that could produce much more than 3% of the total energy. Unfortunately, the lack of a strategy focused on biomass energy, the lack of information and biomass collection levers make this process not work at its optimal capacity.

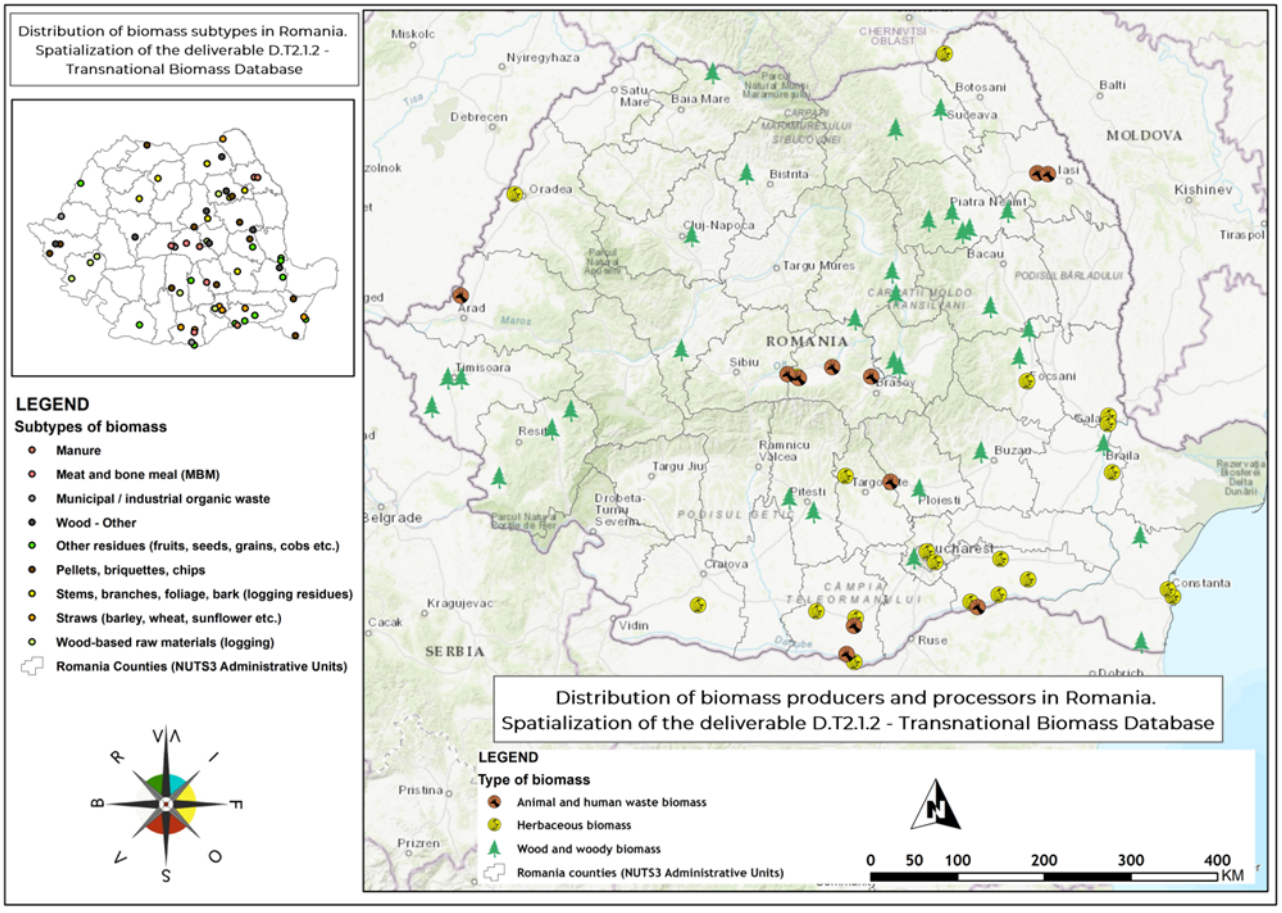


Fig. 6 Map from Biomass Database (WP T2, DanuP-2-Gas) (January – May 2022)

5.3.2 DESCRIPTION OF AUSTRIAN INFRASTRUCTURE LANDSCAPE

Renewable energy occupies a little more than 20% of the total energy production and in terms of daily values in some cases, this value rises to over 30 percent. Renewable energy

sources experience a growth in popularity in Romania, therefore the state must take full advantage of them in order to increase its degree of energy independence and also become more energy efficient.

The first place in terms of energy production is the energy produced by hydropower plants. The production of hydroelectric energy is dominated nationally by the state through the company Hidroelectrica, the largest with a value of 3.5 billion Euros.

The largest hydropower plant in Romania is Portile de Fier I. The Portile de Fier (in translation - Iron Gates) I hydropower plant is the largest hydropower plant on the Danube River and has an installed capacity of 1,166.4 MW. Downstream there is also the Portile de Fier II hydropower plant, with an installed capacity of 251.2 MW. Both hydropower plants are operated in partnership with Serbia, totaling 2160 MW, and those at Iron Gates II totaling 500 MW; the maximum installed flow of the power plants is 8,700 m^3 / s.

Another important source of energy for Romania is nuclear energy, produced at the Cernavoda Nuclear Power Plant, where 2 of the 4 reactors are functional. There were many discussions and allocations of funds for the commissioning of another reactor, but they probably stalled because of these directives urging a transition to green energy.

Thermoelectric energy is also very important, but the closing of the mines in recent years is a signal that the Romanian state wants to give up this method of energy production. However, in case of an energy crisis, the governors mentioned that if they have no choice, they will reactivate and rely on thermoelectric energy.

However, the biggest increases in the share of electricity production in recent years have been wind turbines and photovoltaic panels, appearing various parks and intensive areas per hectare with such infrastructures, Romania having favorable conditions for both productive sources (solar and wind which is neither too weak nor too strong)

The conclusions that emerge are that from the point of view of the energy production infrastructure, Romania is a fairly developed country. A positive aspect is the fact that the main source of energy production is represented by hydropower plants, but on the other hand, the following two means represented by nuclear energy and thermoelectric energy are not exactly in line with the directions and plans of the European Union.

At the same time, however, other energy production infrastructures such as wind and photovoltaic parks, as well as other installations such as those on biomass, have begun to gain ground. Moreover, photovoltaic energy is close to surpassing nuclear energy in terms of MW produced according to the data for the year 2022.

Therefore, Romania's energy infrastructure is a balanced one, which takes precise (slow but sure) steps towards non-polluting sources of energy production, and throughout this process tries to preserve its degree of energy security.

5.3.3 USE CASE ANALYSIS

For Romania, the results of the simulations that have been made with the Optimisation Tool show that the most profitable Power to gas hubs can be linked to Industrial Plants, where investments are viable and durable, in other words, it has the lowest payoff period and the highest profit values.

In the case of Renewable Energy Plant, as mentioned above, the negative values in terms of energy consumption with or without investment can be translated as production, however, they are not economically viable, just as is the case with investments. Greenfield type in this field.

However, it is shown that these values are closely related to the price of methane gas or depending on the existence of a certain subsidy and its percentage/value, for this type of investment. The existence and the percentage of the subsidy can make the difference and prove to be mathematically, and economically more important than the fluctuation of the gas price.

The main conclusion that resulted from the study is that the investments in Power to gas hubs are not sustainable in all scenarios.

Nevertheless, if investments and developments in Power to gas technology were regulated by law and had optimal conditions for development in terms of subsidies or the price of methane, within Romania there would be several areas where this type of investment would be viable and sustainable. Taking into account the biomass deposits in Romania, the most profitable areas to invest in biomass are the region of Moldova in the northeast of the country but also Muntenia (Calarasi county) and Constanta county in Dobrogea region, where most biomass is agricultural. The centre of the country, Transylvania, is not a bad investment option either, where the biomass is mixed, coming from various sources such as livestock, fruit and forest biomass.

Thus, it is noted that the investments in the Power to gas field can produce variable results, they are not economically viable in each case and they depend a lot on the price of gas, on the biomass capacity.

5.3.4 EXISTING FUNDING POSSIBILITIES

Over time, the Romanian state has had several types of subsidies and programs to increase the production and use of renewable energy. These subsidies were dedicated both to individuals (households) and to public or private entities.

In recent years, emphasis has been placed on the development of photovoltaic production capacities both at the household or collective housing level, but photovoltaic parks have also been developed. Among the subsidies, there are also subsidies to increase the production of renewable energy from all available sources of non-polluting energy production.

However, during the 2014-2020 programming period, through the Operational Program for Large Infrastructure, a project of Increasing energy production from less exploited renewable resources (biomass, biogas, geothermal) was launched, part of Priority Axis 6: Promoting clean energy and energy efficiency in order to support a low carbon economy. The authorities responsible for the development of this program were the Government of Romania - Ministry of European Funds through Managing Authority for the Operational Program, and among the eligible entities were found Large enterprise, Local public authority, SMEs, Intercommunity Development Association, but also Territorial administrative units of several levels (NUTS3, LAU2)

With a total value of funds of 15,000,000 euros and a funding of 98%, the program was attractive and following the results, it was discussed about its relaunch in the next programming period. The main results that were pursued within this program were the development of new production capacities and the modernization and expansion of the existing ones.

Another aspect that highlights an analytical and strategic thinking is the presence of the program that aims to increase the capacity of the national energy system. This program comes amid the question mark that hangs over the capacity of the national energy system to take over the surplus of renewable energy that could be produced.

Apart from the previously mentioned program regarding the production of renewable energy from less used sources, the Romanian state has not provided programs specifically dedicated to investments in biomass, sectoral coupling or power to gas technologies, but it also considers these as well as has all sources of renewable energy production. Despite all this, we can see an advance in terms of photovoltaic and wind energy, but it is clear that we want a diversification of the production sources of green, non-polluting energies.

5.4 EXISTING BARRIERS

Legal barriers

- Lack of information mentions and legislative regulation about power to gas technology
- Lack of information mentions and legislative regulation about sector coupling
- No clear and unsufficient legislative frame regarding hydrogen

- Delaying legislative processes that could improve the country's energy situation. The perfect example is the liberalization of the energy market, a process that has been talked about since 2020 but started only in 2021 even then with big problems and delays and many ambiguities. The same situation occurred in the case of the offshore law which involves the exploitation of gas deposits in the Black Sea (Romanian territorial waters), the law is delayed for more than a year.

- Administrative and political instability. Over the last 15 years, there have been very few cases in which a minister has been able to complete his term or a government has remained intact from the beginning without reshuffles and other procedures. Many times there have been entire governments that have not fulfilled their mandates. Thus, each minister came up with his own ideas, with a different team and there were several inconsistencies.

- Although there have been many examples of good practices in Western European countries regarding green energy since its use in transport or subsidizing green energy for households or non-household consumers (shopping centres, industry) they have not been adopted in Romania. Even if the economic and technical means were covered/assured, many technologies or practices are difficult to implement due to the lack of legislative framework

Socio-technical barriers

- Lack of general but also precise information about hydrogen, power to gas legislation, about the usefulness of different types of gas (biogas, biomethane) in the field of energy, energy production or the substitution of other methods to generate energy.

- Instability of the political environment. Governments, prime ministers and line ministers (implicitly also the minister in charge of energy) change very often so that many ideas do not get to be put into practice. The Ministry of Energy was moved (attached and broken) by other ministries or was a stand-alone ministry.

- Since 2017, - no subsidy or other support scheme for new installed renewable energy capacities, and so, no new relevant investments have been done in this period.

- Insufficient use of green energy production facilities, so there is still a precedent and greater popularity of these sources.
- It has long relied on coal-fired electricity and nuclear power to the detriment of other renewable electricity sources.

Techno-economic barriers

- There are no measures to encourage the use of green energy in certain areas such as industry of any kind or transport (eg public transport). Measures could be taken to encourage smaller or larger factories and plants to be supplied with green electricity. Public transport could be encouraged to focus more on vehicles (buses,

minibuses) with electric propulsion that use green energy. Trolleybuses and trams could also be encouraged.

- Measures that already exist and that promote green energy, although some of them are national programs that are insufficiently implemented, are insufficiently promoted whether it is the supply of green energy to a household, a block of flats or other buildings (malls, industrial halls). , technology parks). The owners in question, investors must be encouraged with various benefits, possibly tax exemptions to make them opt for green energy.

- Directing funds and investments to wrong ends or investments made in inappropriate places - in the case of micro hydropower plants - that have been located on mountain rivers, sometimes in areas where this type of activity is not allowed. Many of them do not work, and those that do not pay off in terms of the amount of energy they produce. These have been described by environmental and energy specialists as inappropriate. Instead, they had a negative effect on ecosystems on fish fauna and flora.

5.5 ACTION ITEMS AND RECOMMENDATIONS

Action items needed to overcome legal barriers

- creation of a new legislative framework for each of the following topics: hydrogen, sector coupling, power to gas
- modifying the existing legislative framework to eliminate ambiguities and make it clearer
- the modification of the existing legislative framework in order to favor future investments or the introduction of new technologies
- the grouping of laws in single documents (currently there are several laws that regulate the same subject, because they added and repealed articles from another legislature by another law, which causes the information to be dispersed in several documents from several years)

Action items needed to overcome socio-technical barriers

- public campaigns to promote the means of clean and advantageous energy production that come with it
- the encouragement and then the promotion of headquarters and buildings of public institutions that feed on green energy
- pilot projects and subsidies for homes in disadvantaged residential areas and beyond, for the installation of renewable energy production means
- campaigns to show the difference between an energy bill based only on conventional energy and a bill where renewable energy has a full or partial role
- encouraging large industries but also small and medium enterprises to use renewable energy or even to produce
- the popularization of public transport that uses renewable energy or is friendly to the environment.

Action items needed to overcome techno-economic barriers

- the development and launch of programs and subsidies to develop new projects and investments in the field of renewable energy
- the development of subsidies dedicated to hydrogen projects, those that provide sector coupling or power to gas
- the development of training courses for professionals in the field on renewable techniques
- creating advantages for hydrogen-based energy producers
- following and replicating good examples from foreign countries. Their replication according to the national context
- encouraging small energy producers from renewable sources and protecting them from being absorbed by the big companies in the Romanian energy sector
- encouraging SMEs of any kind but also industries to switch at least partially, if not totally, to renewable energy supply

Further action items and recommendations

It is obvious that Romania is making progress in the field of energy and is trying to align itself with the directives of the European Union and to achieve all the objectives imposed by both the government and the European Commission.

However, this process, although it is taking place, has a slow course. This development, which does not occur so quickly, and the reasons why the Romanian state still lags behind the rest of the European Union, is the inconsistency of the Government. Energy has been the subject of several transitions either being a separate portfolio or ministry with its own relevant minister or being incorporated into other ministries - the Ministry of Economy (eg). Following the prioritization of energy as an independent ministry, there were several changes of ministers from different political parties, each starting projects that he could not complete, being replaced by another minister with a different vision.

Therefore, consistency and continuity represented a problem in this case.

Apart from the introduction of new production capacities, the Romanian state must also consider updating, modernizing and increasing the capacity of the already existing infrastructure. Currently there are examples of photovoltaic parks that produce energy but cannot send it to the grid.

Promotion of renewable energy. This process takes place, but a more aggressive marketing in this sense would be more successful. Many times green energy is presented as something primarily beneficial for the environment, which is certain, but people regardless of whether we are talking about household owners, small businesses or large industrialists, are interested in the benefits that the use of green energy can bring them, how long the investment is covered, how much the investment amounts to, if they have any subsidies from the public authorities, etc. There is communication and transparency on this matter, but things could be done better.

Militancy for the introduction of new technologies and means of energy production. Power to gas, energy based on hydrogen and sector coupling. These things that are more popular in Central and Western Europe must be brought to Romania through advertising, through marketing, they must be promoted and justified. Subsequently, the creation and development of a legislative framework is needed to regulate the use of these new technologies.

Romania is on a good path in this path of energy development, but although there are still things that have not yet reached the national territory or issues that are happening but are not being excelled at or are being produced on a small scale, the Romanian state has in this moment every chance to reach its energy goals in the medium and long term.

LIST OF ABBREVIATIONS

REFERENCES

Andrei Mihai, Sectoral coupling: What it means and what are the advantages; FM Magazin, 2020

Energy Technology Roadmaps. A guide to development and implementation. IEA, 2014 Edition

Law no. 34/2017 on the installation of infrastructure for alternative fuels;

Raluca Diaconesa, Varinia Radu, Hydrogen law and regulation in Romania, CMS Expert

Romania, Integrated National Plan in the field of Energy and Climate Change 2021-2030, 2020, (p.) 102, Bucharest

Romania, Energy Strategy of Romania 2016-2030,with the perspective of 2050, Ministry of Energy, 2018, (pg.) 17, Bucharest