



“Position of the Slovenian Academy of Engineering on the development of the Slovenian energy sector until 2030, with a view until 2050”

The Slovenian Academy of Engineering (IAS) has found that Slovenia is in urgent need of a clear, sustainable, and development-oriented energy vision and strategy. It has formed a working group to prepare IAS positions on the development of the Slovenian energy sector. It has included its members and other experts in individual fields of energy in the working group. Within the scope of theme evenings and expert discussions, experts have demonstrated a great deal of professionalism. The exchange of opinions from different points of view has led to well-deliberated and long-term positions, opinions, and proposals, which is why IAS has expressed its willingness to see IAS members and other involved energy experts also participate in the working groups of the Government or the competent ministry in order to prepare strategic documents for the energy sector, such as the Slovenian Energy Concept (SEC) or other strategic documents.

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Summary of IAS positions on the development of the Slovenian energy sector as an aid to the development of SEC

The energy sector, as a very important activity in any economy, is at an important turning point. Political and economic conditions that affect large fluctuations in energy product prices and the reliability of energy supply have changed. Due to a new distribution of benefits as a result of political disputes and tensions, supply will face increased risks. Furthermore, the sector is largely related to urgent changes in new technologies that will reduce negative effects on climate change and, at the same time, provide a lower level of the EU and Slovenia's dependence on the import of raw materials from other regions (in crisis).

Under such political and economic conditions in the world and Europe as well, the self-supply of energy, clean water, and healthy food has become a great challenge for Slovenia and Europe as well. At the same time, it represents a great opportunity and chance to develop new technologies and gain a competitive edge, which is why Slovenia needs to act swiftly, coherently, and efficiently with focus on results.

Economic and social conditions in Slovenia have encouraged the Slovenian Academy of Engineering to draw up its positions relating to the development of the energy sector in Slovenia until 2030, with a view to 2050. A prolonged in-depth discussion of the Academy members and other experts in energy has led us to adopt the following *positions* (summed up):

- 1. The primary criterion for the development of the Slovenian energy sector for the period until 2050 needs to be conceived anew by taking into account the most important aspects as follows (see Chapter 3.1):**
 - the long-term nature and welfare of all inhabitants of Slovenia (independence from the current governments);
 - sustainability, economy, efficiency, and balance of interests;
 - simplicity of procedures and transparency;
 - expertise – involvement of experts and coherence between government departments and civil society;
 - identification of clear, achievable strategic goals and coherence between the competence and responsibility to realise the energy concept;
 - code of ethics, expertise, responsibility of governance, and control over energy projects and energy companies.

- 2. Slovenia needs to formulate a comprehensive economic development policy covering the development of all key components affecting the competitiveness of the economy and, hence, social prosperity (see Chapter 3.2). These are:**
 - technology supply by the economy;
 - energy supply;
 - other capacities and infrastructure;
 - supply and financial strength of domestic equity.

- 3. To put such a development policy into action, it is vital to set, monitor, and achieve the following goals (see Chapter 3.2.1):**
 - development of domestic technologies and innovations;
 - increase in added value;

- creation of quality jobs;
 - establishment of modern public-private partnerships in development (Triple Helix);
 - development of domestic equity with strategic ownership attributes.
- 4. Investments in infrastructure (including the energy sector) must be considered as a part of the societal development model (see Chapter 3.2.2):**
- infrastructural projects should be considered both as investments in advanced infrastructure as well as reference projects of domestic technology providers in line with such definition of the economic development policy.
- 5. Strategic goals and individual actions/investments should be planned and evaluated on two levels (see Chapter 3.3):**
- a) according to selected criteria for the development of the energy sector within the scope of the Slovenian development strategy, which together create a criterion-referenced environment for decisions guiding the development of the energy sector and investments;
 - b) according to the goals of individual aspects of energy sector planning, i.e. sources, efficiency and the intended use of energy.
- Goals under individual planning aspects are placed and are subordinate to criteria for the development of the energy sector within the scope of the Slovenian development strategy.
- 6. Regulators of the energy sector should be renewed by taking into account the aspects of (see Chapter 3.4):**
- tax policy;
 - provision of financing sources and expertise in decision-making;
 - an initiative with long-term effects focused on the development of products, systems, and technologies, demonstration projects and an active role of all stakeholders;
 - maintaining the status of an equal partner (sovereignty) in international relations.
- 7. It is required to develop a methodology for identifying criteria for the development of the energy sector, set the criteria as an overall criterion-referenced environment for planning, monitoring, and decision-making while directing the development of the energy sector (the preparation of the Slovenian Energy Concept) and for making decisions on specific actions and investments, and define the method for evaluating the fulfilment of criteria (see Chapter 4):**
- each criterion should specify goals within the scope of the implementation of the development strategy for the energy sector in a certain period of time, e.g. for a period until 2020, 2030, 2050 and with finer target granulation on the basis of action plans;
 - to establish a system for determining parameter values, structuring goals in targets and monitoring the fulfilment of criteria, it is required to perform suitable analyses and identify methodologies (for the purposes of reinforcement, this is occasionally repeated under individual criteria).
- 8. In criteria where goals are set based on natural resources (potential for the exploitation of sources) or by comparison to alternative technologies, the principle of economy of an action is applied based on the net volume or net effect: the total volume or effect is decreased by collateral damage (in the environment) that is caused by the execution of the measure. Measures or the scope of measures are broken down to three groups (see Chapter 4.1.2):**
- the scope of measures causing zero to small damage to the environment;
 - the scope of measures causing small to medium damage to the environment;

- the scope of measures causing medium to great damage to the environment.

9. We propose the following criteria which, together, form a criterion-referenced environment (see Chapter 4.2):

- criterion of the synergy of investments infrastructure in domestic technology supply (4.2.1);
- criterion of the source of financing investments (4.2.2);
- criterion of the ratio between classic sources and renewable sources (4.2.3);
- criterion of the ratio between concentrated renewable sources and diffuse renewable sources (4.2.4);
- criterion of efficient energy use against energy consumption per unit of produced GDP (4.2.5);
- criterion of the ratio between greenhouse gases and greenhouse gas targets (4.2.6);
- criterion of the ratio between domestic sources and energy import (4.2.7);
- criterion of the interest of Slovenian inhabitants in natural resources, state ownership against privatisation of resources and public infrastructure (4.2.8).

10. To apply the criteria when planning and assessing investment decisions, it is required to:

- define the relative weight of individual criteria and the permitted deviations from goals within the scope of the energy development policy;
- introduce the monitoring and evaluation of the fulfilment of criteria and use it when planning investments.

11. Slovenia is not rich in conventional energy sources, such as oil and natural gas; however, there is still plenty of coal (Velenje, Lendava – Petišovci). Home stocks of conventional sources should, therefore, be exploited fully and pursuant to the criteria of economy for the production of electrical or thermal energy (see Chapter 5.1).

12. Slovenia should increase its capacities in renewable energy sources (RES) by taking into account technically exploitable potential, economic viability and sustainable development (see Chapter 5.1).

13. We support further research for the development of technologies in chemical accumulation and hydrogen as an energy vector (see Chapter 5.1).

14. It is required to increase the energy efficiency of conversion, which is why strategic goals and responsibilities for their realisation should be defined at state level (see Chapter 5.2).

15. It is required to increase the share of local energy supply in the total energy supply, thus reducing a need to construct concentrated production units (classic and renewable sources) and transmit energy via the power grid. Therefore, the role of the consumer should be enhanced, placing the consumer as the smallest sub-system in the system of energy and natural resource supply by including demand-side management (DSM) in the Slovenian Energy concept with related (see Chapter 5.3):

- introduction of dynamic pricing in the balance sheet group based on automatic trading in energy by consumers;
- increase in the share of diffuse production of renewable energy sources;
- consumers' adaptation based on the integration of new technologies in energy and optimisation of processes in energy consumption, production and storage.

16. When building new energy capacities, it is required to ensure larger participation by domestic

industry, thus creating domestic added-value and accumulation for the development of the Slovenian economy and new jobs.

17. The energy sector, as one of the key sectors for the future development of Slovenia, should be regulated coherently within the scope of the climate and energy package by the intended use of energy in transport, industry, and buildings.

In view of all findings, we believe that Slovenia is in urgent need of a clear and accessible national energy policy and strategy or, rather, a new Slovenian Energy Concept (SEC), both due to changed conditions on global markets and an urgent re-boost of the Slovenian economy.

Positions of the Slovenian Academy of Engineering on the development of the Slovenian energy sector until 2030, with a view to 2050

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1 Introduction

Slovenia is in urgent need of a clear and accessible national energy policy and strategy or, rather, a new Slovenian Energy Concept (SEC), both due to changed conditions on global markets and an urgent re-boost of the Slovenian economy, which most certainly includes the energy sector as an important component of development in the coming period. Despite several documents, Slovenia has no clear and realistically defined strategy for the energy sector until 2030, with a view to 2050, nor an action plan to achieve binding goals within the scope of the EU. The applicable strategic documents (Green Paper for the National Energy Programme), 2009; Draft National Energy Programme, 2011) are in need of amendments or new consideration in respect of numerous changes on global markets in recent years and with respect to the fact that Slovenia fails to achieve some binding goals within the scope of EU energy (and environmental) policy. The key documents need systematic and comprehensive consideration with clearly defined goals of the state in energy supply and management, both in view of necessary measures (short-term by 2020, medium-term by 2030, and long-term by 2050) as well as their efficient implementation considering the protection of the general interest of Slovenian inhabitants in the energy sector and therewith related areas.

2 Bases for the preparation of IAS positions

2.1 Legal bases

The Energy Act, adopted by the National Assembly in February 2014, which provides the basis for the adoption of national strategic documents and is based on 10 European Directives.

Indicative goals of the EU (http://ec.europa.eu/clima/policies/2030/index_en.):

- at least 40% reduction of greenhouse gases (GHG) by 2030 with respect to 1990;
- improvement in efficient energy use by at least 27% until 2030;
- increasing the share of renewable energy sources to at least 27% until 2030;
- 80-95% total reduction of greenhouse gas emissions (transport, industry, households) until 2050 with respect to 1990;
- substantial improvement of energy efficiency will pose the key challenge for EU Member States. By transferring to a low carbon society until 2050, EU would spend 30% less energy than in 2005. The Energy Efficiency Directive (2012/27/EU) stipulates that each Member State is required to lay down an indicative national goal for increasing energy efficiency and, based on that, identify the absolute level of primary and final energy use in 2020;
- effects on the safety and health of inhabitants and employees.

2.2 Theme IAS evenings and IAS panel discussion

Four theme evenings were attended by energy experts and IAS members to review the current position of the energy sector in Slovenia and international guidelines. The topics were:

- the operations of the Euro-Case Energy Platform, perspective Slovenian energy providers, and trends and opportunities in technology;
- electricity production (coal, hydro power, nuclear power);
- natural gas, liquid fuel, biomass, photovoltaics as energy sources;
- the role of consumers in the entry of a larger share of renewable energy sources.

The panel discussion at the end of the project involving the development of the Positions, to which all IAS members and other participating experts were invited, presented the draft Positions, which were thoroughly discussed and supplemented based on the findings presented in the discussion.

2.3 Key challenges for the future of the Slovenian energy sector

- Safe and reliable supply;
- Competitiveness and accessibility;
- Contribution to decarbonise the society and transfer to a low carbon society (cycles, zero waste, renewable energy sources, efficiency of sources) – to define the energy mix + CCS (underground gasification, capture and storage of carbon – zero CO₂ emissions).

3 IAS positions on the national development model for the Slovenian energy sector

3.1 Primary criteria for the development of the energy sector, energy policy in Slovenia

3.1.1 The **Slovenian energy policy and strategy** should be **adequately revised** and defined in a manner **taking into account the long-term development of** Slovenia and the future of its citizens along with EU guidelines. The applicable documents related to the **Slovenian energy policy** follow the guidelines of EU energy policy and are coherent in basic principles and guidelines, but fail to express sufficient meaning for the development and welfare of Slovenia and its citizens.

Example: The strategic goal to reduce greenhouse gas emissions should be prioritised within the context of the development of green technologies of the Slovenian industry in order to increase added value and, secondarily, within the context of the European Development Policy.

3.1.2 As a priority, the Slovenian politics needs to protect, in the interest of inhabitants, all natural resources, public infrastructure and projects in energy constituting a vital component of the overall living environment of Slovenian inhabitants from privatisation or foreign ownership and possible abuses (see Criterion in point 4.9).

3.1.3 The **Slovenian Energy Concept** covers the key and long-term strategic goals: **economical (sustainable) exploitation of own sources, know-how, the minimum possible energy dependence on foreign sources, conversion and energy efficiency, development of domestic technologies and the balancing of** stable (major) energy systems with minor autonomous energy sources (photovoltaic stations, minor hydro power plants, biomass, waste, etc.).

3.1.4 **Initiatives** should be peer-reviewed and focused on **long-term effects** in order to contribute to the maximum extent possible to the achievement of common strategic goals, increase in added value, development of domestic industry and welfare of Slovenian citizens.

The example of initiatives in SE is not an example of good practice, since the development of PN technologies failed to achieve the goal and, furthermore, the initiatives were not premeditated enough.

3.1.5 Strategic documents and legal acts supporting the strategy should be **clear, simple and aligned** with one another. Subsequent amendments or supplements to the legislation are too frequent due to its lack of elaborateness, lack of coherence and the interests of day-to-day politics. Complications and a lack of coherence prolong (and increase the cost of) procedures and limit the implementation of projects for the development of the energy sector and infrastructure.

3.1.6 It is urgent to ensure that **government operations be coherent** with those of implementing bodies in order to make effective, cost-efficient or well-considered/economical decisions. **Inter-departmental expert teams** for the preparation of strategic documents, acts or statutory instruments should be rationally introduced. Members of expert teams should be appointed based on professional and not political merit. The state secretary at the ministry responsible for energy (Director-General of the Energy Directorate) should be an expert and not a political appointee. Their term of office should not depend on the change of minister, but on their expertise.

3.1.7 Public hearings and comments to strategic (energy) documents must be **coordinated on expert platforms with an economic/technological motive**, not a political one. Logrolling, bargaining between political parties and short-term local interests should be prevented.

3.1.8 The realisation of the energy policy and strategy is to be defined **with clear, realisable and measurable goals, implementation deadlines and personal commitment of those responsible for achieving results**. It is required to set measurable criteria on operational levels that will be a performance indicator for a particular action or fulfilment of personal commitments of those responsible for achieving strategic goals.

3.1.9 Systematicity must be ensured when setting goals, taking into account influence between sectors.

Example: How does railway modernisation affect reduced fuel consumption and CO₂ emissions in freight transit by road in Slovenia?

3.1.10 An effective and dynamic control system must be established with loopbacks (action-effect, deviation-correction) and regular monthly monitoring. Upon any deviations in the implementation of action plans, it is vital to ensure a faster response.

3.1.11 Action plans should be revised (defined anew) based on SEC, along with the key influential criteria to achieve strategic goals and measurable performance indicators as well as the persons responsible for the implementation. The current action plans for the energy sector are very fragmented and fail to define metrics for a particular action. If there are no clearly defined measurable criteria, it is no point to indicate such actions (example of the indication of the evaluation method for effects: "End-use energy savings are indirect and cannot be evaluated"). Furthermore, action plans have no formal basis in a strategic document (SEC), based on actions would be fewer or ranked by priority of attaining the maximum and fastest achievable effects.

3.1.12 Competent, responsible, and honest managers working efficiently, transparently, and with due care and diligence are to be appointed **for the management of energy companies** (and public services) owned predominantly by the state.

3.1.13 To establish a **transparent relationship of the representatives of the owner (the state) and energy company managements**, it is vital to draw up and publish a **code of ethics for governance** and **very clearly define measurable strategic goals in advance**, before each new business period or after it, or upon signing an employment contract with key managers. Reward schemes for managers and supervisors should be correlated with results (both in positive and negative terms). Contracts with managers should include a clause preventing managers to be entitled to a reward and severance pay if they failed to achieve adequate results or failed to act in line with the code of ethics.

3.1.14 Supervision over the efficiency of energy company governance (and of other public services) should be consistent and frequent enough to be carried out in view of the attainment of results with respect to the set goals, in view of expertise and economy of management, and in view of the honesty of administrations. Mechanisms must be established for immediate actions upon violations, based on personal liability of an individual or a group. The accountability of supervisors may only be entrusted to politically independent, highly ethical, and top experts.

3.2 Energy sector as a part of the entire economic development policy of Slovenia

The entire Slovenian economic development policy covers:

- the development of technology supply by the Slovenian economy;
- the development and provision of energy supply;
- the development of other capacities and infrastructure (healthcare, transport, and public infrastructure, etc.);
- the development and provision of supply and financial strength of domestic equity in the financing structure for the Slovenian economy. Therefore, the capital market should be renewed (state guarantee, indemnity for affected parties, promotion, mandatory share of investments in Slovenia). Equity cannot be replaced by crediting ("creditisim").

The development of technology supply by the Slovenian economy is related to and realised through a smart specialisation strategy that is based on sustainable development and domestic competences and capacities in the value chain.

3.2.1 Goals of the societal development model

The entire economic development policy is put into action by monitoring and balanced realisation of all goals of the societal development model below:

- development of domestic technologies and innovations;
- increase in added value;
- creation of quality jobs;
- establishment of modern public-private partnerships (PPP) between institutions of knowledge, the economy and the state (a triple helix which would provide the basis for evolution to a quadruple helix with private participants by applying the principles of development PPPs in our society) to introduce break-through technological innovations of the domestic economy on global markets;
- development of domestic equity with strategic ownership attributes, thus co-creating synergy between financial and technological business goals of companies as well as sufficient funding stability in technology development cycles.

3.2.2 Investments in infrastructure (including the energy sector) as part of the societal development model

In line with the definition of the economic development policy, Infrastructural projects are also considered as reference projects of domestic technology providers. Hence, two objectives have been set:

- investments in technologically advanced infrastructure;
- investments in the demonstration of developed solutions by domestic technology providers – establishment of (the first) reference for sale on international markets.

3.3 IAS positions to the strategic goals of the Slovenian energy sector

Strategic goals in energy are to be set based on the consideration and identification of the energy sector as a part of the entire Slovenian economic development policy.

Strategic goals and individual measures/investments should be planned and evaluated on two levels:

- **according to the criteria for the development of the energy sector within the scope of the Slovenian development strategy (Chapter 4),**
- hence, according to the criteria representing a criterion-referenced environment to direct the development of the energy sector and investments (these are presented in a separate chapter for the purposes of transparency);
- **according to the goals and individual energy planning aspects (chapter 5):**
 - according to domestic energy sources;
 - according to the (conversion and transmission) efficiency rate in energy use;
 - according to the intended use of energy.

For the purposes of transparency, these are presented in a separate chapter.

Goals by individual planning aspects are placed under and are subordinate to criteria for the development of the energy sector within the scope of the Slovenian development strategy.

3.4 IAS positions on the establishment or renewal of energy regulators

3.4.1 The country's **tax policy** in energy should **promote long-term goals** of the energy concept and not only the search for sources in order to fill the budget. Solutions for filling the budget should be sought in increasing the efficiency of the energy sector, reducing expenses for the import of primary sources, boosting the domestic economy, and opening new jobs through projects bringing new added value.

3.4.2 In short term, financial resources should be sought in **directing taxes and charges from the energy sector back** to energy projects and in financing by credits; however, **business plans must be well researched**, while implementation must be supervised by experts in terms of cost, quality, deadline, and a suitable period of return on investment.

3.4.3 It is vital that timely and preliminary **impact assessments, feasibility, and viability studies be provided for energy projects and project documents** from conceptual designs to as-built design. The planned implementation of projects following the strategic goals of the

energy sector must not be a victim of bureaucratic barriers of state officials or local communities. The study must decisively show the possible risks and answer responsibly to other circumstances (the content of the terms of reference is decisive), which is why it cannot be an end in itself.

3.4.4 It is vital to **promote and legally direct** to the production and use of **products/devices with high energy efficiency** (small specific uses) and smart solutions (timers, consumption or cost displays, remote on/off, etc.).

3.4.5 Dynamic business models should be **promoted and legally directed** through an active role of all stakeholders (producers, distributors, consumers) and the principles of self-sufficient systems, cascading use of sources, circular economy, and shorter logistical routes helping to the minimise energy consumption and the national GDP.

3.4.6 It is necessary to **promote the development of systems and technologies for grid management** and their reliability (smart grids, automation and control of management, impact of incidents).

3.4.7 It is vital to promote the development of technologies and the implementation of **demonstration projects** of the home industry which promote best technologies or **best practices** for efficient energy use in the long term or accumulation of energy in the running mode of operation.

3.4.8 It is **vital to promote changes in consumer habits** to increase the efficiency of energy and raw material sources.

3.4.9 In **international contracts** relating to connections with energy systems at EU level, it is vital to establish/maintain the status of an equal partner and, at the same time, make a risk assessment and scenarios for alternative solutions.

4 Methodology and criteria for the development of the energy sector within the scope of the Slovenian development strategy

4.1 Methodology for setting and evaluating criteria for planning, monitoring and decision-making

4.1.1 Methodology for setting criteria as a criterion-reference environment for planning, monitoring and decision-making

At level 1, the criteria for the development of the energy sector cover all aspects of the energy sector development within the scope of the Slovenian development strategy and create a criterion-referenced environment for decision-making while directing the development of the energy sector and for decision-making in specific investments.

Therefore, the criteria are set as key performance indicators (KPI), whereby:

- **each criterion specifies goals** within the scope of the implementation of the energy development strategy in a certain period of time, e.g. for a period until 2020, 2030,

2050 or with finer target granulation on the basis of action plans;

- the **planned attainment of values** of the entire set of criteria is used as a **criterion-referenced environment for decision-making** in the planned set of actions and specific investments.

When setting all criteria, it is better to (also) identify values in absolute amounts (units of quantity, energy, money) than (merely) a share (%) of the potential whole or target. When using absolute units (as well), the operability of a criterion increases substantially, as it allows simple addition or deduction at the level of individual investment actions.

In all criteria,

- i) the goals are set at state level for a certain period of time or its end;
- ii) goals are transformed to targets for time units within the scope of the target period (e.g. a year) and for individual segments and investments, whereby it is vital that structuring be carried out by vertically nested subsystems in the society (e.g. the industry, type of industry, type of production process) and by energy planning aspects (as suggested in Chapter 5);
- iii) aggregates for which publicly accessible databases are collected are also taken into account during structuring.

To establish a system for determining parameter values, structuring goals in targets and monitoring the fulfilment of criteria, it is required to perform suitable analyses and identify methodologies (for the purposes of reinforcement, this is occasionally repeated in individual criteria).

4.1.2 Method to quantify the goals for economical fulfilment of criteria

In criteria where goals are set based on natural resources (potentials for the exploitation of sources) or by comparison to alternative technologies, the principle of economy of an action is applied based on the net volume or net effect: the total volume or effect is decreased by collateral damage (in the environment) that is caused by the execution of the action. For the purposes of evaluation, actions or the scope of actions are broken down to three groups:

- the scope of actions causing zero to small damage to the environment;
- the scope of actions causing small to medium damage to the environment;
- the scope of action causing medium to great damage to the environment.

4.2 Criteria

4.2.1 Criterion of the synergy of investments in infrastructure and development of domestic technology supply

All investments in infrastructure shall be subject to the following:

- target/condition: at least 55% participation of home industry, at least 25% above the average GVA in the Slovenian economy (€50,000 of the average GVA);
- metrics and accountability for implementation (a part of the plan-do-check-act cycle);
- implementation of metrics: periodic monitoring and actions based on assigned personal liability.

4.2.2 Criterion of the source of financing investments:

- investments failing to meet the criteria laid down in point 4.2.1 can only be made upon investments of private capital (according to the ESCO model, concessions, etc., for a certain period of time) and are returned to the investor through operations.

4.2.3 Criterion of the ratio between classic and renewable sources

The goals are embedded in the European targets based on the Strategic Energy Technologies (SET) plan.

- It is required to set up coherent national medium-term and long-term targets (a cross-section of frames that lay down possibilities and national strategies).

The EU climate and energy target for 2020, in reference to 1990, is:

- 20% reduction of emissions;
- 20% increase in renewable energy consumption;
- 20% increase in energy efficiency.

The EU climate and energy targets for 2030, in reference to 1990, are:

- at least 40% reduction of greenhouse gas emissions;
- at least 27% share of energy consumption from renewable energy sources;
- at least 27% increase in energy efficiency (a cross-section of frames that lay down possibilities and national strategies).

4.2.4 Criterion of the ratio between concentrated and diffuse renewable sources

A comparison of concentrated and diffuse sources that is based on the following characteristics:

- concentrated sources require the remote transfer of large amounts of energy;
- diffuse sources reduce the need for the remote transfer of energy and increase local self-sufficiency.

The targets are based on *natural resources* and the evolution of a *participating role of the population* in efficient energy use and clean environment.

Natural resources are defined by:

- the available potential for hydro power plants and pump-fed hydro power plants with different scenarios with respect to collateral damage to the environment (3 scenarios: zero to small damage, small to medium damage, medium to great damage);
- the available potential for wind power stations (wind farms) with different scenarios with respect to collateral damage to the environment;
- the available potential for geothermal energy with different scenarios with respect to collateral damage;
- the available potential for biomass exploitation with different scenarios with respect to collateral damage;
- the available potential for solar irradiation with different scenarios with respect to collateral damage.

The active role of consumers in renewable energy sources/efficient energy use is expressed through:

- the available potential for diffuse PV units with different coverage scenarios;
- the available potential for other diffuse units of energy production (biomass co-generation by gasification or no gasification, hydrogen) with different scenarios.

Potentials need to be classified in both groups, i.e. diffuse sources and concentrated sources, which should be subject to relevant analyses and the establishment and maintenance of relevant databases.

4.2.5 Criterion of efficient energy use

The goals are embedded in the European targets based on the Strategic Energy Technologies (SET) plan.

- It is required to set up coherent national medium-term and long-term objectives in energy use for the target per capita GDP in a certain period, i.e. by 2020, 2030 and 2050 (forms: 100GJ per capita in \$20,000 of per capita GDP) (alternately: to lay down the coefficient of elasticity as a subordinate goal).
- Goals are set based on a comparison between the fulfilment of goals and criteria, and the average of selected European countries: Austria, Switzerland, Denmark, Sweden (a cross-section of frames that provide possibilities and lay down national strategies). Within the scope of monitoring the available database, the key and subordinate goals are structured by the intended use: industry, buildings, transport.

The planned efficient energy use indicator of an action/investment is evaluated and compared with the subordinate goal applicable at the time following the introduction of the action/investment. Therefore, it is vital perform suitable analyses and establish and keep suitable comparative databases. To use the criterion by individual segments and investments, it is also required to structure targets vertically by the subsystems in the country.

4.2.6 Criterion of carbon footprint (CO_{2e}) – GHG to GHG target ratio

The goals are embedded in the European targets based on the Strategic Energy Technologies (SET) plan.

- It is required to set national medium-term and long-term goals for periods up to 2020, 2030 and 2050 based on the agreements made within the scope of the EU (the targets take the following forms: tonnes of CO_{2e} per year) (alternately: the share of GHG reduction per year in percentage).
- Subordinate goals and targets are set for interim periods through interpolation.
- Within the scope of monitoring the available database, the key and subordinate goals are structured by the intended use of energy: industry, buildings, transport.

The planned carbon footprint of an action/investment is evaluated and compared to the target applicable at the time following the introduction of the action/investment.

The goal is set at state level for a particular year, while targets are set by vertically nested subsystems with respect to the structure of energy planning aspects (see Chapter 5). Specific structuring should also take into account the aggregate data collected in available databases.

4.2.7 Criterion of the ratio between domestic sources and energy import

The goals are based on the economical exploitation of domestic energy sources (biomass, coal,

water, natural gas, the Sun, geothermal energy, nuclear energy, etc.) in order to achieve the minimum possible energy dependence on foreign sources and a balance of stable (major) energy systems and minor autonomous energy sources (solar power stations, minor hydro power plants, etc.). The evaluation criteria in assessment are:

- natural resources within the scope of economical exploitation;
- competences and capacities for exploitation.

It is required to establish a basis for planning (methodology of viability and economy).

4.2.8 Criterion of the interest of Slovenian inhabitants in the ownership and management of natural resources and strategic public infrastructure, state/social ownership against the privatisation of sources and public infrastructure

Goals: As a priority, all natural resources and the public infrastructure constituting a vital component of the overall living environment of Slovenian inhabitants must be publicly owned (by the state/society).

These include:

- natural resources: air, water, minerals, wood, space (national park and nature reserve surfaces);
- strategic public infrastructure:
 - transport (ports, airports, railway, roads);
 - ICT and energy infrastructure, such as power, gas, thermal grids;
 - strategic energy units: units for concentrated energy exploitation and production that are based on the exploitation of domestic energy sources (the Sun, biomass, coal, water, natural gas, etc.).

Based on the above fundamental definition, it is required to:

- define the terms and conditions for the exploitation of natural resources and management of strategic public infrastructure;
- in units for concentrated exploitation and production that cannot be privatised;
- in units of diffuse production by consumer producers (prosumers), where the primary goal is exploitation for covering own needs, or minor production units, where privatisation is permitted;
- identify (make a list of) infrastructural investments in natural resources and strategic public infrastructure that cannot be privatised due to the interest of Slovenian inhabitants for a planning period (2020, 2030, and 2050), and identify those that can be put in the management of private entities for a certain period based on a concession (based on co-investments within the scope of PPP);
- all investments in public and private governance through a concession must have clearly defined terms and conditions of governance providing protection to the interest of Slovenian inhabitants, including the right of use and access.

The criterion of privatisation prohibition based on a specific list is to be considered as a criterion for exclusion.

All infrastructural investments in natural resources that cannot be privatised due to the interest of Slovenian inhabitants are also subject to the criterion of the synergy of investments (Criterion 4.2.1) and the criterion of investment sources (Criterion 4.2.2).

4.2.9 Evaluation of the fulfilment of criteria for the development of the energy sector and investment planning

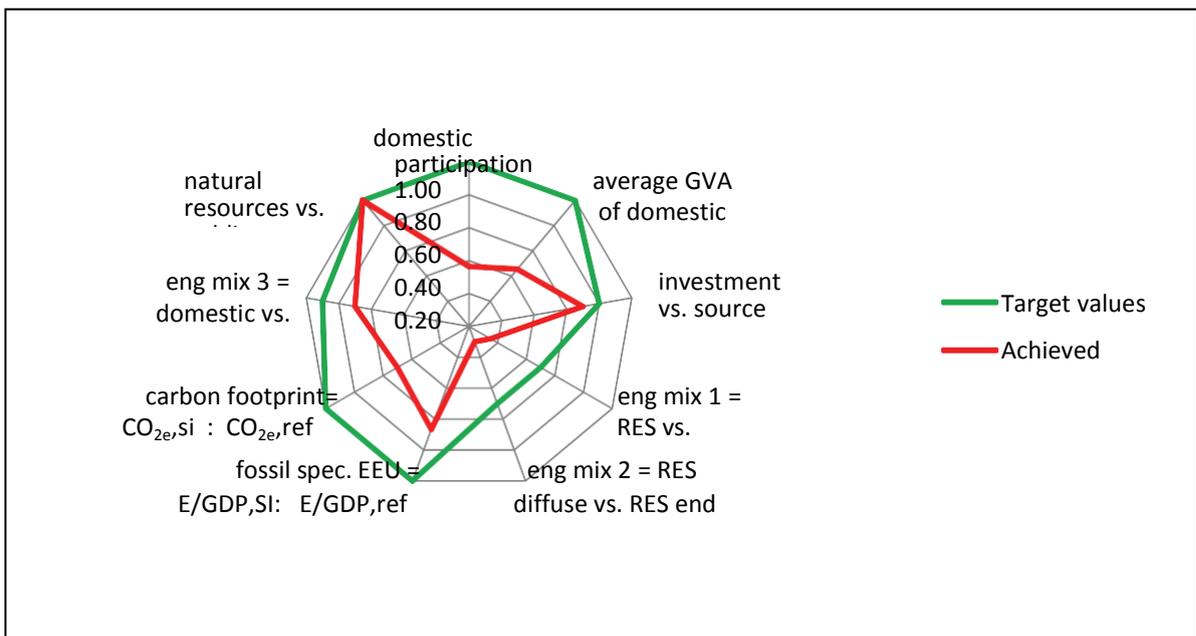
To apply the criteria when planning and assessing investment decisions, it is required to:

- define the relative weight of individual criteria and the permitted deviation from goals within the scope of the energy development policy;
- introduce the monitoring and evaluation of the fulfilment of criteria and use them when planning investments.

The table and chart below show the method of criteria application for the evaluation of the planned energy development, action package (e.g. within the scope of an action plan) or a specific investment.

The table defines the proposed criteria (8 in total) with the categories of quantification, notional amount of the objective or target and the notional achieved value of a planned policy, action, or investment.

The table also includes an auxiliary table in which values are converted to relative values for the purposes of demonstration in the chart.



Indicators for 2015

	units	goal	achieved
domestic participation	%	55	20
average GVA of domestic investment vs. source of financing = public vs. eng mix 1 = RES vs. fossil	€	55,000	25,000
eng mix 1 = RES vs. fossil	share of value (%)	0.8	0.7
eng mix 1 = RES diffuse vs. RES end	GJ or %	50%	15%
specif. EEU = E/GDP, si: E/GDP, ref.	GJ or %	50%	10%
carbon footprint = CO _{2e} , si: CO _{2e} , ref.	GJ per capita, € per capita	100	150
eng mix 3 = domestic vs. import	tonnes per year or reductions)	1	0.5
natural resources vs. public ownership vs. ESCO/concession	GJ or %	90%	70%
	€ or % from the list	1	1

Note In principle, all "absolute" indicators should be in absolute amounts and not merely shares (%).

Relative indicators for 2015

	type of objective	objecti	achieved
domestic participation	unambiguous	1.00	0.36
average GVA of domestic investment vs. source of financing = public vs. eng mix 1 = RES vs. fossil	unambiguous	1.00	0.45
eng mix 1 = RES vs. fossil	alternative (or-or)	0.80	0.70
eng mix 2 = RES diffuse vs. RES end	alternative (or-or)	0.50	0.15
specif. EEU = E/GDP, si: E/GDP, ref.	alternative (or-or)	0.50	0.10
carbon footprint = CO _{2e} , si: CO _{2e} , ref.	unambiguous	1.00	0.67
eng mix 3 = domestic vs. import	unambiguous	1.00	0.50
nat. resources vs. public ownership vs. ESCO/concession	alternative (or-or)	0.90	0.70
	unambiguous	1.00	1.00

Note In criteria with alternative goals, the target values of a criterion are set at a relative target value (e.g. 0.7), while in other (unambiguous) they are set at 1 (100%).

Key

E/GDP.... Per capita energy use/generated per capita GDP

ESCO ... (energy service company), an international expression for a company preparing energy solutions, including design engineering, implementation and operation of energy efficiency projects, along with energy production and supply, as a service based on an innovative financing scheme; one of the TPF (Third Party Financing) forms

CO_{2e} – greenhouse gas emissions in the atmosphere in CO₂ tonne equivalents per year

In the fictional example indicated in the table and chart (the radar diagram), the planned action fully or almost fully meets only two of the eight criteria, two criteria are met by approximately two thirds, and four criteria by much less. It is common sense that such an example cannot be part of the energy policy or, rather, such an investment cannot be supported within the scope of this policy.

5 IAS positions by energy planning aspect

The **Academy** held four theme evenings, where Academy members cooperated with experts in individual energy fields in Slovenia. All four theme evenings were aimed at reviewing the current position of the energy sector in Slovenia. Also reviewed was the position of the energy sector and current policies in Europe.

While reviewing the current position of the energy sector in Slovenia, the following general conclusions were reached:

- The Slovenian energy dependence continues to be high exceeding 47.6% without nuclear fuel (2012) and reaching almost 71% (61%, if only half of Krško Nuclear Power Plant is taken into account) with nuclear fuel.
- In 2012, the cost of fuel import in Slovenia amounted to €2.6 billion or **7.56% of GDP or 12.3% of total import**.
- Slovenia has undertaken a number of international obligations by law, including three the most important ones: reduction of energy use by 9% until 2020 and more until 2030, the share of RES in TPES amounting to 25% until 2020 and probably between 27 and 30% until 2030, and the reduction of GHG emissions by 8% until 2016 and then probably by up to 30% in 2030.
- The Declaration on the active role of Slovenia in the development of a new global policy to climate change (Official Gazette of the Republic of Slovenia, No. 95/2009) and the Slovenian exit strategy.

With this Declaration, the National Assembly labelled the climate change policy as a priority policy in November 2009 and ordered the Government of the Republic of Slovenia to define the transfer to a low-carbon society and a society of sustainable development as the central development goal of Slovenia in the 2020 Strategy.

Furthermore, operative goals for the 2030 National Energy Programme, in reference to 2008, were adopted:

- 20% improvement in efficient energy use by 2020 and 27% improvement by 2030;
- 25% share of renewable energy sources (RES) in gross final consumption of energy until 2020 and 30% share until 2030;
- 9,5% reduction of greenhouse gas emissions from fuel combustion, 21% until 2020, and an additional 18% reduction by 2030;
- 29% reduction of energy intensity by 2020 and 46% reduction by 2030;
- 100% share of almost "zero energy buildings" among new and renovated buildings until 2020 and, in public sector, until 2018;
- 45% import dependence to be reduced by 2030, while sources of energy supply are to be diversified at the same or better level than the current;
- further improvements to the international energy connections of Slovenia for enhanced diversification of energy sources, supply routes, and suppliers, and further integration with the neighbouring energy markets.

Based on the commitments already adopted and with respect to the extensive discussions held, IAS defined three aspects for planning and implementing energy policy actions:

- energy policy by energy source (domestic);
 - conventional and non-conventional energy sources,
 - renewable energy sources;
- energy policy by conversion rate in energy use;

- energy policy by energy use.

6 Summary of IAS positions on the development of the Slovenian energy sector until 2030, with a view to 2050

Under tightened political and economic conditions in the world and Europe, the self-supply of energy, clean water and healthy food has become a great challenge for Europe and especially Slovenia. At the same time, it represents a great opportunity to develop new technologies and gain a competitive edge, which is why Slovenia needs to act swiftly, coherently and efficiently.

In 2012, Slovenia produced 11,888GWh and, in 2013, 12,367GWh of electricity, while using 12,480GWh in 2012 and 13,498GWh in 2013. The produced amount of energy takes into account only half of the electricity produced by the Nuclear Power Plant (which totals at 5,023GWh). Compared to 2012, production in 2013 increased by 4%, while consumption increased by 8.16%, although several plants and medium-size companies were closed down in 2013.

The Slovenian energy dependence continues to be high exceeding 47.6% without nuclear fuel (2012) and reaching almost 71% (61% if only half of the Krško Nuclear Power Plant is taken into account) with nuclear fuel. In 2012, the cost of fuel import in Slovenia amounted to €2.6 billion or **7.56% of GDP or 12.3% of total import**. The major payload in fuel import is the import of oil and gas.

The final consumption of energy in Slovenia amounts to just under 82kWh/d per capita, not taking into account conversion losses exceeding 28% of the total consumption.

The mentioned data in the context of political and economic conditions in the world have encouraged the Slovenian Academy of Engineering to produce its positions relating to the development of the Slovenian energy sector until 2030, with a view to 2050. A prolonged in-depth discussion of the Academy members and other experts in energy has led us to the following conclusions:

1. Presently, Slovenia invests its hard-earned accumulation in the construction of new capacities for electricity production, whereby it fails to ensure that most of that accumulation be spent on supply by domestic producers and suppliers. Our accumulation flows into other countries.
2. The current energy policy fails to take sufficient account of the Slovenian economic development. This is why it is vital that the future Slovenian Energy Concept be developed on a preliminary realistic development concept for the economy.

3. To this end, we prepared the IAS Positions as an aid to prepare the national development model for the Slovenian energy sector. The Positions comprise several chapters. Chapter 3 defines:
 - **14 primary criteria for the development of the energy sector and energy policy in Slovenia (point 3.1);**
 - **the energy sector as part of the entire economic development policy of Slovenia; to formulate the objectives of the development model for the society and define investments in infrastructure (and the energy sector) as part of the development model for the society (point 3.2);**
 - **IAS positions on the strategic goals of the Slovenian energy sector as part of the entire economic development policy of Slovenia** and with the method of 2-level nested planning and evaluation of strategic goals and individual actions, i.e. according to the criteria for the development of the energy sector and according to the goals under individual energy planning aspects (point 3.3);
 - **9 IAS positions on the establishment or renewal of energy regulators (point 3.4).**
4. Point 4 in the chapter defines the methodology for setting criteria for the development of the energy sector and identifies 8 criteria as an overall criterion-referenced environment for planning, monitoring and decision-making while directing the development of the energy sector (the preparation of the Slovenian Energy Concept) and for making decisions on specific actions and investments, and further defines the evaluation method for the fulfilment of the criteria.
5. After reviewing the existing state of the Slovenian energy sector and energy sources and based on the objectives already adopted by the Government and National Assembly, point 5 in the chapter also provides our position on:
 - the energy policy by energy source: conventional and non-conventional sources and renewable sources. Some typical data for each energy source have been provided and a position on further use of that source has been adopted;
 - energy policy by conversion rate in use and
 - energy policy by energy use.

In light of all findings, we believe that Slovenia is in urgent need of a clear and accessible national energy policy and strategy or, rather, a new Slovenian Energy Concept (SEC), both due to changed conditions on global markets as well as an urgent re-boost of the Slovenian economy which no doubt includes the energy sector as an important component of development in the coming period.

Ljubljana, 6 July 2015

Note:

The Positions were considered and adopted by the IAS Executive Committee at its regular session dated 9 June 2015. IAS members discussed the Positions and adopted them at a panel discussion held on 30 June 2015.