Biomass production and energy utilisation of biomass in Slovakia

Dr. Milan Oravec
Dr. Marián Slamka

Moscow, October 2013
Two facts are determining for the vision of development in Slovakia:

• Due to a special openness of its economy, Slovakia is existentially dependent on export, and so on the economic demand from countries to which it can lead its export,

• Slovak economy is greatly penetrated by the foreign capital and in the future it will be heavily dependent on the foreign investments.
The main objectives:

• Developing of knowledge economy in order to increase the added value of the goods and services realized on foreign and domestic markets.

• Diversification of economy structure, which is currently, focused on the engineering, metallurgical and chemical industry.

• Reducing of international economy disparities by means of support of infrastructure building for financial flow and development of economic activities (agriculture, forestry, including biomass production).

• Improving of the environment including economically effective and ecologically sustainable utilization of domestic resources.
Production and use of biomass have following positive effects:

From the view of production:

- Improving the competitiveness of agriculture by the alternative land management not necessary to secure the food self-sufficiency of the state,

- Development of the economic activities in rural areas, production of fuel wood biomass on unused agricultural and other lands,

- Improving the competitiveness in forestry by sustainable increase of wood biomass production in form of fuel chips, also with a goal to improve the state of forest ecosystems (hygiene, stability, production potential),

- Improving the effectiveness of biomass use, as a waste or by-product in wood processing industry, food industry, municipal and other sectors,

- Development of the economic activities related to biomass production (technology, services etc.)
Production and use of biomass have following positive effects:

From the view of energy production:

• Increasing of energy self-sufficiency of the state and substitution of fossil fuel with biomass,

• Stabilization of energy production costs and increasing of energy supply security,

• Improving of trade balance due to the reduction of necessity to import energy and fuels,

• Reduction of emission production, especially greenhouse gases developed during production of energy from fossil fuels and their transportation.
CONCLUSIONS

- To utilize renewable resources in a sustainable way with emphasis on synergic effects, especially in support of employment, to increase the local and regional energy security and reduce of energy import.

- To foster the objective of agriculture in a process of economic, environmental and social utilization of landscape agricultural potential, in its protection and maintenance of nature resources and cultural values of landscape and also in the production of other public goods; to increase contribution of agriculture to the development of rural viability and economy.

- To guarantee the sustainable management of forests, based on the utilization of economic, environmental and social functions for society development, and mainly in rural areas; to increase effectiveness of protective and defensive measures in forest stands endangered by the damaging factors and to foster ecological forest management.
**Implementation of forest biomass**

**Annual quantities of used fuel wood biomass from forest land**

<table>
<thead>
<tr>
<th>Year</th>
<th>2010</th>
<th>2015</th>
<th>2020</th>
<th>2025</th>
<th>2050</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indicator (thousand tons)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fuel wood</td>
<td>720</td>
<td>735</td>
<td>742</td>
<td>750</td>
<td>700</td>
</tr>
<tr>
<td>Fuel chips</td>
<td>450</td>
<td>903</td>
<td>1551</td>
<td>2002</td>
<td>2250</td>
</tr>
<tr>
<td>Totally</td>
<td>1170</td>
<td>1638</td>
<td>2293</td>
<td>2752</td>
<td>2950</td>
</tr>
</tbody>
</table>

**Annual quantities of the utilized fuel wood biomass from white areas**

<table>
<thead>
<tr>
<th>Year</th>
<th>2010</th>
<th>2015</th>
<th>2020</th>
<th>2025</th>
<th>2050</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indicator (thousand ton)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fuel wood</td>
<td>18</td>
<td>59</td>
<td>87</td>
<td>118</td>
<td>125</td>
</tr>
<tr>
<td>Fuel chips</td>
<td>32</td>
<td>106</td>
<td>191</td>
<td>228</td>
<td>249</td>
</tr>
<tr>
<td>Totally</td>
<td>50</td>
<td>165</td>
<td>278</td>
<td>346</td>
<td>374</td>
</tr>
</tbody>
</table>
### Implementation of forest biomass

#### Usable potential and wood biomass consumption in WPI

<table>
<thead>
<tr>
<th>Indicator</th>
<th>2006</th>
<th>2010</th>
<th>2015</th>
<th>2020</th>
<th>2025</th>
<th>2050</th>
</tr>
</thead>
<tbody>
<tr>
<td>Waste after the mechanical processing</td>
<td>1300</td>
<td>1365</td>
<td>1415</td>
<td>1490</td>
<td>1540</td>
<td>1710</td>
</tr>
<tr>
<td>Liquid waste</td>
<td>450</td>
<td>470</td>
<td>485</td>
<td>505</td>
<td>520</td>
<td>560</td>
</tr>
<tr>
<td>Totally</td>
<td>1750</td>
<td>1835</td>
<td>1900</td>
<td>1995</td>
<td>2060</td>
<td>2260</td>
</tr>
</tbody>
</table>
## Implementation of forest biomass

*Energy value of the predicted annual consumption of the wood biomass in SR*

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Indicator</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Forest land</td>
<td>7,3</td>
<td>11,1</td>
<td>14,6</td>
<td>21,7</td>
<td>26,2</td>
<td>28,1</td>
</tr>
<tr>
<td>Non forest land – white areas and line plantings</td>
<td>0</td>
<td>0,5</td>
<td>1,8</td>
<td>2,7</td>
<td>3,5</td>
<td>3,7</td>
</tr>
<tr>
<td>Intensive stands at the agriculture land</td>
<td>0</td>
<td>0</td>
<td>0,2</td>
<td>1,4</td>
<td>4,3</td>
<td>12,4</td>
</tr>
<tr>
<td>Totally agriculture branch</td>
<td>7,3</td>
<td>11,6</td>
<td>16,6</td>
<td>25,8</td>
<td>34,0</td>
<td>44,2</td>
</tr>
<tr>
<td>Totally WPI</td>
<td>21,0</td>
<td>22,0</td>
<td>22,8</td>
<td>23,9</td>
<td>24,7</td>
<td>27,1</td>
</tr>
<tr>
<td>Totally</td>
<td>28,3</td>
<td>33,6</td>
<td>39,4</td>
<td>49,7</td>
<td>58,7</td>
<td>71,3</td>
</tr>
</tbody>
</table>
WHOLE SUPPLY CHAIN

Share of renewable energy sources (RES) in sector of heat, electricity, transport and total gross consumption

Projection of energy production from renewable energy sources
Projection of heat production from renewable energy sources

Summary of overall national goals from share of RES on gross final consumption of energy for 2005 and 2020

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Share of renewable energy on gross final energy production in 2005 (S2005) (v %)</td>
<td>6,7</td>
</tr>
<tr>
<td>Total value of renewable energy on gross final energy production in 2020 (S2020) (v %)</td>
<td>14,0</td>
</tr>
<tr>
<td>Estimated total adjusted energy consumption in 2020</td>
<td>11 226</td>
</tr>
<tr>
<td>Estimated volume of renewable energy equivalent to goal for 2020</td>
<td>1 572</td>
</tr>
</tbody>
</table>
### Summary of all policies and measures

<table>
<thead>
<tr>
<th>No</th>
<th>Title and reference of measure</th>
<th>Type of measure</th>
<th>Estimated result</th>
<th>Target group and/or activity</th>
<th>Existing (E) or planned (P)</th>
<th>Beginning and the end of measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Obligatory addition of bio-components into motor fuels</td>
<td>financial, regulative</td>
<td>Increased use of renewable energy resources in transport</td>
<td>Producers of engine fuels</td>
<td>E</td>
<td>2006 →</td>
</tr>
<tr>
<td>2.</td>
<td>Promotion of use of renewable energy resources in business sector</td>
<td>financial</td>
<td>Production of electricity and heat from renewable energy resources</td>
<td>Investors</td>
<td>E</td>
<td>2007-2013</td>
</tr>
<tr>
<td>3.</td>
<td>Promotion of use of renewable energy resources in households</td>
<td>financial</td>
<td>1. Installation of boilers for biomass 2. Installation of solar panels</td>
<td>Households</td>
<td>E</td>
<td>2009-2015</td>
</tr>
<tr>
<td>5.</td>
<td>Guarantee of obligatory purchase of bio-methane</td>
<td>legislative, regulative</td>
<td>Production of bio-methane of 60 ktoe</td>
<td>Utilization of agricultural biomass</td>
<td>P</td>
<td>2011 →</td>
</tr>
<tr>
<td>6.</td>
<td>Promotion of production of fast-growing wood species</td>
<td>legislative, regulative</td>
<td>Increase of biomass offer</td>
<td>Agricultural enterprises</td>
<td>P</td>
<td>2011 →</td>
</tr>
<tr>
<td>7.</td>
<td>Production growth of wood raw material</td>
<td>legislative, regulative</td>
<td>Increase of biomass offer</td>
<td>Forest enterprises</td>
<td>P</td>
<td>2011 →</td>
</tr>
<tr>
<td>8.</td>
<td>Obligatory use of renewable energy resources in restored buildings</td>
<td>regulative</td>
<td>Heat production</td>
<td>Project engineers</td>
<td>P</td>
<td>2012 →</td>
</tr>
<tr>
<td>9.</td>
<td>Promotion of renewable energy resources for heating and cooling in public buildings</td>
<td>financial</td>
<td>Production of heat and cold in public buildings</td>
<td>Public administration</td>
<td>P</td>
<td>2014-2020</td>
</tr>
</tbody>
</table>
Other important regional objectives

- It will also be necessary to modify the legislation, which currently limits a potential biomass production on unused agricultural land. Part of this land is already covered with forest stand.

- According to above-mentioned facts, forestry will develop a requirement to partially modify forest management system and to found the intensive stands of fast-growing plants with rotation period of 10 to 20 years in appropriate nature conditions.

- Growth in production of fuel biomass in forestry deals with the necessity to solve the impact on the supply of other consumers, particularly pulp and paper industry.

- In the energy sector, there will be a need to solve the entire system of relations including the deployment of energy resources for production of heat, electricity, and logistics of supply and storage of biomass, energy supply to public networks, diversification of biomass and other fuels utilization and use of waste generated during the power production.
Strategic Researches needed for achieving Regional objectives

Strategic researches for wider implementation of forest biomass

Main trends of forest research related to biomass production:

• The impact of climate change on the development of wood structure and production possibilities of forest stands,

• Production and non-production forest functions and enhancement of biodiversity in forest ecosystems,

• Optimization of rotation periods of major economic forests in order to increase timber production and its qualitative structure,

• Procedures for forest stands tending in order to increase the quantitative and qualitative timber production, to improve stability and forest health condition by reaching economic efficiency through a complex processing of wood biomass,

• Intensification of wood biomass production in intensive stands of fast-growing wood species including energy forest stands on forest and non-forest land,

• Economically efficient and environmentally beneficial technologies of felling and complex processing of wood biomass,
Strategic Researches needed for achieving Regional objectives

Strategic researches for wider implementation of forest biomass

Main trends of forest research related to biomass production:

- Optimization of forest roads accessibility and biomass transport logistics,
- Impact of intensive demand for biomass on balance of soil nutrients and fertilization options,
- Preservation of carbon in forest ecosystems in terms of production growth and utilization of forest biomass,
- Storage of biomass in order to improve its energy features,
- Impact of growth in wood biomass production on landscape environmental stability, employment in comparison with alternative solutions,
Main trends of agricultural research related to biomass production:

- Optimizing the utilization of cultivated agricultural land in terms of providing food security and alternative production,
- Impact of climate change on the production capabilities of agricultural land and possibilities of its utilization,
- Impact of alternative agricultural land use on landscape environmental stability and performance of production and non-production functions,
- Possibilities of production of individual types of energy and other industrial crops depending on the natural conditions,
- Economically efficient technology of establishment of forest stands and collection of energy industrial crops, their processing and storage,
Strategic Researches needed for achieving Regional objectives

Strategic researches for wider implementation of agricultural biomass

Main trends of agricultural research related to biomass production:

- Logistics of agricultural biomass,
- Impact of the intensive production of new types of plants on balance of soil nutrients and the possibilities of fertilization,
- Optimize profits and costs in terms of production and utilization of agricultural crops,
- Development of new innovative products from agricultural biomass,
Strategic Researches for achieving whole supply chain

- Technology of modification of physical and chemical biomass properties in terms of their further utilization,

- Optimization of the deployment areas of consumption of biomass (boilers, heating plants, power plants, etc.) in terms of present and prospective resources,

- Biogas production technologies consequently producing electricity and heat,

- Distribution of biogas technology,

- Technology for production of second-generation biofuels from plant biomass,

- Technology for production of biofuels from wood biomass,
Strategic Researches for achieving whole supply chain

*Technology for combustion and gasification of biomass with the aim of energy efficiency and reduction of emissions,*

*Technology for production of electricity, heating and cooling from biomass and energy supplies into distribution networks,*

*Procedures of waste utilization after energetic utilization of biomass,*

*The impact of fuel and energy production from biomass on the environment,*

*Reducing the production cost of fuels and energy from biomass, in compliance with the required environmental parameters.*
Other important Strategic Researches for achieving Regional objectives related to sustainable and multi-functional use of biomass

- Impact of alternative biomass production and utilization for regional development (employment, related economic activities and production activities, land use, etc.)

- Development of technologies required for other utilization of biomass (chemistry, pharmaceutical industry, building industry, etc.)

- Development of machinery necessary for the management of wood and plant biomass stands including its felling and consequent methods of treatment and utilization,

- Breeding of the new clones of wood and plant biomass suitable for various methods of utilization,
**SWOT ANALYSIS**

**Strengths**

- High forest cover of the region combined with increasing growing stock. High quality of harvested timber.

- Large potential for the production of fuel biomass on forest and non-forest land covered by tree vegetation able to provide for up to 8% of domestic consumption of primary energy sources and up to 30% of regional heat consumption.

- The well-established network of public roads and railways suitable for timber transport in the region and outside region.

- Significantly high level of centralised heat production (over 50% of the total production), particularly in cities and mid-sized towns. Regional availability of research capacities in the area of biomass production and its energy use (NFC in particular). Heavy dependence on imports of fossil fuels, particularly gas and coal. Existing regional sources of coal merely cover 2% of the consumption.
SWOT ANALYSIS

Weaknesses

• Financial constraints limiting wider use of advanced felling technologies. Large percentage of incidental felling due to wind throw and bark beetle outbreaks. Timber producers and wood-processing entities lacking financial assets.

• Lack of forest density networks, particularly in mountainous areas of the region.

• Lack of cooperation and information exchange between forestry sector and wood processors and lack of influence of the competent national and regional institutions (Ministry of Agriculture and regional governments) in this area.

• Lack of funding available for investments into wood biomass technology.
Weaknesses

Small and medium wood-processing enterprises are struggling and lack resources for innovations. Larger facilities with foreign investors lack interest in innovations supported by local research.

Extensive area of protected sites limiting exploitation of local timber resource. Legislative obstructions limiting timber production on non-forest land.

Strong influence of lobby supporting consumption of fossil fuels and nuclear energy.
SWOT ANALYSIS

Opportunities

- Fuel wood biomass in the region in terms of its potential possibilities is the most important renewable energy source that can cover a significant portion of energy consumption, in particular heat and partly electric energy.

- Improving of forest management efficiency on forest land (forest tending, reduction of rotation periods, complex technology of wood processing and forest access, review of the scope of protected areas, etc.) will lead to increase of the usable potential of fuel wood biomass and improvement of forestry economic situation.

- Production of fuel wood biomass and other wood assortments will be expanded due to use of uncultivated agricultural and other land with the positive economic, environmental and social effects.

- Preconditions for development and stabilization of the wood processing industry in and outside the region will be created due to increase of timber production, optimizing the production of individual assortments, including fuel wood biomass.
SWOT ANALYSIS

Opportunities

- Replacing fossil fuels in the region, especially gas by fuel wood biomass can significantly reduce the import costs of these fuels and greenhouse gas emissions.

- Development of production and processing, respectively use of wood including fuel wood biomass is the most important factor of sustainable rural development in the region.

- Support of R&D activities and utilization of the results is one of the conditions for development in this area.

- Development of a viable strategy for production and use of fuel wood biomass, including a complex system of support measures to facilitate the optimizing and sustainability of the development and related activities within the region.
SWOT ANALYSIS

Threats

- Lack of interest of concerned ministries in development of viable strategy of production development and use of fuel wood biomass, or other renewable energy sources implemented in the individual regions.

- Persisting or aggravating situation in the field of biomass promotion and production.

- Lack of support and use of R&D results in the area of strategy, production development and wood use, including fuel wood biomass, expert counseling and information activities.

- Lack of funding aimed at implementation of development activities in forestry, agriculture, pulp and paper industry, power industry and other related sectors.
Strategies, activities, measures in JAP

Primary objective of the strategy

- To increase production of biomass produced from the tree-tops and tree trunks in a sustainable way, whose quality do not correspond with the requirement for other use options and other wastes following the timber felling and handling in forestry on forest land. To optimize the waste utilization following the mechanical biomass processing and to use raw material for energy purposes, of quality that do not correspond with the requirement for other use options or the use is not economically profitable. To create or stimulate the creation of the network of energy producers in the region, with heat production or heat and electricity production and related consumption of fuel wood biomass that do not corresponds to its available sources in terms of supply.

- To develop a strategy of production and energy use of fuel wood biomass to be able to implement in the region including the balance of current and prospective opportunities of production and consumption of this fuel with the evaluation of economic, ecological and social impacts of its implementation comprising also the need for supporting measures.
Partial objectives of the strategy in forestry, wood processing industry and energy.

Activity 1: Enhancement of the production potential of fuel wood biomass in forestry.
Type of activity: Applied research, knowledge transfer, continuous evaluation of market trends.
- Type of strategy: WO/SO
- Priority: High
Strategies, activities, measures in JAP

Partial objectives of the strategy in forestry, wood processing industry and energy.

- **Activity 2** Development of the production potential of fuel wood biomass on non-forest and other land.
- **Type of activity:** Applied research, knowledge transfer, adjustment of legislation.
- **Type of strategy:** WO
- **Priority:** High
Strategies, activities, measures in JAP

Partial objectives of the strategy in forestry, wood processing industry and energy.

- Activity 3  Optimization the utilization of wood waste from wood processing industry
- Type of activity: Knowledge transfer, technology transfer, evaluation of market trend, applied research.
- Type of strategy: WO/SO
- Priority: High
Strategies, activities, measures in JAP

Partial objectives of the strategy in forestry, wood processing industry and energy.

- **Activity 4**  Development and optimization of energy use of fuel wood biomass
- **Type of activity:**  Applied research, knowledge transfer, technology transfer, energy policy.
- **Type of strategy:**  WO/SO
- **Priority:**  High