D.T2.4.1

Template report for regional energy action plan drafting	Version n°2: 03/2020 (rev. 2021)

D.T2.4.1: Regional Energy Action Plan - Southern Great Plain (Hungary)

A.T2.4 Regional Energy Action Plan definition

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Interreg CENTRAL EUROPE

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Specific objective:	2.2 To improve territorial based low-carbon energy planning strategies and policies supporting climate change mitigation
Acronym:	**PROSPECT2030**
Title:	**PROmoting regional Sustainable Policies on Energy and Climate change mitigation Towards 2030**
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1. EXECUTIVE SUMMARY

In Hungary, regional energy and climate strategies or plans are at present not developed at regional level, nor have the regions dedicated budgets for structural reforms. Thus, the Southern Great Plain region to a large extent follows the national development trends, and on the other hand the energy and climate planning is performed at county or municipal levels.

The energy saving and renewable potentials are clearly identified in the course of preliminary investigations.

> **Energy efficiency** - The building sector in the SGP region accounts for far the highest energy saving and greenhouse gas reduction potential, and further saving potentials are present in the business and transport sectors.
>
> **Renewables** - The key renewable sources of the SGP Region include solar, geothermal, solid biofuel and agricultural residues-based biomass and biogas.

The REAP of the Southern Great Plain (SGP) region has identified the following priorities:

1. Horizontal measures of the REAP;
2. Creation of decentralized energy and climate programming, implementation and coordination structure - "Climate Agency";
3. Promotion of local and regional renewable energies;
4. Promotion of energy efficiency investments;
5. Strengthening the local R&D and innovation capacities.

The REAP identifies two scenarios, a short-term up to 2030, and a medium term up to 2040.

2030 Short-term scenario

As the European funding plays a crucial role in the funding of low-carbon investments, the Short-term Scenario is identified to run until 2030, in order to encompass the 2021-2027 programming period and the following two years available for the implementation and disbursement of the committed funding before 2027. The present programming framework for the green economic transition including the Multiannual Financial Framework, the Recovery and Resilience Plan, and other relevant instruments of the NextGeneration EU as well as the several local financial instruments and support mechanisms, is overall clear and transparent, and it provides an appropriate technical and financial basis to make reliable projections up to 2030.

2040 Mid-term scenario

The Mid-term Scenario is closely linked to the extension of the Paks Nuclear Power Plant which will be realized between 2030 and 2040. The scenario builds on the assumption that in the course of the process of the phase-out of the old nuclear blocks and phase-in of new blocks the current contribution of the Power Plant to the electricity supply will be maintained at the present level. The Scenario does not take into consideration the major risk factors in the current REAP, namely

- the ongoing debate on the classification of the nuclear-based power generation will be concluded by a decision which identifies the electricity production from nuclear resources as an environmentally non-sustainable economic activity, and therefore, it cannot be aligned with EU taxonomy; and
- the temporal overlap in the operation of old and planned new nuclear reactors will be relatively short, and the transitional increase of nuclear energy in the electricity mix will not exert adverse impacts on the further roll-out of renewable-based power investments.

Greening of SGP region

Based on the scenario modelling the primary energy consumption of the SGP region is not predicted to change until 2040, while the greenhouse gas emission compared to the base year of 2016, will be reduced by 28.3% and 34.5% by 2030 and 2040, respectively.

The carbon emission at national level was around 44.2 million tons in 2016, whilst the same indicator in 1990 totalled to 73,7 million tons. Referring to 1990 base year, the forecast by the current scenario assessment by 2030 and 2040 are 57% and 61%, respectively. That means that the SGP region as a region will be able to achieve along the Fit for 55 Package's target of 55% of carbon saving by 2030 with the available resources. However, the decarbonization process seems to lose momentum in the period between 2030 and 2040. Therefore, the basis for a more radical participation of private sector resources needs to be created in order to fulfil the complete decarbonization by 2050.

Reliance of energy import

The SGP region will remain highly reliant on the energy import. The self-sustainability of the region will only increase by some 2% by from the baseline 3% until 2040 (Figure 7).

2. INTRODUCTORY OVERVIEW

2.1 Status quo summary

The Southern Great Plain (SGP) is one of the seven so-called planning and statistical regions in Hungary situated in the south-eastern part of the country. According to the European territorial hierarchy, the SGP is classified as a NUTS 2 region and as it is direct beneficiary for the application of the EU regional policies. The region is constituted by three counties: Bács-Kiskun, Békés and Csongrád, and borders from the south and east by Serbia and Romania, respectively. The administrative centre of the SGP is the city of Szeged, which is also the seat town of Csongrád County. Respectively, the county seat towns of Békés and Bács-Kiskun Counties, are Békéscsaba and Kecskemét.

According to its current territorial statical structure, Hungary includes seven less developed regions among others the SGP where the GDP per capita is less than 75% of the European (EU-27 average), and the capital city, Budapest which is classified as a more region (with the GDP per capita above the EU average). Due to the fact that the traditional territorial level with administrative functions beneath the national level is the county (NUTS 3 level), there are currently no elected bodies and administrations at NUTS 2 level.

The SGP region represents almost one fifth of the total area of Hungary. The population of the region based on the latest estimate was 1,244,000 people, which is approximately 12% of the total population of Hungary. Southern Great Plain is characterized as having the most parse settlement network of the whole country. However, due to historical reasons, the level of urbanization of few cities is high.

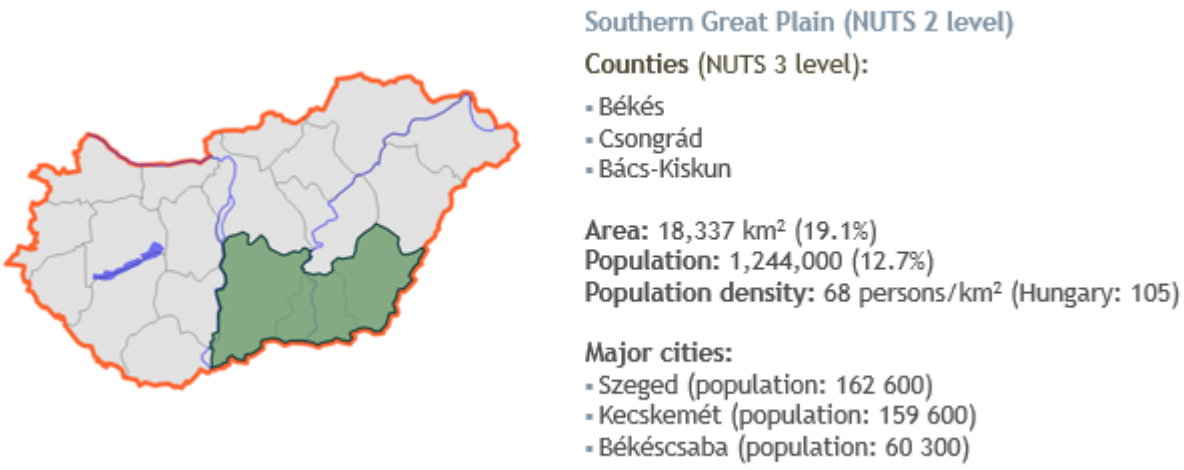

Figure 1: Positioning the South Great Plan Region

The Southern Great Plain Region is characterized by mainly agricultural landscapes and rural area. It also plays a gateway role to the Balkans, since M5 and M43 motorways connect Serbia

and Romania with Budapest and towards with Western Europe. Thus, agriculture, transportation and industrial related activities are widespread in this region. The region's share in the national GDP was 9.1 % in 2017.

Currently, the annual final energy consumption of the region is approximately 22,000 GWh, of which a significant amount is provided from fossil energy sources. Residential (41.8%), transport (20.1%) and industrial (19.3%) sectors are the major three energy consumers.

The CO_2 emission associated with the regional energy consumption is 3.6 tons/year per capita of which the highest contribution with 1.2 tons/year per capita is accounted for by the residential sector.

In 2016, the national CO_2 emission was around 44.2 million tons, within that the share of the Southern Great Plain was 4.5 million tons (10.2%).

The regional energy demand and carbon emissions, based on the calculations from the available information, were estimated in the regional energy report (D.T2.2.3) and used at the scenarios as baseline data.

Baseline overview 2016 base year	Final energy demand (MWh)	Share	Primary energy demand (MWh)	Share	Carbon emission (tonnes)	Share
Agriculture, forestry and fishing	1 766 162	4,0%	2 193 179	3,8%	413 297	4,6%
Industry (without construction), energy, water sewage etc	4 253 286	9,7%	6 457 917	11,2%	984 691	10,9%
Construction	305 766	0,7%	380 780	0,7%	76 344	0,8%
Transport	4 436 461	10,1%	4 997 996	8,6%	1 159 220	12,9%
Services	2 059 105	4,7%	3 059 722	5,3%	447 671	5,0%
Residential	9 199 101	20,9%	11 864 500	20,5%	1 418 549	15,8%
Total	**22 019 881**		**28 954 094**		**4 499 772**	

Table 1: Regional baseline – final and primary consumption and carbon emissions (estimated)

The baseline data used by the scenario tool developed by the European Centre for Renewable Energy in within the framework of the PROSPECT2030 project is presented in Table 2. The results of the scenario planning are presented in this report in Chapter 6.

Estimation of regional final energy demand (MWh)	Solid fossil fuels	Crude oil and petroleum products	Gas	Renewable energies	Non-renewable wastes	Electricity	Derived heat & grid bound thermal system
Agriculture, forestry and fishing	-	1 019 359	403 383	133 552	-	209 868	-
Industry (without construction), energy, water sewage etc	276 998	495 847	1 437 850	142 728	64 492	1 421 991	413 382
Construction	5 227	196 004	58 801	5 227	-	36 587	3 920
Transport	-	4 107 762	46 957	182 937	-	98 805	-
Services	2 769	32 303	1 175 840	44 302	1 846	638 683	163 362
Residential	189 525	-	4 523 274	2 699 100	-	1 397 645	389 557
Total	**474 518**	**5 851 275**	**7 646 105**	**3 207 845**	**66 338**	**3 803 579**	**970 221**

Table 2: Baseline input data for the scenario tool

Electricity is mostly imported by Southern Great Plain Region. In 2016, only 3% of the total demand was covered from internal sources. Nuclear energy plays a dominant role in the domestic energy mix, but the nuclear power generation by Paks Nuclear Plant with a total capacity of 2,000 MW, falls outside the territory of the Southern Great Plain.

In 2016, the Hungarian primary energy production was 132,070 GWh, which equals to 44% of the gross inland consumption (298,949 GWh). Hungary is highly dependent on fossil fuels import, especially in the respect of crude oil and natural gas. It is important to note, that 48% of the final electricity consumption is based on import.

In electricity consumption in the Region, the share of fossil fuels in the electricity fuel mix was 38.7%, whilst the renewable share was 10.2% in total in 2016 (and the outstanding balance is covered by nuclear energy). The renewable-based electricity generation is dominated by the solid biofuel (4.7 %), and the share of wind (2.2 %) and biogas (1.1 %) were also notable of the total electricity production in 2016.

The Region is in a strong need of increased self-supply coupled with effective energy saving. With the help of the key findings of the assessment of the baseline energy status of the region, PROSPECT2030 aims to provide appropriate solutions to achieve the decarbonization targets in Southern Great Plain for 2030. The current internal electricity production is included in Table 3.

Baseline electricity generation (2016)	
Source	**[MWh]**
Hydro	8 800,0
Wind	67,0
Solar photovoltaic	38 346,0
Biogases (incl. sewage-gas)	2 241,4
Liquid fossil	200,0
Gaseous fossil	56 591,2
Total	**106 245,6**
Renewables	**46,5%**

Table 3: Baseline electricity generation by source in the SGP (2016)

Currently, the domestic wind power capacity is concentred in the northwestern region of Hungary. Hydro, solar photovoltaic and renewable waste-based electricity production are also present in Hungary, but their shares are in the electricity production remained under 1 %.

Hungary has a significant geothermal capacity, but the economically explored temperature of the water/steam discharge is only high enough at certain locations to became competitive source for electricity generation. The first geothermal power plant in Hungary which provides

also electricity (2 MW) commenced the operation in 2017, however a further plant is under development close to the Southern Great Plain region.

There are in total 20 heat power plants present in the SGP region with a total thermal capacity of 508 MW. Seven of these facilities are fuelled with renewable resources, and these account for approximately one fifths of the total heat generation.

Heat generation (2016)	
Source	**Baseline values [MWh]**
Solid biomass (residues)	11 370,0
Geothermal (deep)	90 230,0
Gaseous fossil	404 900,0
Total	506 500,0
Renewables	20,1%

Table 4: Baseline heat generation by source in the SGP (2016)

2.2 Current development trends

In Hungary, regional energy and climate strategies or plans are at present not developed at regional level, nor have the regions dedicated budgets for structural reforms. Thus, the Southern Great Plain region to a large extent follows the national development trends, and on the other hand the energy and climate planning is performed at county or municipal levels.

Legal and strategic framework of the sustainable energy sector and the decarbonization process include the following key documents which were consulted during the preparatory process of the current document:

- Directive 2012/27/EU of the European Parliament and of the Council of 25 October 2012 on energy efficiency;
- Law No. XLIV/2020 on climate protection;
- Law No. LVII/2015 on energy efficiency;
- National Energy and Climate Plan;
- National Energy Strategy;
- 1st Climate Change Action Plan (up to 2020);
- 2nd National Climate Change Strategy (2014-2025 with outlook up to 2050);
- National Clean Development Strategy (draft);
- Renewable Energy Utilization Action Plan 2010-2020,
- National Energy Efficiency Action Plan;
- National Building Energy Strategy (February 2015); and
- National transport Infrastructure Development Strategy (2014).

Hungarian government (Ministry of Innovation and Technology) has recently developed two strategic documents the National Energy Strategy of 2030 (with an outlook to 2040) and the

National Energy and Climate Plan which provide the overall policy framework of the green transition.

2.2.1 National Energy Strategy

The National Energy Strategy identifies the following focus areas: security of gas and electricity supply by reducing import dependence, improving energy efficiency and reduction of greenhouse gas emissions.

Security of supply benefits by reducing import dependence which is most obvious for natural gas, as in Hungary 's final energy mix, natural gas represents the largest weight with 32.5%. In recent years, domestic production has accounted for about 20% of the total consumption, and 80% was covered from import.

Objectives:

- decrease of the annual natural gas consumption by the residential sector by 2 billion cubic meters under the implementation the Energy Efficiency Obligation scheme and the Green District Heating Program by 2030;
- reduction of the natural gas consumption in district heating to 50% by 2030;
- reduction of the current natural gas consumption of 2 million in power generation below 1 million cubic meters by 2040 (noting that nuclear power plant development may result in temporarily increase in the consumption level); and
- decrease of natural gas import close to 70% by 2030 and below 70% by 2040.

A total of 32% of the electricity consumption on average between 2013-17 from covered imports. The key to reducing import dependence in the power sector is domestic nuclear capacities renewal and the promotion of domestic production based on renewable resources. The energy mix based on the Paks nuclear power plant and development of the renewable capacities at the same time contributes to achieving the decarbonization objectives.

Objectives:

- increase the share of carbon-neutral domestic electricity production to 90% by 2030;
- increase of installed photovoltaic capacity to 6,000 MW by 2030, and to 12,000 MW by 2040;
- installation of 1 million smart metering units in order to increase the flexibility of the power sector; and
- stabilization of the ratio of electricity imports below 20%.

Reducing energy consumption can also make a major contribution to improving security of supply, therefore, improving energy efficiency is also a priority. The residential sector accounts for approximately one third of the final energy consumption and half of the natural gas consumption. Moreover, in 2016, to produce a unit of added value to the domestic industry

required about two-thirds more energy compared to the EU average. Improving energy efficiency in the business sector strengthens the competitiveness of the economy.

Objectives:

- keeping GHG intensity, or specific energy consumption of each industrial subsectors at a level not exceeding the European average of the respective industrial sector standards; and
- keeping the energy consumption below the 2005 level of 785 PJ in 2030 (if after 2030, any increase of final energy consumption can be covered from carbon neutral sources).

The above goals contribute to a significant reduction of GHG emissions. The energy strategy ensures that the triple goal of "clean, smart and affordable" energy is achieved.

Objectives:

- increase of the ratio of domestic renewable energy use in gross final energy consumption to a minimum of 21%; and
- reduction of GHG emissions by at least 40% compared to the 1990 level.

2.2.2 National Energy and Climate Plan

The National Energy and Climate Plan identifies the following core areas to address:

- Decarbonization;
- Energy efficiency;
- Energy security;
- Internal energy market;
- Research, innovation and competitiveness.

Decarbonization dimension

The EU Climate and Energy Policy Framework adopted by the European Council in October 2014 envisages at least a 40% reduction in greenhouse gas emissions at EU level by 2030 compared to 1990. In compliance with this provision, Hungary also aims to reduce its greenhouse gas emissions by at least 40% by 2030 compared to 1990 base year. This assumes that the gross emissions should not exceed 56.19 million t CO_2eq in 2030, therefore, it yet need to be reduced the gross emission by 7.6 million t CO_2eq compared to the 2017 emission level.

Phase-out of coal and lignite in the power sector

One of the most important decarbonization tasks is the transformation of the lignite-fired Mátra Power Plant to low-carbon technologies, and thus phasing out the coal and lignite from domestic electricity generation by 2030. Mátra Power Plant is of strategic importance as a basic power plant of the Hungarian electricity system, but at the same time, it is the largest in Hungary CO_2 emitter, which account for almost 50% of the CO_2 emissions of the energy sector, and for 14% of total domestic greenhouse gas emission.

Renewable energies

Hungary aims to achieve at least 21% share of renewable energy in gross final energy consumption by 2030. The share of renewable energy in the heating and cooling sector by deploying additional measures and incentives, is expected to be in the region of 30% by 2030. This is to be addressed through the efficient use in biomass and geothermal resources including heat pump systems in the individual heating and in district heating networks. In the district heating sector, a Green District Heat Programme has been devised to increase the market penetration.

In the area of transport, the target for the renewable energy share by 2030 is at least 14%. To achieve this goal the share in production of biofuels form food and feed plants (first generation biofuels) and waste (second generation biofuels) are anticipated to be increased to 7% and 3.5%, respectively. The outstanding balance is envisaged to be covered by the use of electricity in the transport sector.

Hungary intends to increase the share of renewable energy source in gross final electricity consumption to at least 20% by 2030. The central element of "greening" of the electricity sector is the expansion of solar photovoltaic capacities from current level to 6,500 MW by 2030. In 2030, the wind farm capacities will remain close to the current level (approximately 330 MW). In addition to maintaining the existing hydropower plants it, it is also justified to expand the capacity of small hydropower plants.

Energy efficiency dimension

In the National Energy and Climate Plan, Hungary has set the target that its final energy consumption will not exceed 785 Petajoule (PJ) by 2030. This threshold refers to the reference energy consumption in 2005, and in the event of an increase in final energy consumption exceeds the 2005 level, the increase can only be covered from carbon-neutral energy sources. This will require a drop of 0.8% in the annual energy savings within the period from 2021 to the end of 2030 and 7 PJ of new savings per year, assuming that the lifetime of the policy measures cover the whole period. The energy efficiency programs and measures introduced in the period 2014-2020 have resulted in final energy savings of about 3-4 PJ per year. Consequently, about twice the current savings are needed in the period starting from 2021.

On 1st January 2021, introduction of the new policy instrument, the Energy Efficiency Obligation Scheme (EEOS) has started in line with the provisions of the Energy Efficiency Directive. The scheme foresees that the obligated parties must develop their energy reduction program and implement measures that result in proven energy savings on the end-user's side. The obligated parties comprise the electricity and natural gas traders, universal service providers of electricity and natural gas, and the distributors of transport fuel to end users. The beneficiaries of the obligation system will be domestic corporate sector and the residential end-users.

Energy security dimension

In Hungary's energy supply, both in the electricity and in the gas markets, the high share of imports is a decisive factor. High energy import dependence involves severe security of supply and price risks.

By maintaining the domestic production capacities and ensuring a realistic development, the import ratio of electricity which is at present above 30%, should fall below 20%.

The target for gas import is a ratio to close to 70% by 2030. This is to be achieved by a combination of the reduction of the domestic consumption and the increase of the local gas exploitation.

Internal energy market dimension

The proper functioning of the internal energy market depends primarily on three main components: the degree of interconnectivity (system interconnection) and the need to increase it; the level of interconnection of market and its effect on reducing prices and price volatility; and liquidity of electricity and gas stock exchange in Budapest. The EU target for electricity interconnection is Hungary already significantly exceeds it. Nevertheless, the proportion of system connection is planned to increase to approximately 60% by 2030.

Research, innovation and competitiveness dimension

Hungary strives to support the domestic energy industry and research and development and innovation (RDI) sector in order to ensure achievement of the national and EU energy climate policy goals. The following key RDI area are identified:

1. Innovative system balance (flexible storage and demand management);
2. Encouraging the market roll-out of innovative energy supply methods;
3. Energy efficiency innovation program;
4. Promoting the utilization of domestic natural gas resources;
5. "Smart regulation" solutions in energy transmission and distribution;
6. Greening of the transport sector;
7. Promoting renewable energy solutions;
8. Supporting nuclear innovation;
9. Encouraging innovative seasonal electricity and heat storage solutions.

2.2.3 Key policy instruments

The SGP region as a less developed region (as the rest of Hungary excluding the Capital City, Budapest) is to a large extend reliant on the financial resources of the European Union. Figure 2 below illustrates the main EU funding instruments.

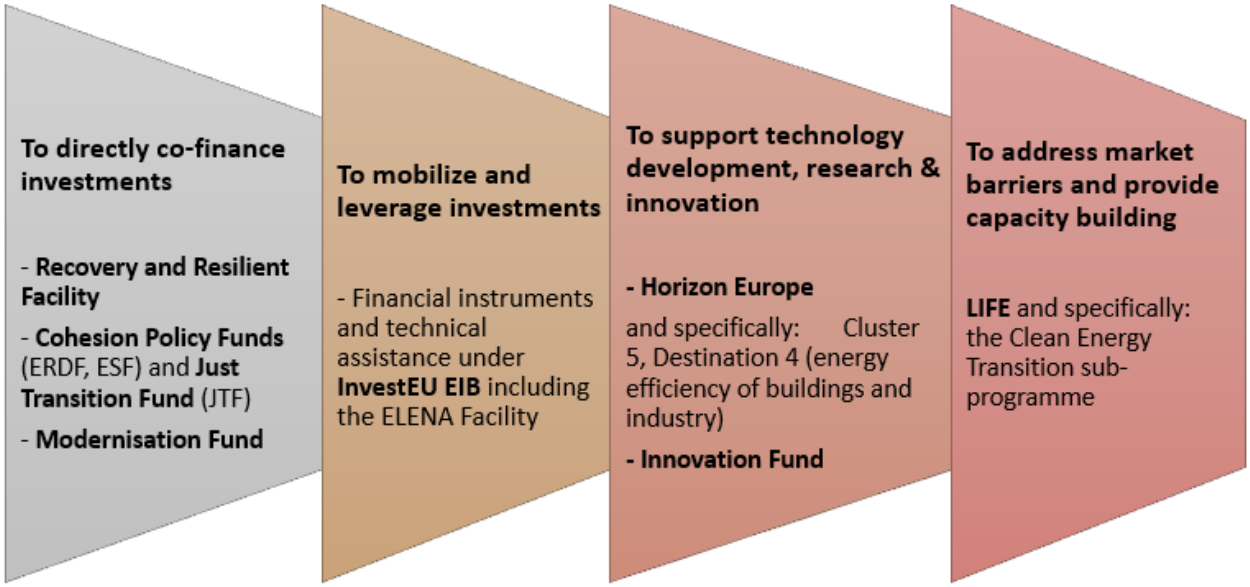

Figure 2: The EU funding landscape for energy efficiency and renewables (source: European Commission)

This section summarized the main policy instruments relevant to the current Regional Energy Action Plan. The main financial resources available for energy efficiency and renewable investments include:

- Multiannual Financial Framework (2021-2027) – decentralized component: under the decentralised funding provided to Hungary via the Multiannual Financial Framework for 2020-2027 the main instruments supporting energy efficiency will be the KEHOP+ (KEHOP: Environmental and Energy Efficiency Operational Programme). Improving the energy efficiency and coupled greenhouse gas emission in the residential sector is a stated objective of KEHOP Plusz.

  KEHOP Plusz will mainly support large scale energy retrofits of public (government and municipal) buildings and fund the Residential Energy Efficiency Loan Programme of the Hungarian Development Bank (MFB) targeting the retail segment with a total budget of HUF 100 billion (€ 280 million). The beneficiaries are individual homeowners, condominiums and housing cooperatives that can take advantage of a 0% fixed interest rate loan for the purposes of energy efficiency and renewable investments, among others, as upgrading of heating systems, insulation, replacing doors and installation of solar systems. The maturity

of the loan can be up to 20 years, with a ceiling of HUF 10 million (approx. € 28,000) for individuals and HUF 7 million (approx. € 20,000) per apartments in multifamily buildings. The own resource requirement is at least 10%.

The renewable sector will be supported by the Economic Development and Innovation Operational Programme (GINOP+) and the Territorial and Settlement Development Operational Programme (TOP+).

- The Energy Efficiency Obligation Scheme (EEOS) a new policy instrument established by the Energy Efficiency Directive was launched in Hungary in January 2021. The scheme foresees that the obligated parties must develop their energy reduction program and implement measures that result in proven energy savings on the end-user's side. The obligated parties comprise the electricity and natural gas traders, universal service providers of electricity and natural gas, and the distributors of transport fuel to end users. According to government's policy the beneficiaries of the obligation system will be domestic corporate sector and the residential end-users.

- Hungarian Recovery and Resilience Plan that supports the green transition by increasing the proportion of the renewable sources in the power generation. The plan aims to promote the decarbonization of the power sector by installation household size (50 kW or less) power generation units in a total capacity of 175 MW, and to enable the flexible feed-in of the energy into the power grid.

- The so-called Renewable Support System (Metár) continues to apply feed-in tariffs securing via long-term contracts an access for the locally produced electricity to the electrical grid. The most relevant investments in the SGP region include solar photovoltaic, biogas and geothermal power generation.

- Recently, a geothermal risk-sharing facility (so called Geotermia Call) has been launched to promote geothermal well development (both production and injection wells) by carrying 30-60 % of the investment cost depending on the successfulness of the well development.

- Green District Heating Programme which plays a key role in the reduction of use and replacement of natural gas in the district heating sector by the increase of the share of renewable energy sources on the heat market.

- The EU Horizon 2020 Programme funded the RenoHUb initiative in November 2019 with the aim to support the scale-up of the energy retrofits in the residential sector. RenoHUb adopts the one-stop-shop model that is regarded to be a proven instrument to efficiently guide homeowners through all stages of the energy retrofit process. The customer journey of RenoHUb addresses the entire value chain of home retrofit: from social, behavioural, communication and capacity building aspects through supporting the decision-making and the technical and financial implementation up to ex-post assessment of energy and cost saving. RenoHUb also intends to establish closer cooperation ties with financial institutions to device more specific funding schemes

including targeted loans, lending/blending, project bundling schemes, guarantee and risk-sharing facilities. RenoHUb structure is made up by an online platform and a network RenoPont offices. The available project resources cover the setting up and bring into full operation of the Online Platform as well as contributes to putting into operation one pilot RenoPont offices in Budapest and another one in the city of Nagykanizsa. Beyond the project lifecycle, the RenoHUb structure is expected to be able to develop its office network in a financially viable manner.

- Other European initiatives such as

  - ELENA (European Local Energy Assistance) Facility which is a joint initiative of the European Investment Bank (EIB) and the European Commission (EC) providing technical assistance for the design and implementation of bankable energy efficiency and renewable investments in public, commercial and residential sectors, and in the sustainable transport sector.

  - Project Development Assistance (PDA) funded by the Horizon 2020 and since 2021 by the LIFE Programme. The PDA supports building technical, economic, managerial and legal expertise needed for project development and leading to the launch of concrete energy efficiency investments. Target sectors include: existing public and private buildings including social housing, with the aim to significantly decrease energy consumption in heating/cooling and electricity; energy efficiency of industry and service as well as in all modes of urban transport and in existing infrastructures such as street lighting, district heating/cooling and water/wastewater services. Eligible projects should demonstrate the following features: an exemplary/showcase dimension in their ambition to reduce energy consumption and/or in the size of the expected investments; organisational innovation in financial engineering (e.g. on-bill financing schemes, guarantee funds, or factoring funds) and/or in the mobilisation of the investment programme (e.g. bundling, pooling or stakeholder engagement); and demonstrating a high degree of replicability.

- Revitalization of the ESCO market. From 1990 to about 2008, the development of the Hungarian ESCO market was promising. However, this market fell into recession after 2008 due to several reasons. The most significant challenges/barriers to overcome for a wider application of ESCO/EPC schemes:
  - competition with high intensity grants;
  - low energy prices enabling only long repayment periods;
  - lack of trust in ESCOs;
  - limited of knowledge and capacities on the contracting authority side;
  - lack of best practices and replicable models;
  - limited investment capacity and access to finance by ESCOs.

  The Law on energy efficiency defines the ESCO/EPC concepts, according to which energy service companies are enterprises providing energy efficiency services or other energy efficiency improvement measures including the up-front investment and related

operation, maintenance and system control, that lead to verifiable or measurable energy efficiency improvements or savings in primary energy use. The energy performance contract is defined as a contract concluded between the energy user and the energy efficiency service provider, which is controlled and monitored throughout its lifetime, and under which energy efficiency services provided are linked to an agreed level of the energy efficiency improvement or other energy efficiency criteria. Both above strategy papers, the National Energy and Climate Plan and the National Energy Strategy 2030 (with an outlook to 2040) reiterate the need to encourage ESCO solutions in the SME sector, public institutions, and in residential buildings.

2.3 Development potentials of the SGP region

Energy efficiency

The share of the residential sector in the regional final energy consumption is higher (42%) than that on national level (35%). Two-thirds of residential building stock is energetically outdated. Almost 25% of the single-family houses were constructed before 1945. The share of houses built between 1946 and 1980 is close to 50%. Consequently, almost 75% of all family houses were built before 1980, in accordance with the energy performance design requirements in force at the time. The complex energy refurbishment of the building stock offers at least 40-50% global reduction in the energy use. Whilst notable progress can be recorded in the energy renovation of multi-family buildings, the single-family house segment is largely untapped. Moreover, the public and industrial/commercial and public buildings are also generally outdated in the Region, and represent an additional significant additional energy saving potential, as well.

As a consequence, the building sector in the SGP region accounts for far the highest energy saving and greenhouse gas reduction potential.

Addressing the energy efficiency potential of the Southern Great Plain, the following possible development paths were identified:

- Deep renovation of residential buildings and promotion of their conversion near zero energy buildings (NZEB); particular attention is to be given the housing estates built between 1960 and 1989 made of prefabricated concrete panels;
- Deep renovation of public building;
- Energy refurbishments of buildings in the enterprise sector; and
- Implementation of individually controllable heating systems for properties provided with district heating (public and residential buildings).

Renewables

The key renewable sources of the SGP Region include solar, geothermal, solid biofuel and agricultural residues-based biomass and biogas.

Solar: According to the climatic and topographical conditions of the region, the solar potential is high. Thanks to the swift spreading of solar technologies the rate of the photovoltaic in the

regional electricity production mix is notable, and develops dynamically. In addition, there is a significant growth in building integrated solar solutions.

Biomass and biogas: Despite to the relatively high importance of the agriculture in the Southern Great Plain, the biomass potential is rather unexploited regarding the electricity and heat generation.

Geothermal energy: In the Southern Great Plain region the geothermic potential is mostly untapped. Currently the geothermic capacity is only used for heat generation. In 2016, geothermal based district heat was available in five towns, and a large-scale geothermal district heat project is under development in the city of Szeged currently.

Although the average temperature of the geothermal water is not high enough for electricity generation at large, its future role in district heat and in other forms utilization such as replacing fossil fuel in heating greenhouses is highly promising. Due to the settlement structure of the SGP, concentrated heat markets on the demand site are present that offer the opportunity for economical use of geothermal resources at a large scale.

E-mobility: The replacement of the transport fleet predominately in urban areas is also a declared priority of the Region, which is however in an embryonic state at the moment. For greening the public transport, there is a Green Bus Initiative of the government which can be instrumental in the SGP region, as well.

3. MISSION STATEMENT

The vision of the Southern Great Plain is to play an increasingly active role in the regional decision-making in the energy and climate policy area, and to this effect to institutionalize the regional energy and climate planning, to create its own programming and implementation and coordination capacity, and to support all local stakeholders in the scoping, design, attracting funding and in implementation of their initiatives aiming to strengthen the green transition process in the region.

3.1 Key energy priorities and identified measures

The REAP for the Southern Great Plain (SGP) region has identified the following priorities:

1. Horizontal measures of the REAP;
2. Creation of decentralized energy and climate programming, implementation and coordination structure - "Climate Agency";
3. Promotion of local and regional renewable energies;
4. Promotion of energy efficiency investments;
5. Strengthening the local R&D and innovation capacities.

Priority 1: Horizontal measures of the REAP

Horizontal measures include the critical horizontal elements which the various promoter organisations such as county and local municipalities, green NGOs, economic and agricultural chambers, economic clusters, universities and college, media experts etc. located in the SGP region, are anticipated to address in order to support the regional stakeholders

- in awareness raising concerning the need for increased climate awareness; and
- in strengthening the policy dialogue on low-carbon investments.

The proposed awareness raising activities addresses various distinct target groups such as, in particular:

- general public in order to trigger the behavioural change in energy consumption;
- homeowners to engage them to invest into EE and building-integrated RES measures to reduce the energy performance characteristics of their homes;
- enterprise sector to promote SMEs how to assess energy saving potentials, implement energy management systems, design appropriate EE measures and combine the energy retrofits with RES solutions;
- local governments to encourage municipalities to adopt energy and climate planning at local level, preferably based on the methodology developed by the Covenants of Mayors, and to them in the engagement process of local the local stakeholders.

Supporting the policy dialogue aims to reach out by the local stakeholders to the government actors via political, academic, media, etc. channels to voice the development needs of the SGP region, and to establishment of a formal consultative forum for a structured policy dialogue which should preferably include selected project developers, investors, ESCOs and representatives of commercial banks.

Priority 2: Creation of decentralized energy and climate programming, implementation and coordination structure - "Climate Agency"

Ideally, the “Climate Agency” is a decentralized independent structure that is set up on the initiative of the Southern Great Plain Region relying on the infrastructure and human and financial resources of the local key actors (county administrations, major cities/municipalities, academic, civic and business community).

According the concept of the REAP the Agency is mandated to

- support the national programming with the collection and analysis of local energy and climate data, engaging local stakeholders, monitoring of the state of affairs with regard to EE and RES investments as well as developing policy inputs;
- initiate, designs and implement or coordinate regional initiatives, in particular high added value projects such as international cooperation and technology transfer projects;
- provide technical support for the local stakeholders (municipalities, homeowners, SMEs, NGOs, etc.) in project design, attracting funding (grants/loans) and in project implementation;

- support local governments to adhere to the timely implementation of their climate and energy commitments;
- promote the sustainable exploitation of local renewable energy potential in particular the biomass and geothermal resources;
- monitor funding opportunities and communicate them to the relevant stakeholders;
- raise awareness and provide targeted trainings for key stakeholder groups (in particular EE and RES); and
- promote innovative financing tools and public-private partnership.

Priority 3: Promotion of local and regional renewable energies

In alignment with the identified key renewable potentials of the SGP region the following measures are envisaged by the REAP:

- increasing the share of biomass-based power and heat generation by promoting more excessive use of solid biofuel for district heating purposes in a sustainable manner and more targeted use of agricultural residues and wastewater sludge for biogas production.

- increased utilization of geothermal heat by the application of more "cascaded" solutions in the existing and future systems in order to maximise the utilization of the exploited heat, reducing the risks of geothermal development through risk sharing schemes, guidelines of mitigation measures for the development and operation of geothermal investments, and by installing smart measuring and regulation systems.

- promotion of other RES solutions in particular solar photovoltaic and heat pump systems in the residential and SME sectors, and supporting sharing best practices and demonstration projects in the municipal sector.

- developing electromobility in urban public transport by promoting electric vehicles, upgrading the municipal vehicle fleets to electric vehicles, developing electric vehicle charging infrastructure, promoting local solar photovoltaic energy generation, scheduling charging in off-peak periods, and by create strategies for reduce automobile use (and developing bike routes).

Priority 4: Promotion of energy efficiency investments

The planned energy retrofit measures encompass the municipal, residential and SME sectors. The key focuses

- energy retrofit of public buildings and infrastructure: i. implementation of energy management system (ISO 50001 or equivalent), ii. development ESCO/EPC/PPP schemes, iii mobilization of public funding for deep renovation of public buildings, and iv. assessment of financially viable technological developments of the municipal infrastructure (e.g. street lighting, municipal water and wastewater treatment facilities);

- residential building segment: i. creation of a regional one-stop-shop (perhaps under the auspices supporting the energy renovation of the residential building stock, and ii. lobby for appropriate financing instruments including public grants and commercial finance facilities; and

- commercial building stock: sharing best practices and promotion of the implementation of formalized energy management systems (ISO 50001 or equivalent).

Priority 5: Strengthening the local R&D and innovation capacities

The necessity of the following key R&D activities supporting the implementation of the REAP were identified:

- general technological advancement (e.g. smart metering, IT based regulation and control systems, solar photovoltaic solutions, fermentation procedures, combustion technologies, etc.);
- technological development in the areas of hydrogen economy, waste to energy technologies, energy storage, and e-mobility;
- support to the roll-out of geothermal energy utilization (e.g. hydrodynamic, hydro-chemical research, cascading, smart regulation);
- socio-economic research, assessment of market potential for renewable energies and replicability options;
- facilitation and promotion of participation in international research projects, international networking and cooperation;
- supporting green technology incubator houses, innovation centres and spin-off enterprises;
- cooperation on innovative financing schemes (e.g. energy efficiency obligation scheme, on-bill finance, mortgage finance, guarantee schemes);
- exemplary and pilot projects for new, innovative technical, organizational and financial solutions.

The above demand side activities largely match the existing R&D profiles of the universities, other public and private research organisations.

3.2 Compliance with European and national targets and strategies

As part of the European Green Deal, with the European Climate Law, the EU has set itself a binding target of achieving climate neutrality by 2050. This requires current greenhouse gas emission levels to drop substantially over the next decades. As an intermediate step towards climate neutrality, the EU has raised its 2030 climate target by committing to cutting greenhouse gas emissions by at least 55% by 2030. The EU addresses the revision of its climate, energy and transport-related legislation under the so-called “Fit for 55 Package” in order to harmonize current laws with the 2030 and 2050 ambitions.

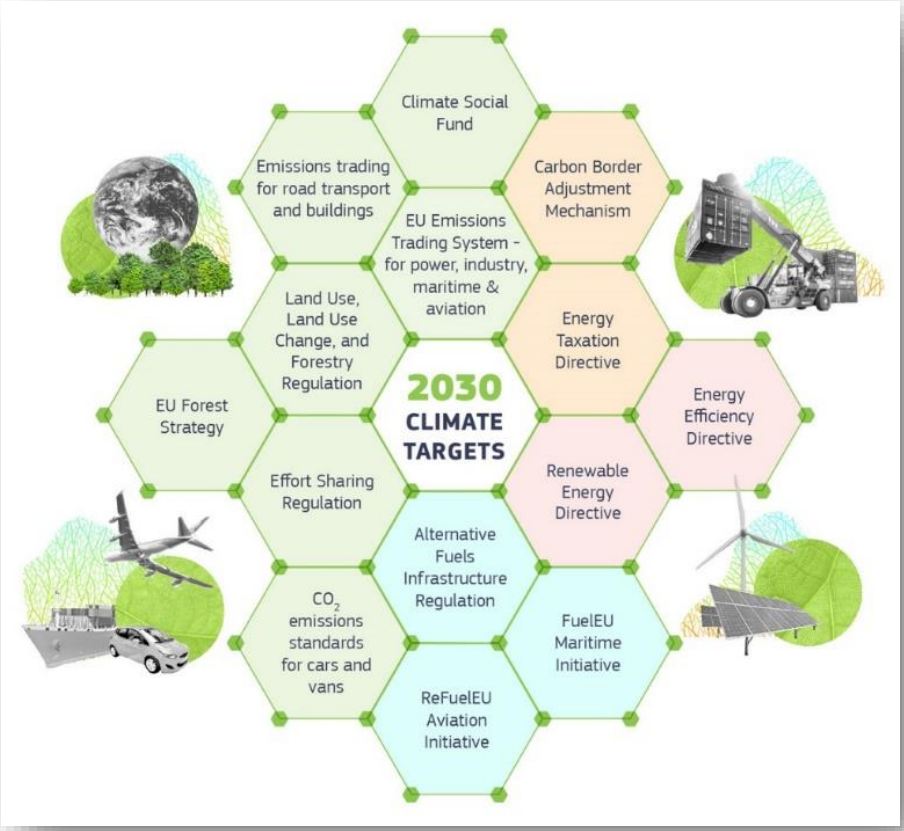

Figure 3: The overall structure of Fit for 55 Package (source: European Commission)

4. MISSION MAPPING

4.1 Levels of policy/governance

Section 4.1 lists the key stakeholder involved at both national and regional levels in the regional energy and climate policy formulation and the governance of implementation measures as well as their relevant roles and responsibilities both national and regional levels.

Key stakeholders at national level

Central authorities

- Ministry of Innovation and Technology (State Secretariat for Development of Circular Economy and Energy and Climate Policy) is in charge of the energy and climate policy;
- National Energy and Utility Regulatory Authority responsible for the regulation of the energy and utility markets, and in charge of the implementation of the Energy Efficiency Obligation Scheme;
- Prime Minister's Office – Deputy State Secretariat for Architecture, Building Affairs and Heritage Protection;
- Ministry of Human Capacities – supervising educational and health care institutions;
- Klebersberg Center – state owned real estate management organization of public elementary, secondary and vocational schools.

Financial institutions:

- Hungarian Central Bank – development of the strategic framework for sustainable finance (preferential capital requirement program for green investments, Green Home and Green Bonds Programmes, Green Guidance to commercial banks on sustainability issues;
- Hungarian Development Bank launching targeted energy efficiency and renewable development financing facilities;
- Saving banks ("Sparkasse") offering financing schemes for general home renovation (not specifically for energy retrofit);
- Commercial banks – financial intermediaries of the loan products of the Hungarian Development Bank; and
- Insurance companies providing liability insurance for consultants, construction contractors and installers.

Relevant energy suppliers and traders:

- Hungarian Electricity Works – owner of the Paks Nuclear Plant, the global electricity wholesaler and the operator of the national grid;
- Relevant distribution system operators;
- Electricity and gas traders.

Non-governmental green organizations:

- Association of Hungarian District Heating Enterprises;

- Energiaklub Policy Institute and Applied Communications, consortium leader of the RenoHUb project;
- Hungarian Energy Efficiency Institute, an advocacy organization of leading green construction material and technology manufacturers and suppliers;
- Hungarian Association of Environmental Enterprises promoting sustainable development;
- Various associations of local governments.

Stakeholders at regional level

Local administration:

- County governments offices (local arms of the central government);
- County Assemblies (locally elected bodies);
- Local governments (locally elected bodies) and their implementation structures (municipalities);
- Microregions (LAU 1 level).

Final beneficiaries of the REAP:

- Local governments in their capacity of being the owners and managers of municipal buildings and infrastructure e.g. street lighting, waterworks, wastewater treatment plants, waste treatment plants and landfills, etc;
- Local government associations;
- Public or contracted private operators of public buildings and infrastructure;
- Small and medium sized companies including industrial, service and agricultural enterprises;
- Farmers involved in any stage of the value change of green investments;
- Homeowners (single-family building owners, condominiums, housing cooperatives);
- Universities and research institution, private R&D organizations, spin-off enterprises, economic clusters, industrial parks, innovation transfer organizations along the R&D value chain;
- Schools in general, involved in climate awareness raising, and vocation schools involved education of use of green materials and technologies.

Other local stakeholders:

- Consultants (energy auditors/experts, financial advisers, experts supporting the preparation of grant applications, other project promoters);
- Construction contractors and installers;
- Green NGOs promoting environmental, energy and climate awareness;
- EPC contractors.

Energy and climate planning is performed at county and municipal levels. Each county of the SGS region has a climate strategy, and several municipalities has or are in the process to

develop Sustainable Energy and Climate Action Plans (SECAPs) along the guidelines of the Covenant of Mayors.

4.2 Spatial focusses

As discussed above the following development priorities were identified in the SGP region with the overall aim to promote the achievement of the set energy and climate targets:

1. Horizontal measures of the REAP;
2. Creation of decentralized energy and climate programming, implementation and coordination structure - "Climate Agency";
3. Promotion of local and regional renewable energies;
4. Promotion of energy efficiency investments; and
5. Strengthening the local R&D and innovation capacities.

All priorities generally cover the whole regions. Spatial dimension is present in

- agriculture and forestry-based biomass production and conversion of biomass to electricity, heat, biofuel and biogas;
- location of natural gas exploitation and gas storage facilities;
- the geothermal potential within the region is not even; the depths of aquifers with useable temperature varies in different in terms of exploration potential and associated investment cost as well as the of the purpose of the utilization;
- the utilization of geothermal heat is largely dependent on the location of the economical heat markets characterised by urban areas with concentrated presence of (currently gas heated) buildings and facilities, agricultural enterprises (e.g. greenhouses), industrial parks, etc;
- the research and innovation which mostly concentrates at universities and research institutions, and the roll-out of the innovation results concerns dedicated locations within the region.

4.3 Specific measures for the transition

The planned specific measures are summarised below as follows.

Title of measure:	**PRIORITY 1 - Awareness rising**			
Description of measure:	▪ The general public awareness raising is to trigger i. behavioural changes (reducing energy consumption by switching lights off, turning the thermostatic valve down, eco-driving, and ii. investments to effectively reduce the energy consumption of homes and to improve their energy performance characteristics. ▪ SMEs are to be targeted to strengthen their energy management in order to identify their saving potentials and the appropriate measures to reduce the energy consumption (this is the adoption of legal obligation of the non-SMEs as a best practice). ▪ Municipalities are to be supported to develop formalized energy and climate plans, preferably based on the methodology developed by the Covenant of Mayors.			
Affected dimension	Decarbonisation	Awareness		
Affected sector	All	All		
Spatial focus	Urban & rural			
Specific target groups	General public, SMEs, municipalities and municipal associations, vulnerable groups.			
Involved stakeholders	Homeowners, local businesses including agricultural enterprises, county and local municipalities and their companies, municipal associations, educational institutions, NGOs.			
Implementation responsibility	SGP Region			

Title of measure:	**PRIORITY 1 - Improving the policy dialogue with the central decision-making level**
Description of measure:	The measure is dedicated to deliver policy recommendations for improving the national regulatory and financial framework which is beyond the competence of the SGP region. These include in particular: <u>Technical issues</u> ▪ Security of energy supply/diversification of import markets. ▪ Upgrading the electricity grid and adjustment of the power sector to be able to handle the feed-in by a large number of electricity producers. ▪ Create Technical Guidelines, BAT for different RES technologies. ▪ Physical and cyber security of energy systems, emergency preparedness. <u>Administrative issues</u> ▪ Simplification and increased transparency of administrative procedures by the regulatory authorities and fund management services. <u>Financial issues</u> ▪ Promoting green finance on a large and economically viable scale. ▪ Preparing national financial incentives for dedicated areas e.g. building renovation – lower VAT rate. ▪ Risk-sharing on the energy efficiency investments (e.g. Energy Efficiency

	Obligation Scheme, ESCOs, guarantee instruments). ▪ Launching dedicated energy support scheme or each Hungarian region (co-financed with the EU).			
Affected dimension	Decarbonisation	Policy		
Affected sector	All	Public		
Spatial focus	Urban & rural			
Specific target groups	General public, homeowners, SMEs, municipalities and municipal associations.			
Involved stakeholders	County and local municipalities, municipal associations, academic sector, NGOs, media, and key enterprises engaged in energy production, transmission and distribution.			
Implementation responsibility	SGP Region			

Title of measure:	**PRIORITY 2 - Building regional programming capacity**			
Description of measure:	Overall, the measure aims to create programming portfolio of the Climate Agency. Anticipated key tasks: ▪ Systematic collection energy and climate related information of the region; introduction of smart data approaches. ▪ Assessment of input data and support to decision-making by the local stakeholders or vulnerable stakeholder segments. ▪ Monitoring low-carbon investments in the SGP region. ▪ Relationship management with the key local, national and international stakeholders. ▪ Identification of regional priorities and measures. ▪ Development and regular updating of the regional energy and climate strategy. ▪ Development of policy recommendation on national development priorities, grant support and financial instruments and their delivery mechanisms.			
Affected dimension	Decarbonisation	Institutional capacity building		
Affected sector	All	Public		
Spatial focus	Urban & rural			
Specific target groups	General public, homeowners, SMEs, municipalities and municipal associations			
Involved stakeholders	Cities/other local governments, local regulatory authorities, academic research community, NGOs, homeowner organisations, financial institutions, selected private sector actors e.g. project promoters, ESCOs and actors at national and international levels (government services, European Commission, CINEA, international financial institutions, etc).			
Implementation responsibility	SGP Region			

Title of measure:	PRIORITY 2 - Leadership in regional projects		
Description of measure:	The measure aims to create regional project generation and implementation portfolio of the Climate Agency. Anticipated tasks: ▪ Development of project concepts/model calculations; permanent consultation on project opportunities with key stakeholders. ▪ Monitoring funding opportunities; early warning. ▪ Leadership in project development/proposal writing. ▪ Coordination/implementation of awarded projects. ▪ Representing the SGP region on projects. ▪ Relationship management with international donor agencies, financial institution, professional organizations, NGOs, etc. ▪ The purpose twofold i. to support the sustainable exploitation of the renewable potential of the SGP region at a large scale, and ii. is to engage the region in high added value international projects with the leadership of the Climate Agency.		
Affected dimension	Decarbonisation	Institutional and capacity building	
Affected sector	All	Public	
Spatial focus	Urban & rural		
Specific target groups	General public, SMEs, municipalities and municipal associations.		
Involved stakeholders	Cities/other local governments, local regulatory authorities, academic and research community, NGOs, homeowner organisations, financial institutions, selected private sector actors e.g. project promoters, ESCOs and actors at national and international levels (government services, European Commission, CINEA, international financial institutions, etc).		
Implementation responsibility	SGP Region		

Title of measure:	PRIORITY 2 - Technical support to key stakeholders in the region			
Description of measure:	The measure aims to create technical support portfolio of the Climate Agency. Anticipated tasks in particular: ▪ Organising targeted awareness-raising programmes and information campaigns (promotion of EE and RES). ▪ Capacity building for the municipalities, SMEs and homeowners' organizations (trainings, presentations, webpage, leaflets, publications, case studies). ▪ Cooperation with one-stop-shop projects. ▪ Consultation on technical, financial and legal matters such as energy audits, EE plans, RES schemes, business plans/models, funding opportunities). ▪ Expert support to preparation of funding applications.			
Affected dimension	Decarbonisation	Capacity building		
Affected sector	All	Public		
Spatial focus	Urban & rural			

Specific target groups	General public, SMEs, municipalities and municipal associations.
Involved stakeholders	Cities/other local governments, local regulatory authorities, academic and research community, NGOs, homeowner organisations, financial institutions, selected private sector actors e.g. project promoters, ESCOs and actors at national and international levels (government services, European Commission, CINEA, international financial institutions, etc).
Implementation responsibility	SGP Region

Title of measure:	**PRIORITY 3 - Increased biomass-based power and heat generation**			
Description of measure:	In the Southern Great Plain region, agriculture and forestry representing a share of 12 % of the total regional GVA plays an important role in local economy. Agricultural residue-based biomass and biogas production is a key potential for renewable electricity, heat and biofuel generation. Currently, solid biomass is the dominant fuel in renewable sector of the SGP region. In 2016, the 16 licensed biogas power plants generated 21% of the total regional electricity production. However, the biomass potential of the region is currently highly underutilized. The aim of the measure is to dynamize the utilization of biomass potential of the SGP region for electricity, heat and alternative fuel production, thereby, to reduce the very high energy import dependency of the region by creating local biomass-based energy generation units.			
Affected dimension	Decarbonisation	Renewables		
Affected sector	All	Agriculture & forestry		
Spatial focus	Urban & rural			
Specific target groups	Private and public developers of biomass, biogas, alternative fuel plants.			
Involved stakeholders	Agricultural and forestry enterprises, investors, municipalities, regulatory authorities, consultants, financial institutions, project promoters, ESCOs.			
Implementation responsibility	SGP Region			

Title of measure:	**PRIORITY 3 - Maximizing the utilization of geothermal heat**			
Description of measure:	In 2016, five towns in the SGP region (Szentes, Hódmezővásárhely, Makó, Csongrád and Szarvas) had geothermal district heat capacity, which supplied 18% of the generated district heat. In several smaller municipalities of the region public buildings and spas are heated with geothermal sources. The aim of the measure is to promote the utilization of geothermal heat in public buildings, horticultural enterprises, industrial parks, leisure facilities, and in other concentrated heat markets.			
Affected dimension	Decarbonisation	Renewables		
Affected sector	All	Private & public		
Spatial focus	Urban & rural			

Specific target groups	Public buildings, SMEs, industrial parks.
Involved stakeholders	Cities/other local governments, private investors, central administration (risk-sharing) financial institutions, selected private sector actors e.g. project promoters and ESCOs.
Implementation responsibility	SGP Region

Title of measure:	**PRIORITY 3 - Electromobility in urban public transport**			
Description of measure:	Transport is a key pillar of the energy transition through phasing out petroleum fuels. The SGP region in its own competence can address the following areas: ▪ Replacement of municipal vehicle fleet to electric vehicles including personal cars and passenger transport vehicles; ▪ Establishment of charging infrastructure and managing charging schedule to optimally benefit from off-peak periods; ▪ Installation of electric vehicle charging stations powered with solar PV panels and batteries, for public use; ▪ Limitation of automobile use in central areas of cities, and developing bike routes.			
Affected dimension	Decarbonisation	E-mobility		
Affected sector	All	Transport		
Spatial focus	Urban & rural	Urban		
Specific target groups	General public, municipalities and municipal associations.			
Involved stakeholders	Cities/other local governments, transport operators, electricity distributors and suppliers, local electricity producers, financial institutions, selected private sector actors e.g. project promoters and ESCOs.			
Implementation responsibility	SGP Region			

Title of measure:	**PRIORITY 3 - Promotion of other renewables**			
Description of measure:	This measure aims to promote other RES such as solar photovoltaic panels, sun collectors, wind energy, hydropower and alternative RES such as hydrogen. Currently, photovoltaic energy generation grows quite dynamically at both small and medium size power plants up to a peak capacity of 50 kW and 500 kW respectively. The substantial increase of PV capacities is a stated government objective. Wind energy generation us practically suspended due to legislative reasons and the potentials for hydropower are limited in the SGP region.			
Affected dimension	Decarbonisation	Renewables		
Affected sector	All	All		
Spatial focus	Urban & rural			
Specific target groups	General public, SMEs, municipalities and municipal associations.			

Involved stakeholders	Cities/other local governments, SMEs, regulatory authorities, electricity grid operators and electricity suppliers, local electricity producers, financial institutions, selected private sector actors e.g. project promoters and ESCOs.
Implementation responsibility	SGP Region

Title of measure:	**PRIORITY 4 - Investment in the energy efficiency of public buildings and infrastructure**			
Description of measure:	The measure aims at the ▪ Promotion of exemplary role of local authorities in energy renovation of public buildings (administration buildings, schools, nurseries, sport facilities, etc.) as well as the energy efficiency upgrade of municipal infrastructure (street lighting, waterworks, wastewater treatment plants, etc.). ▪ Promotion of the deep renovation principle for public building retrofits. ▪ Promotion of the integration of RES in the energy retrofit of buildings. ▪ Promotion of energy management and smart solutions.			
Affected dimension	Decarbonisation	Energy efficiency		
Affected sector	All	Public		
Spatial focus	Urban & rural			
Specific target groups	Municipalities and municipal associations and the state operating public buildings in the SGP region.			
Involved stakeholders	Municipalities, state real estate operators, energy consultants/auditors, construction contractors/installers, management and administration of grant scheme, financial institutions offering targeted financing for public building and infrastructure retrofits, construction material and energy installation producers and suppliers.			
Implementation responsibility	SGP Region			

Title of measure:	**PRIORITY 4 - Support to energy efficiency in residential and commercial building segment**
Description of measure:	The overall aim of the measure is the provision of complex technical, financial and legal support along the whole costumer journey of home retrofit (e.g. potential adoption of the one-stop-shop approach in the region). The key barriers hindering the market take-up of the energy efficiency investments in the residential sector are well identified, and include in particular: - lack of awareness and personal motivation to undertake to a complex (technical, financial and legal) process; - lack of trust/miscommunication between homeowners and construction contractors/installers; - lack of comprehensive information sources and independent advisory services providing the homeowners with guidance throughout in the decision-making and implementation process; - lack of easily accessible financing; and

	- uncertainties in the future availability of policy instruments coupled with the likely phase out of high-intensity grant contribution.			
Affected dimension	Decarbonisation	Energy efficiency		
Affected sector	All	Residential		
Spatial focus	Urban & rural			
Specific target groups	Private home owners, condominiums, housing cooperatives, social housing segment.			
Involved stakeholders	Homeowners, condominiums and housing cooperatives managers, apartment owners and tenants, municipalities, energy consultants/auditors, construction contractors/installers, management and administration of grant scheme, financial institutions offering targeted financing for residential retrofits, construction material and energy installation producers and suppliers.			
Implementation responsibility	SGP Region			

Title of measure:	**PRIORITY 5 - Promoting and supporting R&D in the low-carbon sector**			
Description of measure:	The measure aims to strengthen the R&D and innovation profile of the SGP region with regard to green economic transition. The R&D and innovation activities to be supported over the whole cross-section of the low-carbon sector including technological and financial innovation, business incubation, exemplary projects, socio-economic research, and the development of international networks. The focus areas include in particular energy efficiency and biomass-based, geothermal and solar photovoltaic renewable production. However, phasing in new R&D profiles such as smart consumption monitoring and regulation, hydrogen economy value chain, waste to energy technologies, energy storage, and e-mobility aspects, is also supported.			
Affected dimension	Decarbonisation	Regional R&D portfolio development		
Affected sector	All	R&D		
Spatial focus	Urban & rural			
Specific target groups	Research centres, universities, private R&D companies.			
Involved stakeholders	Academic and research community, project development and innovation transfer organizations, innovation promotion organizations including the European Commission (LIFE and HORIZON Europe programmes), academic scholarship donors, venture capital companies& funds, private innovation donors.			
Implementation responsibility	SGP Region			

4.4 Enabling and restraining factors

4.4.1 Enabling factors

Enabling factors on authority, administrative and organizational level

- most municipalities have identified energy and climate mitigation/adaptation measures; there is an increasing interest to adopt the climate planning and monitoring methodology of the Covenant of Mayor in developing Sustainable Energy and Climate Action Plans;
- have most municipalities have been already involved in renewable energy and energy efficiency projects;
- county administrations support municipalities in the energy and climate programming process;
- as of next year, municipalities will have to employ (full or part-time) energy expert responsible for the energy management and supporting new sustainable investments;
- there is a good awareness and transparency in the availability of funding opportunities in the public and business sectors.

Enabling factors on infrastructure level

Renewables

- availability of renewable resources throughout in the region (solar energy, biomass, geothermal);
- availability and access to proven technologies and best practices;
- high degree of flexibility in plant size;
- operating a feed-in tariff system for renewable electricity production (METÁR);
- possibility to make benefit of the low-voltage electrical grid as puffer storage by small scale (household size) renewable producers;
- added values to the value change in the agri-food and forestry sectors;
- stronger cooperation with grid operators and planners.

Energy efficiency

- high energy saving and greenhouse gas reduction potential in the residential, public and SME sectors;
- increasing awareness of citizens, municipalities and SMEs;
- energy audits are to be completed by qualified experts;
- immediate comfort benefits for citizens;
- waste heat recovery options;
- increased energy security;
- favourable incentive and support schemes already in place (EEOS, one-stop-shop, public grants to municipalities;)

- revitalization of the ESCO market, EPC contracts in the public sector to maximise the leveraging of public resources;
- openness to adopt new building techniques/architecture.

E-mobility
- electric vehicles are socially accepted and spreading;
- simple infrastructure, to be implemented with small interventions;
- growth opportunity for bio and geothermal electricity production.

Enabling factors on socio-economic-cultural level

- increased awareness and acceptance of sustainable energy investments in the region;
- increasing interest of homeowners as well as SMEs in participating in sustainable energy projects;
- business opportunities for local consultants and construction companies;
- creation of local material supply chains.

4.4.2 Restraining factors

Restraining factors on authority, administrative and organizational level

- poor availability of the regional energy data for regional energy and climate programming;
- lack of financial and human resources of municipalities for appropriate design of sustainable energy projects;
- limited own resources of municipalities and private persons for energy efficiency and/or renewable investments;
- business sector typically invests into sustainable energy projects with short financial return.

Restraining factors on infrastructure level

Renewables
- long permitting process (environment, grid connection);
- depending on the location grid connection may be costly;
- unavailability of steady inputs to biomass/biogas production;
- electricity grid needs major improvement to align with the renewable energy supply;
- diverting interests of energy supplier and grid operators.

Energy efficiency
- energy retrofits require complex (technical, financial, legal etc.) knowledge;
- cost/benefit scenarios are not explored;
- no market transparency in terms performance and quality standards of materials and technologies;
- weak regulatory control and lack of ethical standards of contractors;
- diverting renovation focus by obligated parties of the Energy Efficiency Obligation Scheme or EPC contractors.

E-mobility

- low effective range of electric vehicles;
- higher vehicle cost;
- lack of efficient technologies for battery reuse;
- low charging infrastructure in place;
- conventional energy resources are used;
- high operation cost of the charging infrastructure.

Restraining factors on socio-economic-cultural level

- limited purchasing power in the residential sector to finance sustainable energy investments (socio-economically less developed region);
- generally, long repayment periods;
- geographical imbalances of interventions;
- low interest of the business in investing in energy efficiency measures without short-term economic benefits.

4.5 Challenges, estimation of efforts and impact

Main challenges that may appear during the implementation of the described measures will mostly be linked with involvement and commitment of key stakeholders and their financial participation in the anticipated decentralized energy and climate programming, implementation and coordination/support structure ("Climate Agency") and in other horizontal measures.

Figure 4 shows the assessment of identified regional priorities by expected impact and required effort. As it can be seen all identified priorities trigger nearly maximum impacts. The investment elements (investment into energy efficiency and renewables) require nearly maximum efforts, whilst the other elements, energy strategy, creating a decentralized management structure, and R&D activities lower, still high effort (70-80% of the maximum).

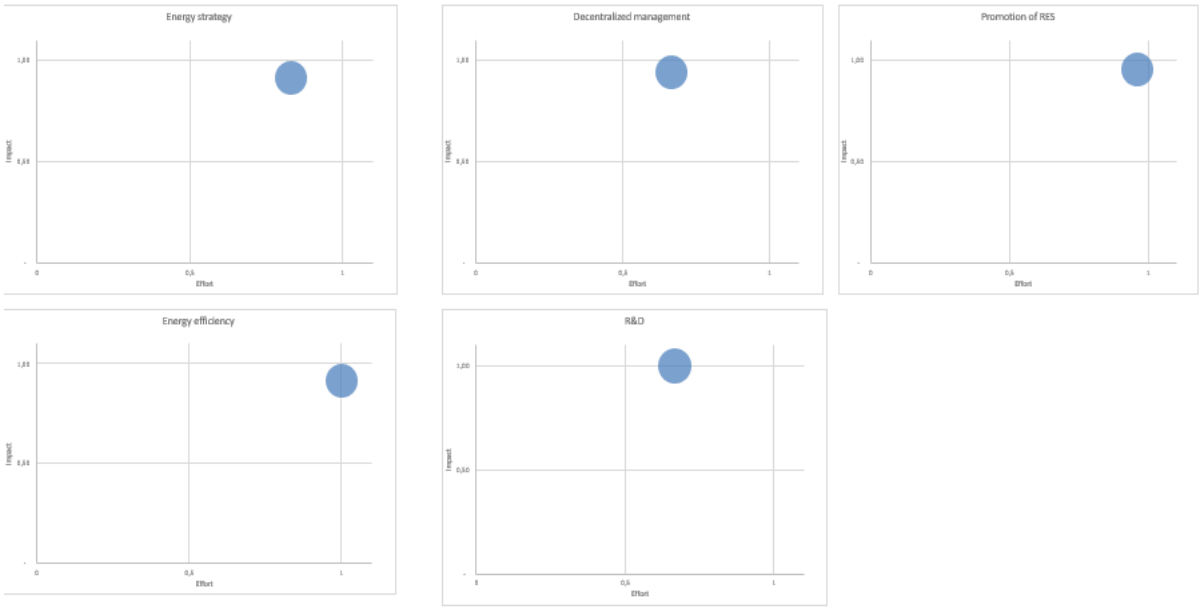

Figure 4: Impact/effort diagrams of the identified regional priorities

The following key challenges were identified

- NUTS 2 regions in the present territorial hierarchy in Hungary are not regarded as an administrative level with elected decision-making bodies. Below the national level counties (NUTS 3 level) composing the regions have administrative function. Therefore, the suggested regional energy and climate planning process and the regional programming, implementation and coordination structure ("Climate Agency") can only be created for bottom-up by the strong political will and commitment of the local stakeholders. It is expected that the completion between regions and the clear socio-economic benefits of the green transition process will trigger the stronger internal cooperation.

- The financial resources available for the development of sustainable energy measures are mostly planned at national level, and therefore, do not they always reflect the specific regional needs, and the access to the funding may create imbalances between regions based on the level of preparedness.

- Between 2030 and 2040, the extension of the Paks Nuclear Power Plant may create uncertainties in terms of potential increase of the share of nuclear energy in the electricity supply. The increased supply of electricity due to the parallel operation of the old and new nuclear reactors and the price of the nuclear energy may exert unpredictable adverse impacts on the roll-out of renewable investments.

- With regard to the energy supply of Hungary, a crucial decision at European level will be how nuclear energy will be considered within the context of the EU taxonomy alignment.

5. ACTION DEFINITION

In the Southern Great Plain region, there has not been any regional strategy or development plan prepared, therefore the region tries to exploit and fit into the national incentives. Based on the three stakeholders' meetings, webinars and different discussions the below measure matrix has been agreed upon (Table 5).

The assessment of the key features of the identified measures are summarized in Table 5. The assessment criteria include (letter is bold refer to the abbreviations in the table):

- Type (**P**olicy or **T**echnical);
- Level is importance (**1**: most important, **3**: least important);
- Time horizon (**s**hort, **m**edium or **l**ong term);
- Impact triggered (**H**igh, **M**edium or **L**ow);
- Effort required (**H**igh, **M**edium or **L**ow).

Southern Great Plain					
	Type	***Level***	***Time frame***	***Impact***	***Effort***
Formulation of regional energy strategy	P	1	s	H	L
Creation of decentralized energy coordination/management structure(s)	P/T	1	s	H	M
Promotion of local and regional renewable energies	P/T	3	s	M	L
Capacity building for energy planning and implementation and creation of cooperation networks	T	2	s/m	M	L
Local/regional financial initiatives for energy refurbishment of the public and private building stock	P/T	2	s	M	M
Increased efficiency of existing geothermal energy recovery	T	2	s/m	M	M
Increased share of photovoltaic power generation	T	2	s/m	H	M
Increased utilization rate of the regional geothermal potential (district heating, power generation)	T	2	s/m	H	H
Increased biomass-based power and heat generation	T	2	s/m	H	H
Electromobility in urban public transport	T	2	s/m	H	H
Development of energy infrastructure: transmission and distribution grids, energy storage, etc.	T	3	m	H	H
Strengthening the local R&D and innovation capacities	T	3	s/m	H	M
Investigation of wind power potentials of the region	T	2	s	M	M
Improving the national regulatory framework (permitting, technical standards, market regulation, feed-in tariff system, etc.)	P	2	s/m	H	L
Development of green financing tools	P/T	2	s/m	H	H
Security of energy supply/diversification of import markets	T	3	s/m/l	H	H

Table 5: Strategic assessment of the identified regional measures

The description, targets, responsibilities, target groups and a description of the set of instruments to use are included for each measure by the enclosed REAP Action Development Matrix (Appendix A).

6. SCENARIOS

6.1 Overview on main actions and measures on the time scale

Renewables

The national target to increase the share of renewable energy sources to at least 21% by 2030 as a proportion of gross final energy consumption is considered achievable in the SGP region. In fact, this target is considered that it can be slightly exceeded due to the rich and diverse renewable potential of the region.

There are strong financial incentives for geothermal investments, renewable-based electricity and fuel production, development of biogas production based on the largely untapped agricultural/food waste and wastewater sludge resources. Considering the renewable potentials of the region, with the appropriate deployment of this instruments reaching a target of renewable share (21.5%) slightly above the national target appears to be feasible.

Energy efficiency

There is a variety of financial and technical support instruments to develop energy retrofits in the residential, business and public sectors such as the Energy Efficiency Obligation Scheme (EEOS), ESCO companies, one-stop-shop supporting residential retrofits, grants, preferential loan and credit guarantee which enable significant reduction of energy consumption and greenhouse gas emission.

E-mobility

The national target is 14% renewable share in the transport sector by 2030 which is not considered to achievable in South Great Plain region. A realistic target is to replace petroleum products used in the transport sector up to 14% electricity produced from renewable and conventional energy sources. This process is supported by various initiatives including grant support and the development of the electric vehicle industry.

6.2 Scenario 2030

As the European funding plays a crucial role in the funding of low-carbon investments, the Short-term Scenario (Scenario 2030) is identified to run until 2030, in order to encompass the 2021-2027 programming period and the following two years available for the implementation and disbursement of the committed funding before 2027. The present programming framework for the green economic transition including the Multiannual Financial Framework, the Recovery and Resilience Plan, and other relevant instruments of the NextGeneration EU as well as the several local financial instruments and support mechanisms, is overall clear and transparent, and it provides an appropriate technical and financial basis to make reliable projections up to 2030.

6.2.1 General description: Actions and measures in the scenario

The justification for the assumptions and estimates is provided in this section. The quantified assumptions for the reduction of fossil energy by 2030 are included in Table 6 through Table 8.

Phase-out of solid fossil fuels until 2030

Solid fossil fuels representing a small share in the total final energy consumption (2.2%) are used in the following four sectors: industry (without construction), energy, water sewage etc., construction, services and residential sectors. The overall target for 2030 is to reduce the solid fossil share by nearly 30% in which the major is played by the industry, construction and the service sectors.

The main sectors concerned by the use of solid fossil fuels are the industry and the residential sector.

Industry, construction and service sectors

In the industry, coal is mostly used for building heating, and the use of coal, coke, pet coke in processes (e.g. lignite power plant, steel and iron production or cement industry) has a limited relevance in the SGP region. The phasing out solid fossil fuels is regarded to be a relatively dynamic process. By 2030, approximately 40% of the used fossil fuel is planned to be replaced by other type of fuels. In this area, a rapid change to solid biofuels, and heat pump and geothermal solutions, or replacement of solid fossil fuels by piped gas or LPG is anticipated.

The same trends apply to the construction and service sectors. However, the transition process of these service sectors may be somewhat more rapid (phase out: 45%).

Residential sector

The residential consumers who predominately live in the small villages and other sparsely populated areas where the natural gas supply grid is not built out, use coal for heating. As there is a little chance mainly from economic perspective to further expand the existing gas network, the options for these people are to replace coal fuelled heating equipment to more efficient ones and/or replace coal with mostly solid biofuels (mostly solid biomass) and heat pump systems. However, this is considered to be a relatively slow process. The short-term target is 11.4% based on renewable and heat pump solutions.

Solid fossil fuels	Start value (MWh)	Shift in energy source up to 2030			
		Renewable general	Heat pump system	Grid-bound thermal system	Gas
Agriculture, forestry and fishing	-				
Industry, energy, water sewage etc	276 998	25,00%	2,00%		20,00%
Construction	5 227	30,00%	2,00%		20,00%
Transport	-				
Services	2 769	30,00%	2,00%		20,00%
Residential	189 525	10,00%	2,00%		
Total	**474 519**				

Table 6: Reduction of solid fossil fuels use by 2030

Phase-out of crude oil and petroleum products until 2030

The use of crude oil and petroleum products represents a share of nearly 27% in the total final energy consumption mix of the SGP region of which approximately 70.2 % and 17.4 % account for the transport and agriculture, forestry and fishery sectors, respectively. Overall, a drop of 16.5% in the consumption crude oil and petroleum products is forecasted by 2030.

Transport

The key assumption is the national target of 14% renewable share in the transport sector by 2030 is not considered to achievable in South Great Plain region. A realistic target is to replace the current petroleum-based final energy consumption of the transport sector with 14% electricity produced from renewable and conventional energy sources. The use of electric vehicles is typical for urban areas in passenger and short-range freight transport. One of the flagship projects in the SGP region under implementation is the (electric) tram-train connection between the cities of Szeged and Hódmezővásárhely (approx. 30 km).

The vehicle fleet used in public transport in the SGP region is relatively aged. There are strong policy initiatives at government level to support the electric vehicle industry and the lithium and other innovative efficient battery production. On the one hand the government supports through providing favourable business environment the settling down and expansion of bus and battery producers mainly from the Far-East (China, Korea, Japan), and on the other hand there are ambitious targets to revitalize and redirect traditional Hungarian bus production to electric bus manufacture in different sizes.

The replacement of transport vehicles is expected to be triggered by traffic and emission control measures in urban areas, as well. According to the government policy the renewal of the public transport will incentivized by public grants (Green Bus Programme). The roll-out of electric vehicles is considered as a relatively rapid process which will not be able to be followed

by the renewable electricity production capacities, and therefore, surplus electricity from conventional sources (nuclear and gas) will be required in the phase out of petroleum fuels.

Realistically, 5% of renewable electricity production in the SGP region may contribute to the decarbonisation of the transport sector and the outstanding balance of 9% will be based on conventional nuclear and gas-based energy mix.

Agriculture, forestry and fisheries

In agriculture, crude oil and petroleum products are assumed to be used by purpose-built machinery and transport vehicles (80-85%) and for heating and power generation (15-20%) at agricultural farms, afforested areas and fisheries.

The phase-out of conventional fuels in the agricultural machinery is anticipated by replacement of conventional fuel with biofuels. Other petroleum fuel use (building heating and power generation) will be addressed by the heat utilization of local biogas units, geothermal, and heat pump solutions. The share of geothermal energy is expected to developed the most rapidly and it is anticipated to represent 50% in renewable mix.

Other sectors

Other sectors are envisaged to phase out petroleum product with the same pace as agriculture with the exception of the service sector where a more radical phase-out is planned based on renewables including heat pumps and where relevant, geothermal energy and replacement of petroleum products with on-grid and off-grid natural gas solutions.

Crude oil and petroleum products	**Start value (MWh)**	**Shift in energy source up to 2030**				
		Renewable general	**Heat pump system**	**Grid-bound thermal system**	**Gas**	**Electricity**
Agriculture, forestry and fishing	1 019 359	**5,0 %**	**2,0%**		**10,0%**	
Industry, energy, water sewage etc	495 847	**5,0%**	**2,0%**		**5,0%**	
Construction	196 004	**5,0%**	**2,0%**			
Transport	4 107 762	**5,0%**				**9,0%**
Services	32 303	**15,0%**			**10,0%**	
Residential	-					
Total	**5 851 275**					

Table 7: Reduction of crude oil and petroleum products use by 2030

Phase-out of natural gas until 2030

Natural gas has the largest share with almost 35% in the final energy consumption in the SGP region. In terms of gas consumption, the residential sector plays the most decisive role with a share of 59.2% which is followed by the industry and service sectors with respective shares of 18.8% and 15.4%.

In total, 80% of the gas consumption at national level is imported which is a high risk in terms of energy security. The national target is to decrease the current gas import to 70% by 2030 partially by the increase of the domestic gas exploration, and partially by energy saving and phasing in renewables. In alignment of this target, a total shift of 7.2% to renewables with a different pattern of renewable combining solar photovoltaics, biomass, biogas, geothermal heat, heat pump systems options, appears to be realistic at the SGP region. The only sector is agriculture where somewhat more ambitious target can be set.

Residential sector

In the residential sector the major driver is the energy efficiency. Therefore, the available financial resources are expected that the energy performance of the buildings (façade and roof insulation, change of gas boilers, windows and door to more energy efficient ones) will be in the focus as opposed to building integrated renewables. In the single-family building segments, which represents some 95% of the buildings and approximate 80% of the households, the staged renovation is typical due to the homeowner's financial capacity.

Gas	Start value (MWh)	Shift in energy source up to 2030			
		Renewable general	Heat pump system	Grid-bound thermal system	Electricity
Agriculture, forestry and fishing	403 383	8,0%	2,0%		
Industry, energy, water sewage etc	1 437 850	5,0%	3,0%		
Construction	58 801	5,0%	2,0%		
Transport	46 957				5,0%
Services	1 175 840	5,0%	2,0%	3,0%	
Residential	4 523 274	5,0%	2,0%	2,0%	
Total	**7 646 105**				

Table 8: Reduction of gas consumption by 2030

6.2.2 Energy saving options

The assumptions on energy efficiency/energy saving as input data for the scenario modeling are detailed below.

Heat and thermal process

The assumption is that on heat and thermal process a total of 5 % can be saved in the residential sector which means that 50% of the total building stock in the SGP region will be renovated resulting in an average of 10% energy saving. For single-family buildings, the staged renovation is typical, and the estimated 10% saving represents the first phase of the renovation wave.

The energy saving in the industrial and service sectors will be higher i.e. 6% and 8% respectively. The renovation of the public (central government and municipal) buildings which is government priority, the energy saving results of this is accounted under the service sector.

Electricity

More radical phase out is anticipated for the saving on electricity owning to the application of more energy efficient installations and technologies, smart regulation, implementation of energy management systems in the business and public sectors.

However, it can be seen based on the current trend, that the phase of electric vehicles in the transport sector will be more rapid process than the increase of the renewable share. Therefore, in the transport sector surplus electricity need is predicted to arise.

Transport fuel

The decrease in the transport fuel consumption is due to application of more energy efficient use of fossil fuels in conventional vehicles, in-built electronics regulating fuel saving driving as well as due to the shift to hybrid and electronic vehicles.

6.2.3 Required investments

The estimate for required renewable investments is presented in Table 7 below. The estimated investment costs are based on widely used benchmarks for unit investment costs.

Shift in energy source up to 2030			
Renewable source	**Investment (EUR)**	**Feed-in tariff (EUR)**	**Grant Incentive (EUR)**
Solar photovoltaic	278 841 115	69 710 279	111 536 446
Geothermal	198 777 825	0	39 755 565
Biogas	74 811 031	37 405 515	0
Heat pump	111 395 069	0	33 418 521
Total	**663 825 041**	**107 115 794**	**184 710 532**
Percentage	**100%**	**16%**	**28%**

Table 9: Estimated investment needs until 2030

6.2.4 Renewable energy in supply and consumption

Table 10 presents the energy demand and the internal supply in the region and the renewable share in the internal supply.

Short-term scenario MWh	Demand	Internal supply	Internal renewable supply	Share of renewable
Heat and thermal process	12 904 513	656 554	251 654	27,5%
Electricity	3 560 560	106 246	49 454	11,3%
Alternative & transport fuels	3 571 162			9,8%
Total	**20 036 234**	**762 800**	**301 109**	**21,5%**

Table 10: Energy demand and internal supply by 2030

As illustrated by Figure 5 the renewable share in the energy consumption increases by some 4% by the 2030 compared to the base year of 2016.

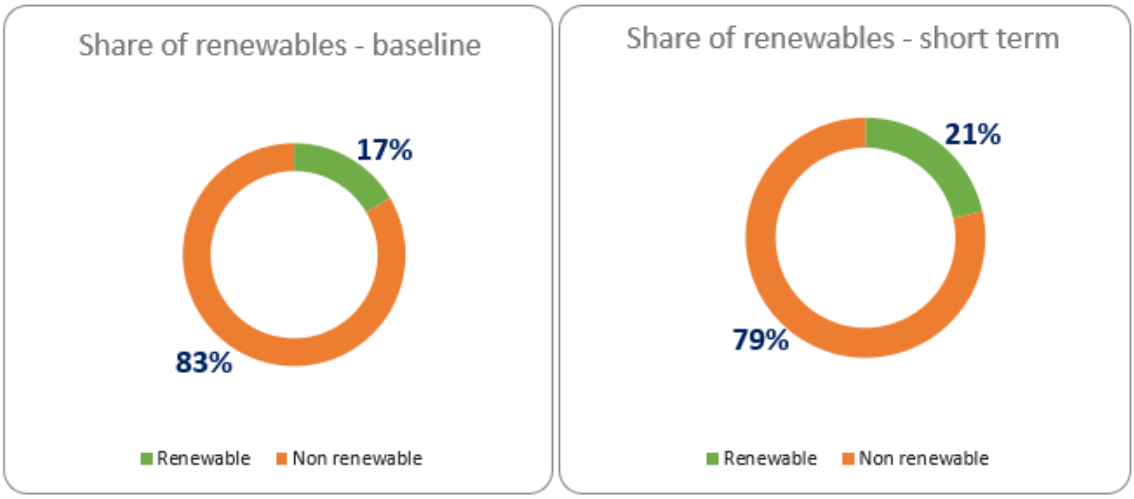

Figure 5: Share of renewable in the demand mix

6.2.5 Primary energy in supply and consumption

Based on the results of the scenario modeling the primary energy consumption by 2030 will very slightly decrease, meanwhile the pattern of the energy demand by source is restructured. Compared to the 2016 base year the share of renewables increases from 14.6% to 28.9%, and in parallel the fossil fuel demand will drop by one third, and the use of petroleum products by 14.2%. The gas consumption slightly decreases, while the electricity demand will increase with nearly the same ratio.

Shift in energy source up to 2030								
Estimation of regional primary energy demand (MWh)	Solid fossil fuels	Crude oil and petroleum	Gas	Renewable energies	Non renewable	Electricity	Derived heat & grid bound	Total
Agriculture, forestry and fishing	0	930 675	511 478	260 827	0	499 898	0	2 202 879
Industry	161 490	479 980	1 525 033	385 565	70 941	3 299 204	537 396	6 459 609
Construction	2 760	200 512	60 958	25 575	0	113 633	5 096	408 533
Transport	0	3 885 943	51 653	427 157	0	509 164	0	4 873 917
Services	1 462	26 650	1 168 062	138 168	2 030	1 480 028	212 371	3 028 772
Residential	183 460	0	4 527 797	3 312 696	0	3 266 741	506 424	11 797 119
Total	**349 171**	**5 523 759**	**7 844 982**	**4 549 988**	**72 971**	**9 168 669**	**1 261 288**	**28 770 828**
Change compared to baseline (2016)	**-33,1%**	**-14,2%**	**-6,7%**	**28,9%**	**0,0%**	**5,1%**	**0,0%**	**-0,6%**

Table 11: Regional primary energy demand pattern by 2030

6.2.6 Final energy consumption and GHG emissions

Table 11 suggests that compared to the baseline year there is an overall 1.7% saving in the final energy consumption. However, the shift in energy source results in a global decrease of 28.3% in the carbon emission (Table 12).

Shift in energy source up to 2030								
Estimation of regional final energy demnand (MWh)	Solid fossil fuels	Crude oil and petroleum	Gas	Renewable energies	Non renewable	Electricity	Derived heat & grid bound	Total
Agriculture, forestry and fishing	0	846 068	464 980	237 116	0	217 998	0	1 766 162
Industry	146 809	436 345	1 386 394	350 514	64 492	1 438 732	413 382	4 236 666
Construction	2 509	182 283	55 417	23 250	0	49 553	3 920	316 932
Transport	0	3 532 675	46 957	388 325	0	222 038	0	4 189 996
Services	1 329	24 227	1 061 874	125 607	1 846	645 417	163 362	2 023 664
Residential	166 782	0	4 116 179	3 011 542	0	1 424 575	389 557	9 108 636
Total	**317 429**	**5 021 599**	**7 131 801**	**4 136 353**	**66 338**	**3 998 314**	**970 221**	**21 642 055**
Change compared to baseline (2016)	**-33,1%**	**-14,2%**	**-6,7%**	**28,9%**	**0,0%**	**5,1%**	**0,0%**	**-1,7%**

Table 12: Regional final energy demand pattern by 2030

The shift in energy source results in a carbon emission reduction above 50% in the electricity demand and a nearly 40% and 22% on the phase-out of solid fossil fuels and petroleum products, respectively.

Shift in energy source up to 2030								
Estimation of regional energy CO2 emissions (t/a)	Solid fossil fuels	Crude oil and petroleum	Gas	Renewable energies	Non renewable	Electricity	Derived heat & grid bound	Total
Agriculture, forestry and fishing	0	200 749	85 387	3 135	0	29 788	0	319 059
Industry	47 112	103 533	254 592	4 634	19 523	196 595	0	625 990
Construction	805	43 251	10 177	307	0	6 771	0	61 311
Transport	0	838 208	8 623	5 134	0	30 340	0	882 305
Services	427	5 749	194 999	1 661	559	88 193	0	291 586
Residential	53 522	0	755 880	39 813	0	194 661	0	1 043 876
Total	**101 866**	**1 191 489**	**1 309 658**	**54 683**	**20 082**	**546 349**	**0**	**3 224 127**
Change compared to baseline (2016)	**-39,2%**	**-22,0%**	**-15,2%**	**17,2%**	**-9,1%**	**-54,2%**	**-**	**-28,3%**

Table 13: Regional carbon emission by 2030

6.2.7 Sankey diagram

6.3 Scenario 2040

The Mid-term Scenario (Scenario 2040) is closely linked to the extension of the Paks Nuclear Power Plant which will be realized between 2030 and 2040. The scenario builds on the assumption that in the course of the process of the phase-out of the old nuclear blocks and phase-in of new blocks the current contribution of the Power Plant to the electricity supply will be maintained at the present level. The Scenario does not take into consideration the major risk factors in the current REAP, namely

- the ongoing debate on the classification of the nuclear-based power generation will be concluded by a decision which identifies the electricity production from nuclear resources as an environmentally non-sustainable economic activity, and therefore, it cannot be aligned with EU taxonomy; and
- the temporal overlap in the operation of old and planned new nuclear reactors will be relatively short, and the transitional increase of nuclear energy in the electricity mix will not exert adverse impacts on the further roll-out of renewable-based power investments.

6.3.1 General description: Actions and measures in the scenario

The quantified assumptions for the reduction of fossil energy by 2030 are included in Table 14 through Table 16.

Phase-out of solid fossil fuels until 2040

The overall target by 2040 is to phase out fossil fuels entirely.

Industry, construction and service sectors

In industry, approximately two thirds of the used fossil fuel is planned to be replaced by other type of fuels by 2040.

The same trends continue to apply to the construction and service sectors. In these sectors to the phase-out ratio will be range between 83-85%.

In the replacement of energy source, the renewables will dominate with a share of 63.4%.

Residential sector

The residential consumers, the options will remain for replacing coal fuelled heating equipment to more efficient ones and/or replace coal with mostly solid biofuels (mostly solid biomass) and heat pump systems. However, the transition in the residential sector is still considered to be significantly lagging behind the other sectors concerned. The medium-term target is 27.1% based on renewable and heat pump solutions.

Solid fossil fuels	Start value (MWh)	Shift in energy source up to 2040				
		Renewable general	Heat pump system	Grid-bound thermal system	Gas	
Agriculture, forestry and fishing	-					
Industry, energy, water sewage etc	276 998	26,00%	5,00%	5,00%	30,00%	
Construction	5 227	50,00%	5,00%		30,00%	
Transport	-					
Services	2 769	50,00%	8,00%		25,00%	
Residential	189 525	20,00%	10,00%			
Total	**474 519**					

Table 14: Reduction of solid fossil fuels use by 2040

Phase-out of crude oil and petroleum products until 2040

The overall target to reduce crude oil and petroleum products consumption by at least 40% by 2040.

Transport

The final electricity consumption of the transport fleet in the SGP region will be more than doubled by 2040, but the renewable share in this area is not expected to grow beyond 10%. The start of the planned new nuclear blocks at the Paks Nuclear Power Plant, and parallel operation of the old blocks for a transition period of time make extremely difficult to forecast of the electricity market between 2030 and 2040.

The 2040 scenario proposes the contribution of 10% of renewable and 20% conventional electricity production to the decarbonisation of the transport sector in SGP region.

Agriculture, forestry and fisheries

More intensive biofuel production and exploitation of geothermal resources including water discharge from shallow aquifers for heat pump development are considered the main contributor to the renewable shift between 2030 and 2040. The use natural gas/LPG is not expected to further grow.

Other sectors

Other sectors are envisaged to phase out petroleum product with the same pace as the industry with the exception of the service sector where a more rapid phase-out is anticipated to continue based on renewables including heat pumps and where relevant, geothermal energy and replacement of petroleum products with on-grid and off-grid natural gas solutions.

Crude oil and petroleum products	Start value (MWh)	Shift in energy source up to 2040				
		Renewable general	Heat pump system	Grid-bound thermal system	Gas	Electricity
Agriculture, forestry and fishing	1 019 359	16,0%	5,0%		10,0%	
Industry, energy, water sewage etc	495 847	10,0%	5,0%		5,0%	
Construction	196 004	10,0%	5,0%			
Transport	4 107 762	10,0%				20,0%
Services	32 303	30,0%			10,0%	
Residential	-					
Total	5 851 275					

Table 15: Reduction of petroleum products use by 2040

Phase-out of natural gas until 2040

The realistic target for 2040 is a total shift of 17.1% to renewables with a different pattern of renewable combining solar photovoltaics, biomass, biogas, geothermal heat, heat pump systems options, appears to be realistic at the SGP region. The only sector is agriculture where somewhat more ambitious target can be set.

Residential sector

The resources of the provide homeowners will be invested into energy efficiency as opposed to building integrated renewables unless financial incentives will be available or the prices of the technologies will significantly drop.

Gas	Start value (MWh)	Shift in energy source up to 2040			
		Renewable general	Heat pump system	Grid-bound thermal system	Electricity
Agriculture, forestry and fishing	403 383	20,0%	5,0%		
Industry, energy, water sewage etc	1 437 850	18,0%	6,0%		
Construction	58 801	12,0%	5,0%		
Transport	46 957				15,0%
Services	1 175 840	18,0%	5,0%	3,0%	
Residential	4 523 274	5,0%	5,0%	2,0%	
Total	**7 646 105**				

Table 16: Reduction of gas consumption by 2040

6.3.2 Energy saving options

Heat and thermal process

The assumption is that the saving on the heat and thermal process is doubled to 10 % by 2040 and thereby 50% of the total building stock in the SGP region will be renovated resulting in an average of 20% energy saving.

The energy saving in the industrial and service sectors will grow more dynamically i.e. by 15% and 13% respectively. The renovation of the public (central government and municipal) buildings which is government priority, the energy saving results of this is accounted under the service sector.

Electricity

In general, it is assumed that the electricity demand will grow in all sectors. The lowest increase in predicted in the residential sector. In the transport sector the 25% phase out of petroleum product is assumed to increase the electricity demand by 10%. The increase of electricity need in the industry and service sectors is also assumed to be 10%.

Transport fuel

The fossil fuel consumption in the transport fuel consumption is expected to decrease by 25% mostly due to the shift to hybrid and electronic vehicles.

6.3.3 Required investments

The addition estimated investment costs into renewables between 2030 and 2040 is included in table 17. The estimated investment costs are based on the same benchmarks for unit investment costs in euro terms used for the short-term scenario. The total investment needs in the 2030-2040 period appears to be two and a half time higher than in the period to date to 2030.

Shift in energy source up to 2040			
Renewable source	**Investment (EUR)**	**Feed-in tariff (EUR)**	**Grant Incentive (EUR)**
Solar photovoltaic	701 678 660	175 419 665	0
Geothermal	500 206 570	0	0
Biogas	188 255 250	94 127 625	0
Heat pump	264 800 472	0	0
Total	**1 654 940 952**	**269 547 290**	**0**
Total	**100%**	**16%**	**0%**

Table 17: Estimated investment needs between 2030 and 2040

6.3.4 Renewable energy in supply and consumption

Table 18 presents the energy demand and the internal supply in the region and the renewable share in the internal supply. The high energy import dependence will continue to exist. The shift of renewable share in the global energy mix will increase from the initial 17% to 26% (refer to Figure 6).

Mid-term scenario MWh	Demand	Internal supply	Internal renewable supply	Share of renewable
Heat and thermal process	11 952 982	873 058	468 158	33,6%
Electricity	4 569 902	106 246	49 454	11,1%
Alternative & transport fuels	2 637 078			16,9%
Total	**19 159 962**	**979 304**	**517 613**	**25,9%**

Table 18: Energy demand and internal supply by 2040

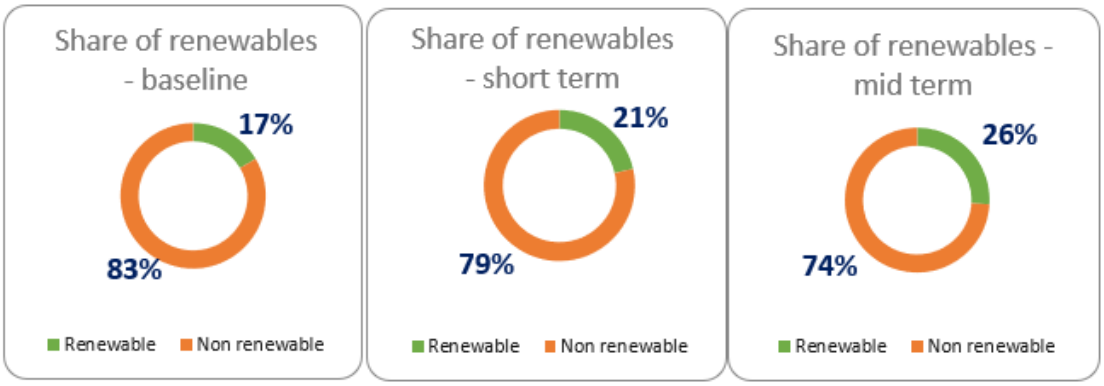

Figure 6: Share of renewable in the demand mix

6.3.5 Primary energy in supply and consumption

Primary energy consumption of the SGP region by 2040 is not expected to change.

Shift in energy source up to 2040								
Estimation of regional primary energy demand (MWh)	**Solid fossil fuels**	**Crude oil and petroleum products**	**Gas**	**Renewable energies**	**Non renewable wastes**	**Electricity**	**Derived heat & grid bound thermal system**	**Total**
Agriculture, forestry and fishing	0	773 693	444 920	470 952	0	527 863	0	2 217 429
Industry	103 597	436 345	1 293 300	673 605	70 941	3 342 656	555 401	6 475 846
Construction	1 437	183 263	54 893	47 587	0	146 996	5 096	439 272
Transport	0	3 162 977	51 653	653 084	0	854 551	0	4 722 265
Services	822	21 320	961 220	339 794	2 030	1 503 249	212 371	3 040 808
Residential	156 358	0	4 378 529	3 441 653	0	3 365 582	506 424	11 848 547
Total	**262 215**	**4 577 599**	**7 184 516**	**5 626 676**	**72 971**	**9 740 897**	**1 279 293**	**28 744 166**
Change compared to baseline (2016)	**-49,8%**	**-28,9%**	**-14,6%**	**59,5%**	**0,0%**	**11,7%**	**1,4%**	**-0,7%**

Table 19: Regional primary energy demand pattern by 2040

6.3.6 Final energy consumption and GHG emissions

In final energy consumption by 2040 a slight decrease (3.1%) is predicted (Table 20), whilst in parallel the carbon emission will drop by nearly 35% (Table 21).

Shift in energy source up to 2040								
Estimation of regional final energy demnand (MWh)	Solid fossil fuels	Crude oil and petroleum products	Gas	Renewable energies	Non renewable wastes	Electricity	Derived heat & grid bound thermal system	Total
Agriculture, forestry and fishing	0	703 358	404 473	428 138	0	230 193	0	1 766 162
Industry	94 179	396 677	1 175 728	612 368	64 492	1 457 681	427 232	4 228 356
Construction	1 307	166 603	49 903	43 261	0	64 103	3 920	329 096
Transport	0	2 875 433	46 957	593 713	0	372 656	0	3 888 760
Services	748	19 382	873 837	308 904	1 846	655 544	163 362	2 023 622
Residential	142 144	0	3 980 481	3 128 775	0	1 467 678	389 557	9 108 636
Total	**238 377**	**4 161 454**	**6 531 378**	**5 115 160**	**66 338**	**4 247 854**	**984 071**	**21 344 632**
Change compared to baseline (2016)	**-49,8%**	**-28,9%**	**-14,6%**	**59,5%**	**0,0%**	**11,7%**	**1,4%**	**-3,1%**

Table20: Regional final energy demand pattern by 2040

Shift in energy source up to 2040								
Estimation of regional energy CO2 emissions (t/a)	Solid fossil fuels	Crude oil and petroleum products	Gas	Renewable energies	Non renewable wastes	Electricity	Derived heat & grid bound thermal system	Total
Agriculture, forestry and fishing	0	166 888	74 276	5 660	0	31 455	0	278 278
Industry	30 223	94 121	215 906	8 096	19 523	199 185	0	567 054
Construction	419	39 530	9 164	572	0	8 759	0	58 445
Transport	0	682 262	8 623	7 849	0	50 922	0	749 655
Services	240	4 599	160 468	4 084	559	89 577	0	259 526
Residential	45 615	0	730 961	41 363	0	200 551	0	1 018 490
Total	**76 497**	**987 399**	**1 199 398**	**67 623**	**20 082**	**580 447**	**0**	**2 931 448**
Change compared to baseline (2016)	**-54,3%**	**-35,3%**	**-22,3%**	**45,0%**	**-9,1%**	**-51,3%**	**-**	**-34,9%**

Table21: Regional carbon emission by 2040

6.3.7 Sankey diagram

7. IMPLEMENTATION MONITORING AND KPIs

7.1 Evaluating body and evaluation periods

According to the plans the evaluating body will be the Climate Agency to be set up in the course of the implementation of the present Regional Energy Action Plan. One of the key tasks of the Climate Agency is the thorough monitoring and ex-ante and ex-post evaluation of green transition process in the SGP region.

Periodic evaluation of the evolving green transition process is anticipated to be completed on annual basis.

7.2 KPIs for impact monitoring

Main KPIs for impact monitoring are the following:

- general renewables consumption per capita (primary and final);
- renewables' share in electricity supply;
- renewables' share in final electricity consumption;
- renewables' share in final thermal consumption;
- share of electricity in transport;
- share of alternative fuels in transport;
- final energy consumption per sectors and energy carriers;
- average final energy consumption of households;
- final energy consumptions per GDP;
- carbon emissions and emission reductions;
- carbon emissions per capita;
- average carbon emissions per households;
- carbon emissions per electricity generation;
- regional energy generation, import, export;
- regional renewable energy generation pattern;
- public funds per capita used for energy efficiency investments;
- public funds per capita used for renewable investments;
- ratio of leveraging of public grants by private funding in energy efficiency investments;
- ratio of leveraging of public grants by private funding in renewable investments;
- number of Energy Communities.

8. ASSESSMENT OF SUITING BUSINESS MODELS AND FUNDING SCHEMES

8.1 Existing business models with regional relevance for low carbon energy supply and development potentials

Currently, the bulk of the incentives are provided in the form of grant with a delivery mechanism established at the national level. The final beneficiary can access funding via submission of applications to publicly announced specific calls.

Public grants are completed by preferential loans, targeted risk sharing mechanisms, ESCO/EPC financing and the by the Energy Efficiency Obligation Scheme, and the application of feed-in tariffs for renewable power generation.

8.2 Alternative business models and regional applicability

As discussed in the Conclusions Chapter, the carbon emission target set be the recent Fit for 55 Package is achievable by the Southern Great Plain Region by 2030. However, the decarbonization process seems to lose momentum in the period between 2030 and 2040. Therefore, the basis for a more radical participation of private sector resources needs to be created in order to fulfil the complete decarbonization by 2050.

8.3 Usable funding schemes: applicability and possible gaps to be filled

Discussed under Section 2.2.3 Key policy instruments.

9. CONCLUSIONS

9.1 Summary findings

In Hungary, regional energy and climate strategies or plans are at present not developed at regional level, nor have the regions dedicated budgets for structural reforms. Thus, the Southern Great Plain region to a large extent follows the national development trends, and on the other hand the energy and climate planning is performed at county or municipal levels.

The energy saving and renewable potentials are clearly identified in the course of preliminary investigations.

Energy efficiency - The building sector in the SGP region accounts for far the highest energy saving and greenhouse gas reduction potential, and further saving potentials are present in the business and transport sectors.

Renewables - The key renewable sources of the SGP Region include solar, geothermal, solid biofuel and agricultural residues-based biomass and biogas.

The REAP for the Southern Great Plain (SGP) region has identified the following priorities:

1. Horizontal measures of the REAP;
2. Creation of decentralized energy and climate programming, implementation and coordination structure - "Climate Agency";
3. Promotion of local and regional renewable energies;
4. Promotion of energy efficiency investments;
5. Strengthening the local R&D and innovation capacities.

The REAP identifies two scenarios, a short-term running up to 2030, and a medium-term scenario up to 2040.

2030 Short-term scenario

As the European funding plays a crucial role in the funding of low-carbon investments, the Short-term Scenario is identified to run until 2030, in order to encompass the 2021-2027 programming period and the following two years available for the implementation and disbursement of the committed funding before 2027. The present programming framework for the green economic transition including the Multiannual Financial Framework, the Recovery and Resilience Plan, and other relevant instruments of the NextGeneration EU as well as the several local financial instruments and support mechanisms, is overall clear and transparent, and it provides an appropriate technical and financial basis to make reliable projections up to 2030.

2040 Mid-term scenario

The Mid-term Scenario is closely linked to the extension of the Paks Nuclear Power Plant which will be realized between 2030 and 2040. The scenario builds on the assumption that in the course of the process of the phase-out of the old nuclear blocks and phase-in of new blocks the current contribution of the Power Plant to the electricity supply will be maintained at the present level. The Scenario does not take into consideration the major risk factors in the current REAP, namely

- the ongoing debate on the classification of the nuclear-based power generation will be concluded by a decision which identifies the electricity production from nuclear resources as an environmentally non-sustainable economic activity, and therefore, it cannot be aligned with EU taxonomy; and
- the temporal overlap in the operation of old and planned new nuclear reactors will be relatively short, and the transitional increase of nuclear energy in the electricity mix

will not exert adverse impacts on the further roll-out of renewable-based power investments.

Greening of SGP region

Based on the scenario modelling the primary energy consumption of the SGP region is not predicted to change until 2040, while the greenhouse gas emission compared to the base year of 2016, will be reduced by 28.3% and 34.5% by 2030 and 2040, respectively.

The carbon emission at national level was around 44.2 million tons in 2016, whilst the same indicator in 1990 totalled to 73,7 million tons. Referring to 1990 base year, the forecast by the current scenario assessment by 2030 and 2040 are 57% and 61%, respectively. That means that the SGP region as a region will be able to achieve along the Fit for 55 Package's target of 55% of carbon saving by 2030 with the available resources.

Reliance of energy import

The SGP region will remain highly reliant on the energy import. The self-sustainability of the region will only increase by some 2% by from the baseline 3% until 2040 (Figure 7).

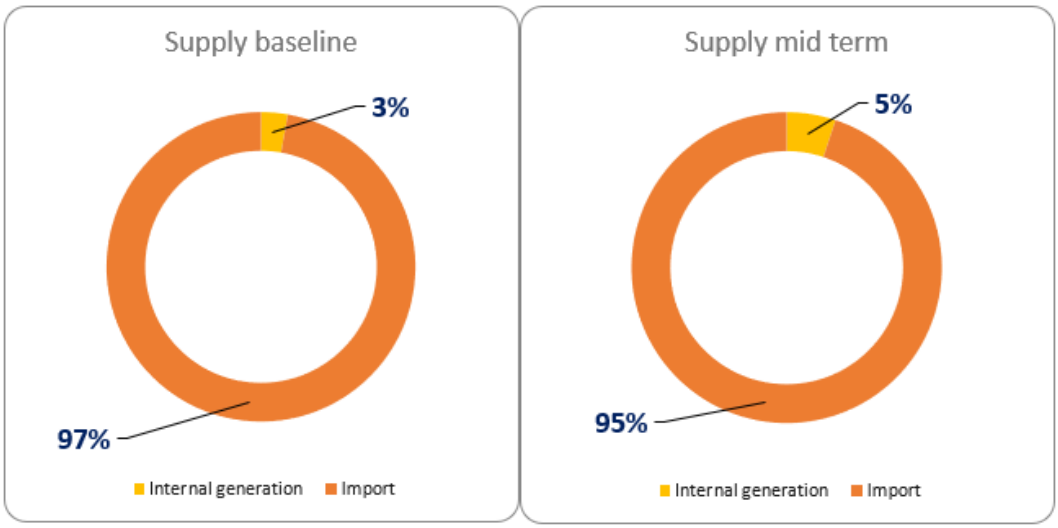

Figure 7: Internal energy generation and import dependency

9.2 Challenges for the regional authorities and stakeholders

The following key challenges were identified

- NUTS 2 regions in the present territorial hierarchy in Hungary are not regarded as an administrative level with elected decision-making bodies. Below the national level counties (NUTS 3 level) composing the regions have administrative function. Therefore, the suggested regional energy and climate planning process and the regional programming, implementation and coordination structure ("Climate Agency") can only be created for bottom-up by the strong political will and commitment of the local stakeholders. It is expected that the completion between regions and the clear socio-economic benefits of the green transition process will trigger the stronger internal cooperation.

- The financial resources available for the development of sustainable energy measures are mostly planned at national level, and therefore, do not they always reflect the specific regional needs, and the access to the funding may create imbalances between regions based on the level of preparedness.

- Between 2030 and 2040, the extension of the Paks Nuclear Power Plant may create uncertainties in terms of potential increase of the share of nuclear energy in the electricity supply. The increased supply of electricity due to the parallel operation of the old and new nuclear reactors and the price of the nuclear energy may exert unpredictable adverse impacts on the roll-out of renewable investments.

- With regard to the energy supply of Hungary, a crucial decision at European level will be how nuclear energy will be considered within the context of the EU taxonomy alignment.

- The region is highly reliant on energy export, and no notable change can be expected on a mid-term time horizon.

- Compared to the purchasing power of the citizens, the financial return on sustainable investments is generally too long to encourage people to invest into energy efficiency and building integrated renewable solutions.

9.3 Expected impact on regional economy

The green economic transition brings an added value to job creation and growth of the business sector, and it gives a strong impetus to the emerge of a new innovation portfolio.

New professions and study profiles will emerge, along the not fully foreseeable economic greening process. The costs of technologies are expected to constantly decrease, which will make the access to sustainable energy solution affordable to majority of the society.

The energy system is expected to undergo a major transition towards decentralized energy production and access. This process positively contributes to the region cohesion and cooperation networks.

The improved quality of life and the ensuring the sustainability of the natural environment will contribute to the reduction of the health care costs.

9.4 Gaps to fill for proper implementation (technical, regulatory, financial)

The main challenge from the perspective of the implementation of the present Regional Energy Action Plan is to strengthen the cooperation amongst the key stakeholders of the region, and the willingness to mobilize internal resources to create on a voluntary basis the planned institution and capacity building measures as early as possible.