

INFORSE-Europe Sustainable Energy Seminar
August 21-24, 2017
Nordic Folkecenter for Renewable Energy, Denmark

INFORSE-EUROPE
International Network for Sustainable Energy

Transition Towards Sustainable Energy – Denmark
by Jasmina Said; August 21, 2017
EKO-svest



See the Program and the Proceedings at: http://www.inforse.org/europe/seminar_17_DK.htm



Transition of Macedonia to Renewable Energy

(ENERGY SCENARIO FOR MACEDONIA 2050)

Jasmina Said, Eko-svest, Macedonia

21 August 2017

INFORSE- Europe Sustainable Energy Seminar, August 21-26, 2017



I – INTRODUCTION

- 1) Current situation in Macedonia
- 2) The aim of the national energy scenario
- 3) Based on SEE 2050 carbon calculator and experts opinions
(link: <http://www.see2050carboncalculator.net/?lang=mk>)
- 4) Short description of the SEE 2050 carbon calculator :
 - a) models a range of physical and technical potentials in 10 different sectors and 45 different parameters for each country
 - b) based on collected scientific and engineering data
 - c) capacity to explore a large variety of scenarios



I – Introduction

d) 4 levels for each sector:

- ▶ Level 1: implies a minimum effort on this choice.
- ▶ Level 2: implies a moderate effort, viewed as ambitious but reasonable according to most experts
- ▶ Level 3: implies significant efforts, financial investments or significant technology progress, which requires a significant change from the current system
- ▶ Level 4: implies upper end of what is thought to be physically plausible by the most optimistic observers

2010 is baseline year, and the predictions are made for 2050.

II – ELECTRICITY SUPPLY

1. Onshore wind (4th level)

1) 100% of technically feasible potential will be installed by 2050

Year	Installed capacity	Production feasible
2010	0	0
2050	1.25 GWh	3.63 TWh

2) **Policies** for more intensive stimulation of wind:

- feed-in tariffs in the beginning; stimulating individual households on electricity production from wind turbines
- aggressive awareness raising campaigns must be carried out in order to enable the shift from the mindset that fossil fuels are the only option for Macedonia



II – ELECTRICITY SUPPLY

2. Hydro energy

a) HPPs large (2nd level)

- Our views on HPPs construction
- Plants by 2050: Old capacities will be modernized as necessary; new ones are limited

Year	Installed capacity	Production feasible
2010	0.098 GWh	2.18 TWh
2050	0.628 GWh	1.76 TWh

*2010 year is specific year regarding hydrology

II – ELECTRICITY SUPPLY

2. Hydro energy

b) HPPs small (3rd level)

Year	Installed capacity	Production feasible
2010	0.06 GWh	0.24 TWh
2050	0.11 GWh	0.44 TWh

Policies:

- stricter policies for sustainability of hydro energy should be introduced and legislation for protection of environment must be strictly respected and prioritized
- strategic environmental assessment of national plan for small hydro power plants must be done and regularly updated
- awareness raising on importance of ecosystem services, sustainability, nature protection, water quality, aquaculture must be done
- funding for fields of research enabling scientific calculation and valuation of ecosystem services and valuation of electricity produced from HPPs installed

II – ELECTRICITY SUPPLY

3. Solar (>4th level)

Based on the 3rd level of SEE 2050 carbon calculator + production from solar fields placed on the southern part of Macedonia

Year	Installed capacity	Production feasible
2010	0	0
2050	3Gwh +3GWh	4.4 TWh+4.4 TWh

Policies:

- Introducing intensive roof panels stimulation both by government and municipalities, as well as through banks (introducing credit lines with low interest rates for both PV and hot water production)
- stimulating decentralized energy production both financially and with public campaigns for promotion
- reducing or exempting VAT for PV
- eligibility for lower electricity price for households which use very little electricity and/or use solar panels
- introducing ladder-cost energy prices to reduce energy intensity in homes



II – ELECTRICITY SUPPLY

4. Biofuels (3rd level)

- Domestic production of biogas is 7% of the total biofuels production (0.16 TWh in 2050)
- Biofuels domestic production and biofuels imports are only used for transport

Year	Production feasible
2010	2.31 TWh
2050	3.79 TWh (10% or 0.379 TWh-import+3,41 TWh domestic product.)



II – ELECTRICITY SUPPLY

5. Biomass (1st level)

- 30% of airpollution comes from firewood
- Available waste biomass (pallets from forestry&agriculture)

Policies:

- Moratorium on using firewood for household heating in cities with district heating (keeping use of firewood at the level of 2010 in cities that do not have district heating available)
- Introducing aggressive policies for use of waste biomass pellets for household heating (from forestry and agricultural waste).
- Increase of air pollution and efficiency standards for biomass use, to comply with coming EU standards. This can cut emissions substantially and increase efficiency so less wood is needed for each house.

II – ELECTRICITY SUPPLY

6. Coal (3rd level)

- Existing plants are closed when they are 50 years old; no facilities are foreseen until 2050, nor in the future

- Additional retrofits on existing plants to meet IED (Industrial Emissions Directive)

Year	Installed capacity	Production feasible
2010	0.75 GWh	4 TWh
2050	0 GWh	0 domestic prod.; 5% import

Policies:

- no coal production of any kind will be done until 2050, nor after that
- aggressive policies for just transition of mining regions will be put in place (timely reeducation/requalification of workers from TPPs to begin working in other fields- “green sector”)
- planning and interventions in the education system with vision for

III – ELECTRICITY DEMAND

1. Transport (3rd level)

a) Domestic passenger transport

-Travel demand per person by 2050, compared to 2010

Average transport demand per person	+ by 95%
Occupation level of cars	+ by 19%
Occupation levels of buses and trains	+ by 35%

-Transport mode in 2050 compared to 2010

The usage of public transport instead of cars	for 55% of our travel
Non-motorized transport- walking and biking for short distance journeys	increases moderately

III – ELECTRICITY DEMAND

1. Transport (3rd level)

a) Domestic passenger transport

-Modal shift in 2050 compared to 2010

Share of walking and cycling	+ to 8%
Share of bus/coaches	+ to 47%
Share of rail	+ to 8%
Share of cars	- to 37%

-Energy efficiency in 2050 compared to 2010

Fuel combustion efficiency of cars	+by 35%
Plug-in hybrids efficiency	+by 45-50%
Electric cars efficiency	+by 50%

III – ELECTRICITY DEMAND

1. Transport (3rd level)

a) Domestic passenger transport

-Energy efficiency in 2050 compared to 2010

Fuel combustion efficiency of buses	+by 21%
Hybrid and electric buses efficiency	+by 25%
Rail transport's efficiency	+by 23% for diesel +by 20% for electric traction

-Technology mix/electrification (transport system electrification 2050)

Plug-in hybrids	25% of the cars 70% of the buses
Battery electric	50% of the cars 30% of buses

III – ELECTRICITY DEMAND

1. Transport (3rd level)

b) Domestic freight transport (3rd level)

-Demand for freight transport in 2050 compared to 2010

Transported freight volumes	+ by 50%
-----------------------------	----------

-Modal shift in 2050 compared to 2010

Truck's share	- from 91.4% to 77.5%
Rail's share	+from 8.6% to 22.5%
Inland waterways' share	0%

-Energy efficiency in 2050

Efficiency of fuel combustion trucks	+ by 17%
Efficiency of diesel trains	+ by 23%
Efficiency of electric trains	+ by 20%



III – ELECTRICITY DEMAND

1. Transport (3rd level)

b) Domestic freight transport (3rd level)

-Technology mix/electrification in 2050

Diesel (hybrid) trucks	70%
CNG (hybrid) trucks	25%
Electric trucks	5%
Diesel trains	0%
Electric trains	100%

III – ELECTRICITY DEMAND

1. Transport (3rd level)

c) Total energy demand for transport (domestic passenger+domestic freight)

Year	Energy demand for transport (domestic passenger+domestic freight)
2010	5.31 TWh
2050	3.79 TWh



III – ELECTRICITY DEMAND

1. Transport (3rd level)

Policies:

- Aggressive campaign for decision-makers to stimulate the shift of mindset towards alternative ways of transport and towards electrification of transport
- Significant stimulation of electric and hybrid vehicles to reduce dependence on imported oil and oil derivatives, as well as reduce air pollution caused by transport. Introducing policies to stimulate the use of electric trains, buses and taxis.
- Improving the public transport in Skopje and outside Skopje in order to use significantly more public transport trips. Stimulating initiatives for joint travel (carpooling) and biking. Appropriate adjustment of the street infrastructure and enabling biking



III – ELECTRICITY DEMAND

1. Transport (3rd level)

Policies

- Ongoing awareness raising campaigns for stimulating alternative transport, particularly walking and biking
- Introducing policies to make rail freight transport more competitive and efficient than truck freight transport
- Campaign for transport companies to help with the shift to other ways of transport



III – ELECTRICITY DEMAND

2. Home efficiency (3 Level)

Home efficiency (domestic heating and hot water; domestic lighting, appliances and cooking; public and commercial heating and cooling; public and commercial lighting, appliances and catering).

- No. of households in 2010 was 543426, in 2050 it will be 669817; no.of new flats in 2050 will be 39043; no.of new dwellings in 2050- 117128
- More of 2/3 of our homes have additional insulation in 2050
- More than half of heat is supplied by heat pumps (heat pumps are considered the best option for individual houses)
- Gasification is not modelled in this scenario, as this would only lead to further dependency on fossil fuels
- In the cities priority is given to district heating and new innovative technology and energy efficient measures
- Domestic and public innovative heating technologies with efficient use of electricity will cover a large share of heat demand (ex. air source heat pumps, ground-source heat pumps and other new technologies that are going to appear on the market until 2050)

III – ELECTRICITY DEMAND

2. Home efficiency (3 Level)

a) Domestic heating and hot water in 2050

Share of flats in new housing stock	+25-40%
-------------------------------------	---------

-House heating and cooling

Average internal temperature of heated area in households	- 1°C (from 21 to 20 °C)
Hot water demand per household	constant (1450KWh per household)
Cooling demand	constant (25% of households use cooling)



III – ELECTRICITY DEMAND

2. Home efficiency (3 Level)

a) Domestic heating and hot water in 2050

- **Electrification level in 2050**

Heat pumps	75% of the installed heating devices in the housing stock
------------	---

- **Innovative heating technology in 2050**

Innovative technologies*	cover a large share of heat demand
--------------------------	------------------------------------

* ex. air source heat pumps, ground-source heat pumps and other new technologies that are going to appear on the market until 2050

III – ELECTRICITY DEMAND

2. Home efficiency (3 Level)

b) Domestic lighting, appliances and cooking

-Demand/efficiency in 2050

Total demand of energy for lighting	- of 50-80% (with EE&new techn)
Electricity demand from white appliances	+from 20 to 50% (with increased penetration of white appliances with EE measures)
Electricity demand from black appliances *	between doubles and triples

-Electrification in 2050

Share of electric home cooking	between 90% and 100%
--------------------------------	----------------------

*computers, TVs..



III – ELECTRICITY DEMAND

2. Home efficiency (3 Level)

c) Public and commercial heating and cooling

-Public and commercial heating and cooling in 2050

Energy demand *	+ between 2.1% -2.8% p.a. between 2010 and 2050
-----------------	--

-Efficiency in 2050

Heating demand*	between 30% efficiency improvement compared to the level of 2010 and reduction of 90% of heat demand compared to the level of 2010
Cooling demand	+ between 15%-65%

*energy demand is driven by added value of the service sector



III – ELECTRICITY DEMAND

2. Home efficiency (3 Level)

c) Public and commercial heating and cooling

-Electrification level in 2050

Heat pumps	represent 75% of the installed heating devices in the stock
------------	---

-Innovative heating technology in 2050

Innovative technologies	cover a large share of heat demand
-------------------------	------------------------------------

III – ELECTRICITY DEMAND

2. Home efficiency (3 Level)

d) Public and commercial lighting, appliances & catering

-Demand/efficiency in 2050

Office lighting demand per added value	- between 40-70% by 2050 (ex. the increased use of LEDs and use of motion detective lighting)
--	---

-Electrification: Commercial cooking: 100% will use electricity

Year	Energy demand for domestic & public lighting, appliances & cooking with EE measures
2010	2.42 TWh
2050	3.18 TWh

Year	Energy demand for domestic and public & commercial heating and cooling with EE measures
2010	6.45 TWh
2050	3.68 TWh



III – ELECTRICITY DEMAND

2. Home efficiency (3 Level)

Policies for home efficiency:

- Energy Efficiency Fund established
- Municipal funds for energy efficiency that will be adapted to the climate conditions and the needs of each municipality
- Raising human and financial capacities of the municipalities to support the energy efficiency of households
- Establishing municipal commissions for energy efficiency that will gather and disseminate information on energy efficiency, will follow the conditions and needs of households in their municipality and will propose appropriate policies and financial instruments for improving the EE & RES representation.



III – ELECTRICITY DEMAND

2. Home efficiency (3 Level)

Policies for home efficiency:

- Aggressive campaign for promoting energy efficiency benefits
- Stimulation of the use of energy efficient technologies – LED bulbs need to be stimulated at the expense of tungsten (wolfram) lights by loading the price of the latter with additional inefficiency and pollution levies
- Stimulating purchase of energy efficient appliances through providing favorable loans for such devices and denying loans for purchase of household appliances with energy label less than A.
- Introducing a gradual pricing system for electricity – the more you spend – the higher the price you pay per kW/h.



III – ELECTRICITY DEMAND

2. Home efficiency (3 Level)

Policies for home heating and cooling:

- Introducing subsidies for heat pumps to incentivize population to use heat pumps. Currently the only heat pumps used are air-to air heat pumps because they are cheaper, but for other types of heat pumps, incentives that are more substantial will be necessary, as they are much more expensive
- Campaign to promote benefits of reduction of home temperature. Medical professionals to be included in campaign

Policies for public and commercial efficiency, heating and cooling:

- Campaign for businesses to raise awareness about generated savings by introducing energy efficiency measures
- Fund for energy efficiency to provide also for improving energy efficiency for public buildings



III – ELECTRICITY DEMAND

3. Industry (3rd level)

Year	Energy demand from industry
2010	6.27 TWh
2050	5.78 TWh

Greenhouse gas emissions reduction will be within +/- 10% of the 80% reduction goal in 2050, or the emissions in 2050 will be 23% compared to emissions in 2010.

IV- ENERGY BALANCE

Energy supply/production in TWh	2010	2014	2050
Onshore wind	0	0.07	3.63
Hydro PP large	2.18	0.96	1.76
Hydro PP small	0.24	0.24	0.44
Solar	0	0.01	8.8
Coal	4	3.5	0.2
Electricity imports	1.6	3.07	0
Biofuels	2.31	1.97	3.79
Crude oil&oil products	10.92	10.33	0
Natural gas	1.15	1.29	0.5
Total energy supply	22.4	21.44	19.12

IV- ENERGY BALANCE

Energy demand in TWh	2010	2014	2050
Domestic passenger transport and domestic freight transport	5.31	6.2	3.79
Domestic and public lighting, appliances and cooking	2.42	7.9	3.18
Domestic and public&commercial heating and cooling	6.45		3.68
Industry	6.27	6	5.78
Total energy demand	20.45	20.1	16.43