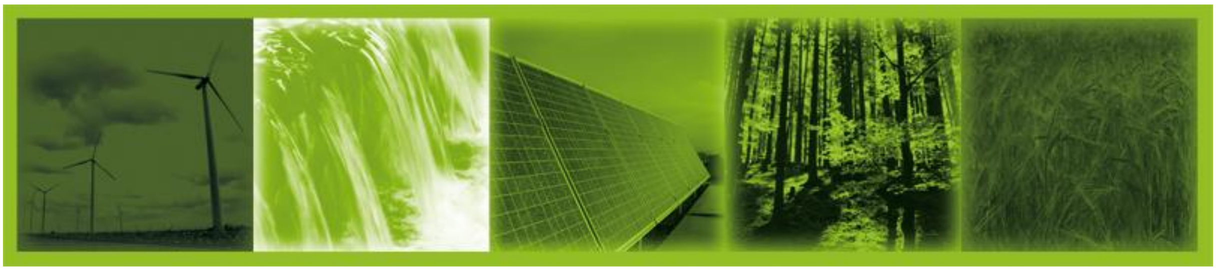
REPAP 2020

Renewable Energy Policy Action Paving the Way towards 2020



# *Renewable Energy Industry Roadmap for Latvia*

-Draft -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Intelligent Energy Europe

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## 1.1 Current situation of renewable energies

### 1.1.1 Background

The Latvian energy supply is characterized by strong dependence on energy imports and the highest share of renewable energy in the whole European Union, with about one third in overall energy consumption.

Imported energy sources account for roughly two thirds of Latvia's total energy consumption. Except for peat, which can be found in approximately 10% of its soil, Latvia has no fossil resources for energy production worth mentioning. Natural gas, oil products and coal are all provided by mainly Russian imports.

Renewable energy sources however, are substantial. Forests cover approximately half of Latvia's territory, making biomass the largest domestic resource currently used in heat generation. Hydropower is already the biggest contributor to electricity generation and still has unused potential. Wind power gained importance in recent years and has good potential as wind is plentiful. This is particularly the case along the coast where, in addition, the transmission network is particularly developed.[1]

Latvia can satisfy about 70% of its electricity demand domestically mainly with CHP-plants, wind turbines and hydroelectric facilities. The latter two are subject to natural variations in water and wind availability. Therefore, large shares of imported electricity are needed. Many of these imports came from the Lithuanian nuclear power plant Ignalina, which was shut down in 2009. This situation creates further challenges for the Latvian electricity supply sector and represents a real opportunity for the exploitation of renewable energy sources within the country.

For 2010, the EU-Directive 2001/77/EC sets a target of 49.3% of gross electricity consumption to be of renewable sources. 5.75% biofuel-use is demanded by the Directive 2003/30/EC in the same period.

The target for renewable energy as a share of the final consumption is 40% until 2020 according to the EU-Directive 2009/28/EC on the promotion of the use of energy from renewable sources. The same directive demands a minimum of 10% of renewable energy in transport.

National commitments include biofuel targets of 10% by 2016 and 15% by 2020, 8% of electricity produced in biomass-run CHP-plants, as well as the above mentioned 49.3% target for 2010 segmented into different generation technologies.[2]

[2] EREC (2009), pag.3

[2] EREC (2009), pag.3

The Ministry of Economics supervises the energy sector in Latvia together with two further regulatory bodies.

The Public Utilities Commission defines tariffs and competition rules, issues licenses and arranges out-of-court dispute settlements, while the State Energy Inspectorate controls all technical aspects.[3]

A further important market actor is Latvenergo. Although the electricity market has been fully liberalized in 2007, the state owned company has a dominating market position in electricity generation, transportation and distribution, and is also engaged in district heating.[4]

### 1.1.2 Current status of renewable energies

**Electricity:**

Electricity generation from renewable sources (RES-E) is dominated by three large-scale hydropower plants contributing around a third of Latvia's electricity generation, which varies strongly along with the natural water supplies. Increase in these large-scale hydroelectric capacities though, was marginal since 1990.[5]

However, other forms of renewable power profited from a unique feed-in tariff, granting twice the average electricity price for a period of 8 years after grid-connection. This tariff was valid until 2003 and effectively promoted small-scale hydro as well as wind power and biogas, as depicted in **Figure 1-2**.[6]

The feed-in tariff was then replaced by a quota system, with predefined capacity levels that had to be installed. Those capacity levels were determined by the Cabinet of Ministers. But as this quota system could not achieve favourable results, it again was replaced by a tariff system in 2007.

In 2007, small-scale hydropower plants reached 68 GWh and 25 MW while in biogas, 38 GWh and 7 MW could be reached. Near Latvia's shores, 5 wind parks with a total of 26 MW generated 53 GWh. Biomass, mainly used in CHP-plants, reached a generation of 5 GWh of electricity with a total capacity of 3 $MW_{el}$.[7]

Due to low potentials, geothermal and solar thermal sources are neither supported, nor used in Latvia.

The following figures show how electricity generation developed since 1990.

[3] REEEP (2009), pag.3

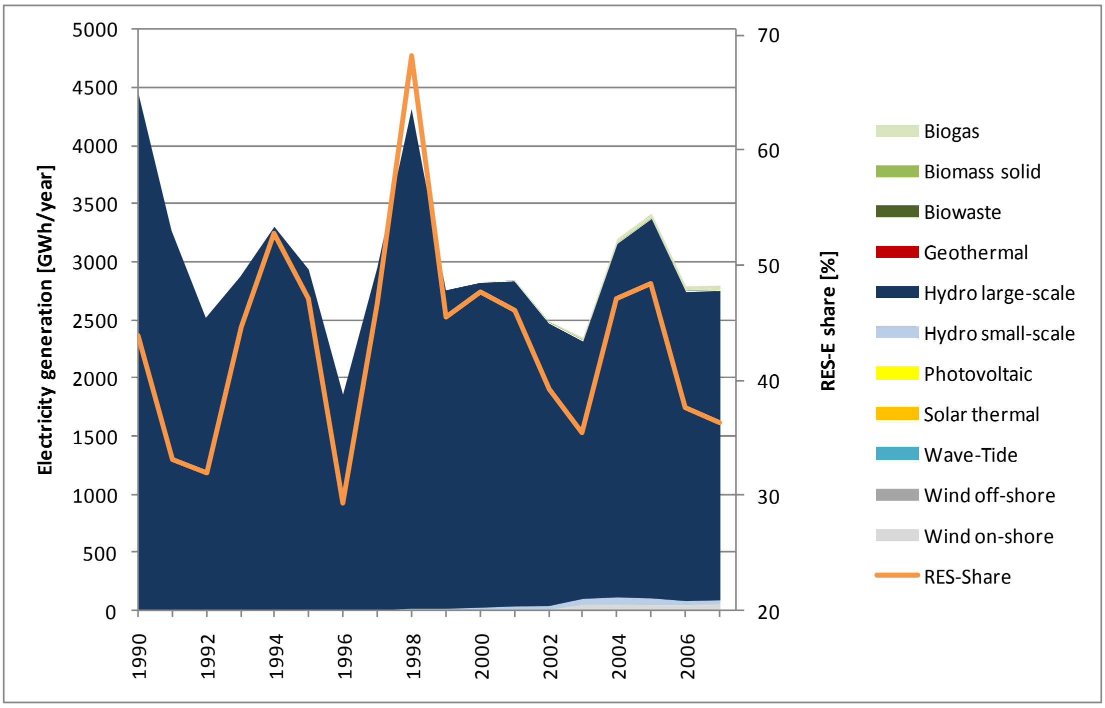
[4] Austrian Energy Agency (2009a)

[5] REEEP (2009), pag.1

[6] EREC (2009), pag.4

[7] Eurostat (2009)

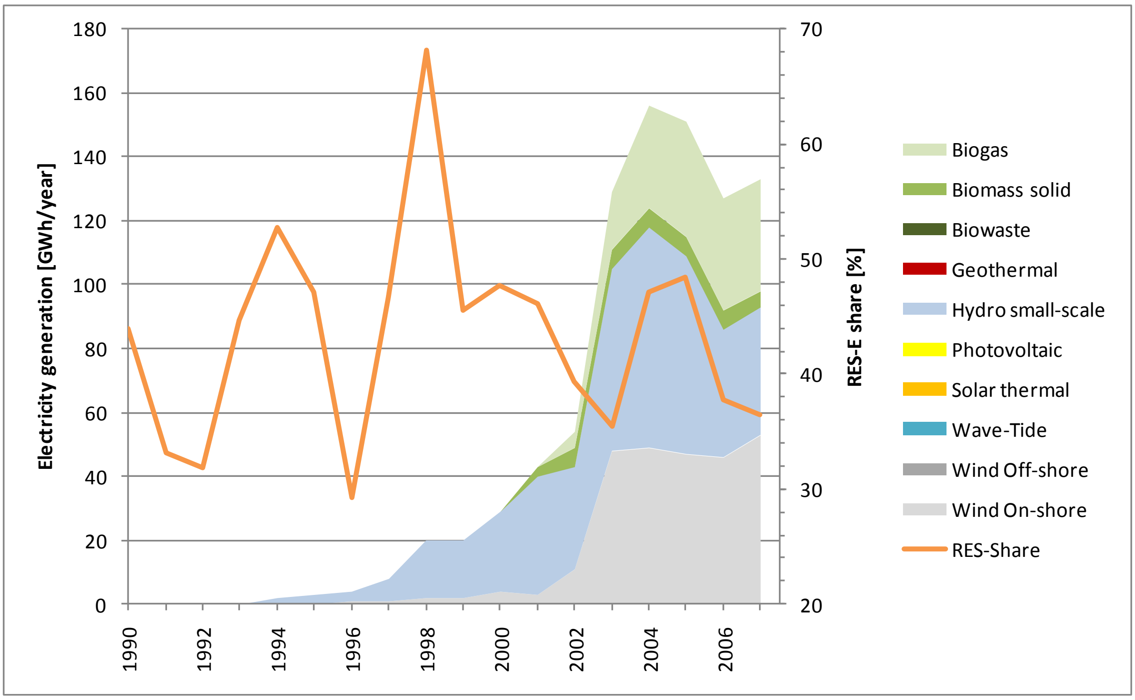
**Figure 1-1:** Development of RES-Electricity generation in Latvia 1990 – 2007




**Source:** Eurostat (2009)

For better visibility, **Figure 1-2** shows the development for all technologies other than large-scale hydro:

**Figure 1-2:** Development of RES-Electricity generation in Latvia 1990 – 2007 without large-scale hydropower




**Source:** Eurostat (2009)

The following tables show the development and the compound annual growth rate (CAGR) of capacities and generation for all renewable technologies in more detail:

**Table 1-1:** Development of RES-Electricity generation in Latvia 1990 – 2007

| Technology | Electricity generation | | | CAGR | | |
|---|---|---|---|---|---|---|
| | 1990 [GWh] | 2000 [GWh] | 2007 [GWh] | 1990-2007 [%] | 1990-2000 [%] | 2000-2007 [%] |
| Biogas | 0 | 0 | 38 | : | : | : |
| Biomass solid | 0 | 0 | 5 | : | : | : |
| Biowaste | 0 | 0 | 0 | : | : | : |
| Geothermal power plants | 0 | 0 | 0 | : | : | : |
| Hydro large-scale | 4,496 | 2,794 | 2,665 | -3.0 | -4.6 | -0.7 |
| Hydro small-scale | 0 | 25 | 68 | : | : | 15.4 |
| Photovoltaic systems | 0 | 0 | 0 | : | : | : |
| Solar thermal | 0 | 0 | 0 | : | : | : |
| Tide & wave | 0 | 0 | 0 | : | : | : |
| Wind-turbines onshore | 0 | 4 | 53 | : | : | 44.6 |
| Wind-turbines offshore | 0 | 0 | 0 | : | : | : |
| RES-E total | 4,496 | 2,823 | 2,829 | -2.7 | -4.5 | 0.0 |

**Source:** Eurostat (2009)

**Table 1-2:** Development of RES-Electricity capacities in Latvia 1990 – 2007

| Technology | Capacity | | | CAGR | | |
|---|---|---|---|---|---|---|
| | 1990 [MW] | 2000 [MW] | 2007 [MW] | 1990-2007 [%] | 1990-2000 [%] | 2000-2007 [%] |
| Biogas | 0 | 0 | 7 | : | : | : |
| Biomass solid | 0 | 0 | 3 | : | : | : |
| Biowaste | 0 | 0 | 0 | : | : | : |
| Geothermal power plants | 0 | 0 | 0 | : | : | : |
| Hydro large-scale | 1,487 | 1,504 | 1,511 | 0.1 | 0.1 | 0.1 |
| Hydro small-scale | 0 | 9 | 25 | : | : | 15.7 |
| Photovoltaic systems | 0 | 0 | 0 | : | : | : |
| Solar thermal | 0 | 0 | 0 | : | : | : |
| Tide & wave | 0 | 0 | 0 | : | : | : |
| Wind-turbines onshore | 0 | 2 | 26 | : | : | 44.3 |
| Wind-turbines offshore | 0 | 0 | 0 | : | : | : |
| RES-E total | 1,487 | 1,515 | 1,572 | 0.3 | 0.2 | 0.5 |

**Source:** Eurostat (2009)

**Heat:**

Biomass is still mostly fired in small boilers of low efficiency in private households. But it is also used in district heating, which is widely used in Latvia, as around 70% of its households are connected to a heat grid.[8]

In total, biomass covers over 50% of private household energy consumption, due to its high share in heat production.[9] The total heat demand was covered to 42.6% based on renewable sources in 2007.

**Table 1-1:** Development of RES-Heat generation in Latvia 1990 – 2007

| Technology | Generation | | | CAGR | | |
|---|---|---|---|---|---|---|
| | 1990 [ktoe] | 2000 [ktoe] | 2007 [ktoe] | 1990-2007 [%] | 1990-2000 [%] | 2000-2007 [%] |
| Biogas (grid) | 0.0 | 0.0 | 2.0 | : | : | : |
| Solid biomass (grid) | 17.0 | 86.0 | 103.0 | 11.9 | 17.6 | 3.1 |
| Biowaste (grid) | 0.0 | 0.0 | 0.0 | : | : | : |
| Geothermal heat (grid) | - | - | - | : | : | : |
| Solid biomass (non-grid) | 615.0 | 824.0 | 1002.0 | 3.1 | 3.0 | 3.3 |
| Solar thermal heating and hot water | 0.0 | 0.0 | 0.0 | : | : | : |
| Heat pumps | - | - | - | : | : | : |
| RES-H total | 632.0 | 910.0 | 1107.0 | 3.6 | 3.7 | 3.3 |

**Source:** Eurostat (2009)

**Transport:**

**Table 1-4** depicts the development of the consumption of biofuels in Latvia and their share in the transport sector during recent years.

**Table 1-2:** Development of RES-Transport fuel consumption in Latvia

| Technology | Unit | 2005 | 2006 | 2007 |
|---|---|---|---|---|
| Biodiesel | ktoe | 3 | 2 | 2 |
| Bioethanol | ktoe | 0 | 1 | 0 |
| Biofuels, total | ktoe | 3 | 3 | 2 |
| Share Biofuels | % | 0.2 | 0.3 | 0.2 |

**Source:** Eurostat (2009)

### 1.1.3 Current renewable energy support policies

**Electricity:**

As main support instrument in the renewable electricity sector, Latvia makes use of a feed-in tariff system. A previous tendering scheme for e.g. wind farms with a capacity of more than

[8] Austrian Energy Agency (2009b)

[9] Latvian Ministry of Economic Affairs (2007), pag. 5

0.25 MW was cancelled. The current feed-in tariff was amended in 2009 with regulation No. 198 on Electricity Generation from RES and Price Regulation.[10] It came into force on 14 March 2009. The feed-in tariff will be reduced after 10 years of plant operation.

The following abbreviations were chosen for the formulas in the following two tables:

C – purchase price of RES-E without VAT

e – exchange rate of Latvian Lats (LVL) and Euro on the date of electricity bill

k – certain coefficient depending on the installed capacity

Tg – end user natural gas price approved by the Regulatory Authority (without VAT)

**Table 1-3:** Feed-in tariff in Latvia

| Technology | Capacity restriction | Support level 1 (First 10 years) | | Support level 2 (Following 10 years) | |
|---|---|---|---|---|---|
| | | Formula | Price range [€/MWh] | Formula | Price range [€/MWh] |
| Wind | < 0.25 MW | C=147*e*k | 117 - 128 | C=147*e*k*0.6 | 70 - 77 |
| | Other | C=120*e*k | 67 - 95 | C=120*e*k*0.6 | 40 - 57 |
| Biomass, biogas | Biomass < 4 MW | $C = \frac{T_g * k}{9.3} * 4.5$ | 91 - 117[a] 138 - 177[b] | $C = \frac{T_g * k}{9.3} * 3.4$ | 69 - 88[a] 104 - 134[b] |
| | Biogas > 2 MW | | 75 - 94[a] 114 - 142[b] | | 57 - 71[a] 86 - 107[b] |
| Biomass | > 4 MW | $C = \frac{T_g * k}{9.3} * 3.6$ | 60 - 73[a] 91 - 110[b] | $C = \frac{T_g * k}{9.3} * 3.0$ | 50 - 61[a] 76 - 92[b] |
| Biogas | < 2 MW | C=188*e*k | 133 - 164 | C=188*e*k*0.8 | 107 - 131 |
| Hydro | < 5 MW | C=159*e*k | 108 - 139 | C=159*e*k*0.8 | 86 - 111 |
| Solar | - | C = 427*e | 330 | C=427*e | 330 |

a: at a price of 130 LVL/1000 Nm3

b: at a price of 230 LVL/1000 Nm3

**Source:** Regulation No. 198 on Electricity Generation from RES and the Price Regulation http://www.likumi.lv/doc.php?id=189066

[10] Available in Latvian language at: http://www.likumi.lv/doc.php?id=189066

**Table 1-4:** Calculation of the coefficient k

| Installed capacity | | K factor |
|---|---|---|
| From including [MW] | To excluding [MW] | |
| 0.00 | 0.08 | 1.240 |
| 0.08 | 0.15 | 1.231 |
| 0.15 | 0.20 | 1.202 |
| 0.20 | 0.40 | 1.131 |
| 0.40 | 0.60 | 1.086 |
| 0.60 | 0.80 | 1.072 |
| 0.80 | 1.00 | 1.055 |
| 1.00 | 1.50 | 1.035 |
| 1.50 | 2.00 | 1.008 |
| 2.00 | 2.50 | 0.992 |
| 2.50 | 3.00 | 0.982 |
| 3.00 | 3.50 | 0.974 |
| 3.50 | 10.00 | 0.965 |
| 10.00 | 20.00 | 0.950 |
| 20.00 | 40.00 | 0.920 |
| 40.00 | 60.00 | 0.890 |
| 60.00 | 80.00 | 0.860 |
| 80.00 | 100.00 | 0.830 |
| 100.00 | - | 0.800 |

**Source:** Regulation No. 198 on Electricity Generation from RES and the Price Regulation http://www.likumi.lv/doc.php?id=189066

The feed-in tariff is capped so that electricity producers have the right to sell their electricity at the above described fixed price until a certain share of RES-E in the total electricity consumption is reached. The following table shows the supported share of RES-E in total electricity consumption.

**Table 1-5**: Share of RES-E in final electricity consumption

| Technology | 2009 | | 2010 - 2020 | |
|---|---|---|---|---|
| | % | GWh | % | GWh |
| Hydro (>5 MW) | 36.35 | 2301 | 34.31 | 2107 |
| Hydro (<5MW) | 1.88 | 119 | 1.98 | 122 |
| Wind | 4.08 | 258 | 5.37 | 330 |
| Biogas | 6.90 | 437 | 7.93 | 487 |
| Biomass | 3.46 | 219 | 4.97 | 305 |
| Solar | 0.00 | 0 | 0.01 | 1 |
| Total | 52.67 | 3334 | 54.57 | 3352 |

**Source:** Regulation No. 198 on Electricity Generation from RES and the Price Regulation http://www.likumi.lv/doc.php?id=189066

Furthermore, renewable electricity receives financial support. For electricity supplied to the end user a tax of 0.55 LVL/MWh (0.77 €/MWh[11]) in 2009 and 0.71 LVL (0.99 €/MWh) in 2010 has to be paid according to the Law on Electricity Tax. Electricity from RES and effective CHP is freed of this tax.

RES-E projects in Latvia can further receive support from the EU structural fund (e.g. 9.89 M€ expected for wind from 2007 – 2013), Environment Protection Fund (grants up to 42,197 M€), Environment investment fund for soft loans, EEA Financial Mechanisms and Norwegian Financial Mechanisms as well as Green Investment Scheme.

RES-electricity has no priority of access to the grid, but operators are entitled to the connection of their systems to the grid according to the principle of non-discrimination. Connection however, is carried out at their own expense.[12] [13]

**Heat:**

Latvia supports renewable heat through few fiscal measures, but not with direct support mechanisms. Projects are financed through EU structural funds in 2007 – 2013 in form of direct funds, which will contribute at least to 25% to the total eligible costs. Thereby, the minimum allowed amount to be financed per project is 100,000 LVL (140,657 €) and the maximum 4 million LVL (5.6 M€). The total budget is 17,345,202 LV (24.4 M€). In this scheme, investments in constructions of new CHP and reconstruction of existing boilers into CHP utilizing RES can be supported. Furthermore, utilization of biomass and biogas will be supported.

More information is given on the websites of the State Agency of Construction, Energy & Housing (http://www.bema.gov.lv) and on the one of the Latvian Environment Protection Fund Administration (http://www.lvaf.gov.lv).

**Transport:**

The Law on Biofuel (2005) contains a biofuel quota obligation. Biofuels should sum up to 5.75% by 2010 and to 10% by 2016.

Latvia promotes the obligation firstly by direct support and secondly in form of fiscal measures.

In order to be supported, the applicants have to fulfill the requirements of Rules No. 290 on Financially Eligible Quotas for Biofuels. Producers of biofuels from rapeseed grains, rapeseed oil and grains are eligible for the support. The quota is shown in the following table.

[11] Exchange rate 1 EUR = 0.71095 LVL

[12] German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (2009)

[13] EREC (2009f), pag. 4, 5 and 6

**Table 1-6:** Financially eligible quotas of biofuels in 2008 – 2010

| Biofuels | Unit | 2008 | 2009 | 2010 |
|---|---|---|---|---|
| Bioethanol | kt | 22 | 27 | 32 |
| Biodiesel | kt | 28 | 35 | 43 |
| Total biofuels | kt | 50 | 62 | 75 |
| Share of biofuels | % | 4.25 | 5.00 | 5.75 |

**Source:** Rules No. 280 on Financially Eligible Quotas for Biofuels

Every unit of biofuels under the quota obligation receives a direct support. The compensation for biofuel producers was 0.38 LVL per liter (0.53 € per liter) and for biodiesel producers was 0.41 LVL per liter (0.58 € per liter) in the second half of 2008.

Biodiesel produced from rapeseed oil has a reduced excise tax, which is regulated in the Law on Excise tax. Thereby, the reduced excise tax has a range from 164 LVL (229 €) to 223 LVL (314 €) depending on the quantity of additives. If biodiesel is exclusively derived from rapeseed oil, there is no tax to be paid.

## 1.2 Targets & trajectories

### 1.2.1 Overall renewable energy targets and trajectories

**Table 1-7:** Overall renewable energy targets and trajectories – Latvia

| 2005 | Average 2011 - 2012 | Average 2013 - 2014 | Average 2015 - 2016 | Average 2017 - 2018 | 2020 |
|---|---|---|---|---|---|
| 32.60% | 34.08% | 34.82% | 35.93% | 37.41% | 40.00% |

**Source:** Directive 2009/28/EC

With 32.6%, Latvia held the second largest RES share of gross final energy consumption in the whole European Union in 2005. Until the year 2020, Latvia is due to increase this share to 40% according to Directive 2009/28/EC.

### 1.2.2 Sector targets and trajectories

Possible future developments of the renewable energy sector in Latvia until 2020 have been assessed based on two scenarios using the Green-X model, the NAT and ACT scenarios (defined in Appendix 1) and considering a moderate energy demand (based on PRIMES 20% case scenario).[14]

Considering a moderate energy demand, under no scenario will Latvia meet its RE target of 40% in 2020, as shown in **Tables 1-10** and **1-11**. All scenarios lead to total RES shares being slightly below the target. Hereby, the RES shares are slightly above 50% in the electricity sector and slightly below 50% in the heating sector under both scenarios. The share of renewable energy in the transport sector reaches 10% in both scenarios.

[14] Results and figures for a low energy demand scenario (based on PRIMES high energy efficiency case scenario) are shown in Appendix 2.

**Table 1-8:** Sectoral targets and trajectories – NAT scenario Latvia

| Latvia | | NAT (National target fulfillment) | | | | | |
|---|---|---|---|---|---|---|---|
| Indicator | Unit | 2005 | Average 2011 - 2012 | Average 2013 - 2014 | Average 2015 - 2016 | Average 2017 - 2018 | 2020 Targets |
| Expected Gross Final energy consumption | Ktoe | 4,292 | 5,082 | 5,242 | 5,406 | 5,567 | 5,776 |
| Total share of RES in final energy consumption | % | 32.3% | 34.9% | 35.3% | 36.1% | 37.6% | 39.2% |
| Gross Final Consumption of RES-E | Ktoe | 261 | 318 | 358 | 410 | 460 | 498 |
| Share of RES-E in gross final electricity consumption | % | 43.0% | 42.7% | 45.7% | 49.6% | 52.5% | 52.7% |
| Gross final energy consumption RES-H | Ktoe | 1,124 | 1,407 | 1,422 | 1,458 | 1,533 | 1,634 |
| Share of RES-H in final Heating and Cooling consumption | % | 42.9% | 46.0% | 45.6% | 45.7% | 47.0% | 48.6% |
| Final energy from renewable sources consumed in transport | Ktoe | 2 | 51 | 72 | 84 | 99 | 132 |
| Share of RES in gross final transport energy consumption | % | 0.3% | 4.4% | 6.0% | 6.7% | 7.7% | 10.0% |

**Source:** Green-X Model (2009)

**Table 1-11:** Sectoral targets and trajectories – ACT scenario Latvia

| Latvia | | ACT (proactive support - realisable deployment) | | | | | |
|---|---|---|---|---|---|---|---|
| Indicator | Unit | 2005 | Average 2011 - 2012 | Average 2013 - 2014 | Average 2015 - 2016 | Average 2017 - 2018 | 2020 Targets |
| Expected Gross Final energy consumption | Ktoe | 4,292 | 5,082 | 5,242 | 5,406 | 5,567 | 5,776 |
| Total share of RES in final energy consumption | % | 32.3% | 34.9% | 35.4% | 36.3% | 37.9% | 39.6% |
| Gross Final Consumption of RES-E | Ktoe | 261 | 318 | 363 | 420 | 477 | 518 |
| Share of RES-E in gross final electricity consumption | % | 43.0% | 42.7% | 46.4% | 50.8% | 54.4% | 54.8% |
| Gross final energy consumption RES-H | Ktoe | 1,124 | 1,407 | 1,422 | 1,458 | 1,535 | 1,636 |
| Share of RES-H in final Heating and Cooling consumption | % | 42.9% | 46.0% | 45.6% | 45.7% | 47.0% | 48.6% |
| Final energy from renewable sources consumed in transport | Ktoe | 2 | 51 | 72 | 84 | 99 | 132 |
| Share of RES in gross final transport energy consumption | % | 0.3% | 4.4% | 6.0% | 6.7% | 7.7% | 10.0% |

**Source:** Green-X Model (2009)

### 1.2.3 Contribution of renewables to electricity consumption

Latvia has a vast production of hydroelectricity, especially through large scale facilities, which can hardly be increased due to a vastly exhausted potential, as **Tables 1-12** and **1-13** show for both scenarios. Generation in hydro plants of small scale however will be more than four times higher in 2020 and will reach a share of almost 4% in the RES-E sector in 2020.

When the NAT scenario is assumed, the largest growth can be found in the field of wind energy, especially onshore. It starts at a marginal level in 2005 and will contribute 23% in the year 2020, whereas offshore energy will contribute only 1%. Wind energy production will grow intensely until the middle of the next decade when a satiation sets in.

Electricity generation from solid biomass will increase steadily until a 12% share is reached in 2020. A similar development on a lower level sets in for Biogas from the beginning of the next decade, but only 6% of all regenerative electricity will be generated through this technology in 2020. Photovoltaics will be installed at the end of the next decade, but will remain marginal due to its very limited potential in Latvia.

**Table 1-12:** Contribution of renewables to electricity consumption – NAT scenario Latvia

| Latvia | NAT (National target fulfillment) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Technology | 2005 | | Average 2011 - 2012 | | Average 2013 - 2014 | | Average 2015 - 2016 | | Average 2017 - 2018 | | 2020 Targets | |
| | MW | GWh | MW | GWh | MW | GWh | MW | GWh | MW | GWh | MW | GWh |
| Biomass | 10.0 | 42 | 63.4 | 351 | 85.7 | 488 | 114.4 | 664 | 148.2 | 873 | 186.4 | 1,087 |
| Solid | 3.0 | 6 | 46.7 | 274 | 64.5 | 381 | 86.5 | 515 | 109.2 | 651 | 122.1 | 719 |
| Biogas | 7.0 | 36 | 14.6 | 64 | 18.2 | 87 | 24.8 | 129 | 36.1 | 202 | 61.3 | 348 |
| MSW | 0.0 | 0 | 2.1 | 13 | 3.0 | 19 | 3.0 | 19 | 3.0 | 19 | 3.0 | 19 |
| Liquid | : | : | : | : | : | : | : | : | : | : | : | : |
| Concentrated Solar | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 |
| Geothermal | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 |
| Hydro, total | 1,536.0 | 2,947 | 1,624.4 | 3,097 | 1,653.0 | 3,158 | 1,677.1 | 3,208 | 1,697.0 | 3,250 | 1,705.5 | 3,271 |
| >10MW | 1,511.0 | 2,895 | 1,581.6 | 2,985 | 1,595.9 | 3,010 | 1,605.8 | 3,027 | 1,615.7 | 3,044 | 1,615.7 | 3,044 |
| <10MW | 25.0 | 52 | 42.9 | 112 | 57.1 | 147 | 71.2 | 180 | 81.3 | 206 | 89.8 | 227 |
| Of which pumping | : | : | : | : | : | : | : | : | : | : | : | : |
| Photovoltaic | 0.0 | 0 | 3.5 | 3 | 8.3 | 6 | 14.3 | 11 | 24.6 | 18 | 47.6 | 35 |
| Ocean | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 |
| Wind | 26.0 | 45 | 97.8 | 247 | 205.5 | 516 | 364.8 | 883 | 518.5 | 1,209 | 606.4 | 1,393 |
| Onshore | 26.0 | 45 | 94.4 | 237 | 197.6 | 491 | 352.4 | 844 | 501.8 | 1,156 | 582.8 | 1,315 |
| Offshore | 0.0 | 0 | 3.4 | 11 | 7.9 | 25 | 12.4 | 39 | 16.7 | 54 | 23.7 | 78 |
| Gross Final Consumption of electricity from RES | 1,572.0 | 3,034 | 1,789.1 | 3,698 | 1,952.6 | 4,167 | 2,170.6 | 4,764 | 2,388.4 | 5,350 | 2,546.0 | 5,787 |

**Source:** Green-X Model (2009)

The NAT scenario is similar to the ACT scenario. As **Table 1-13** shows, a very proactive policy support leads to the same projections for most technologies as under the NAT scenario. The exceptions are biomass solid and hydro large scale energy, which will be promoted more intensely under the ACT scenario.

**Table 1-13:** Contribution of renewables to electricity consumption – ACT scenario Latvia

| Latvia | ACT (proactive support - realisable deployment) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Technology | 2005 | | Average 2011 - 2012 | | Average 2013 - 2014 | | Average 2015 - 2016 | | Average 2017 - 2018 | | 2020 | |
| | MW | GWh | MW | GWh | MW | GWh | MW | GWh | MW | GWh | MW | GWh |
| Biomass | 10.0 | 42 | 63.4 | 351 | 85.7 | 488 | 114.4 | 664 | 150.3 | 886 | 188.4 | 1,100 |
| Solid | 3.0 | 6 | 46.7 | 274 | 64.5 | 381 | 86.5 | 515 | 111.2 | 665 | 124.1 | 732 |
| Biogas | 7.0 | 36 | 14.6 | 64 | 18.2 | 87 | 24.8 | 129 | 36.1 | 202 | 61.3 | 348 |
| MSW | 0.0 | 0 | 2.1 | 13 | 3.0 | 19 | 3.0 | 19 | 3.0 | 19 | 3.0 | 19 |
| Liquid | : | : | : | : | : | : | : | : | : | : | : | : |
| Concentrated Solar | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 |
| Geothermal | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 |
| Hydro, total | 1,536.0 | 2,947 | 1,624.4 | 3,097 | 1,684.0 | 3,214 | 1,739.6 | 3,329 | 1,793.7 | 3,438 | 1,821.1 | 3,493 |
| >10MW | 1,511.0 | 2,895 | 1,581.6 | 2,985 | 1,626.9 | 3,067 | 1,668.4 | 3,149 | 1,712.4 | 3,231 | 1,731.3 | 3,266 |
| <10MW | 25.0 | 52 | 42.9 | 112 | 57.1 | 147 | 71.2 | 180 | 81.3 | 206 | 89.8 | 227 |
| Of which pumping | : | : | : | : | : | : | : | : | : | : | : | : |
| Photovoltaic | 0.0 | 0 | 3.5 | 3 | 8.3 | 6 | 14.3 | 11 | 24.6 | 18 | 47.6 | 35 |
| Ocean | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 |
| Wind | 26.0 | 45 | 97.8 | 247 | 205.5 | 516 | 364.8 | 883 | 518.5 | 1,209 | 606.4 | 1,393 |
| Onshore | 26.0 | 45 | 94.4 | 237 | 197.6 | 491 | 352.4 | 844 | 501.8 | 1,156 | 582.8 | 1,315 |
| Offshore | 0.0 | 0 | 3.4 | 11 | 7.9 | 25 | 12.4 | 39 | 16.7 | 54 | 23.7 | 78 |
| Gross Final Consumption of electricity from RES | 1,572.0 | 3,034 | 1,789.1 | 3,698 | 1,983.5 | 4,224 | 2,233.1 | 4,886 | 2,487.1 | 5,551 | 2,663.6 | 6,022 |

**Source:** Green-X Model (2009)

### 1.2.4 Contribution of renewables to heating & cooling consumption

Both scenarios are rather similar as **Tables 1-14** and **1-15** show. The main driver for the development of the RES-H sector will be grid-connected solid biomass. It will see a strong and steady growth of more than 300% until 2020 making it the second largest contributor to the renewable heat sector after non-grid-connected solid biomass whose share in the RES-H sector will increase by 15% in this period. Grid-connected solid biomass will have a share of around 26% in the RES-H sector in the scenarios in 2020. It will be the main reason for the RES-H sector to grow in Latvia, since the quantitative dynamic of non-grid-connected solid biomass is very low and geothermal and solar thermal energy will remain of far smaller importance.

**Table 1-14:** Contribution of renewables to heating and cooling consumption – NAT scenario Latvia

| Latvia | NAT (National target fulfillment) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Technology | 2005 | | Average 2011 - 2012 | | Average 2013 - 2014 | | Average 2015 - 2016 | | Average 2017 - 2018 | | 2020 | |
| | MWth | Ktoe | MWth | Ktoe | MWth | Ktoe | MWth | Ktoe | MWth | Ktoe | MWth | Ktoe |
| Biomass | 0 | 1,124 | 8,339 | 1,404 | 8,250 | 1,415 | 8,301 | 1,448 | 8,600 | 1,519 | 9,014 | 1,613 |
| Solid | 0 | 1,122 | 8,316 | 1,398 | 8,221 | 1,408 | 8,269 | 1,441 | 8,563 | 1,511 | 8,964 | 1,604 |
| Biogas | : | 2 | 13 | 3 | 15 | 4 | 18 | 4 | 24 | 4 | 36 | 6 |
| Biowaste | : | 0 | 10 | 2 | 14 | 4 | 14 | 4 | 14 | 4 | 14 | 4 |
| Geothermal | : | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Solar Thermal | : | 0 | 42 | 2 | 94 | 4 | 147 | 6 | 205 | 8 | 305 | 11 |
| Heat pumps | : | 0 | 9 | 1 | 20 | 3 | 32 | 5 | 44 | 7 | 64 | 10 |
| Gross final energy consumption from RES in heating and cooling | 0 | 1,124 | 8,390 | 1,407 | 8,365 | 1,422 | 8,480 | 1,458 | 8,850 | 1,533 | 9,382 | 1,634 |

**Source:** Green-X Model (2009)

**Table 1-15:** Contribution of renewables to heating and cooling consumption – ACT scenario Latvia

| Latvia | ACT (proactive support - realisable deployment) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Technology | 2005 | | Average 2011 - 2012 | | Average 2013 - 2014 | | Average 2015 - 2016 | | Average 2017 - 2018 | | 2020 | |
| | MWth | Ktoe | MWth | Ktoe | MWth | Ktoe | MWth | Ktoe | MWth | Ktoe | MWth | Ktoe |
| Biomass | 0 | 1,124 | 8,339 | 1,404 | 8,250 | 1,415 | 8,301 | 1,448 | 8,600 | 1,520 | 9,014 | 1,614 |
| Solid | 0 | 1,122 | 8,316 | 1,398 | 8,221 | 1,408 | 8,269 | 1,441 | 8,563 | 1,512 | 8,964 | 1,605 |
| Biogas | : | 2 | 13 | 3 | 15 | 4 | 18 | 4 | 24 | 4 | 36 | 6 |
| Biowaste | : | 0 | 10 | 2 | 14 | 4 | 14 | 4 | 14 | 4 | 14 | 4 |
| Geothermal | : | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Solar Thermal | : | 0 | 42 | 2 | 94 | 4 | 147 | 6 | 205 | 8 | 305 | 11 |
| Heat pumps | : | 0 | 9 | 1 | 20 | 3 | 32 | 5 | 44 | 7 | 64 | 10 |
| Gross final energy consumption from RES in heating and cooling | 0 | 1,124 | 8,390 | 1,407 | 8,365 | 1,422 | 8,480 | 1,458 | 8,850 | 1,535 | 9,382 | 1,636 |

**Source:** Green-X Model (2009)

### 1.2.5 Contribution of renewables to transport fuel consumption

The utilization of biofuels in the Latvian transport sector will increase noticeably in the scenarios until 2020 as **Table 1-16** shows. Bioethanol will make up 17% of the domestic biofuel consumption, while biodiesel will contribute 8% to the market. With around 6%, biofuels of the second generation will be the smallest contributor, yet be considerable. The vast majority with around 69% of all domestic biofuel consumption however, will have to be covered by imports.

**Table 1-16:** Contribution of renewables to transport consumption – all scenarios Latvia

| Latvia | | NAT | | | ACT | | |
|---|---|---|---|---|---|---|---|
| Technology | Unit | 2005 | Average 2011 - 2012 | Average 2013 - 2014 | Average 2015 - 2016 | Average 2017 - 2018 | 2020 |
| Bioethanol | ktoe | 0.0 | 14.1 | 22.1 | 22.1 | 22.1 | 22.1 |
| Of which imported | ktoe | : | : | : | : | : | : |
| Biodiesel | ktoe | 3.0 | 7.7 | 11.6 | 5.2 | 0.0 | 10.3 |
| Of which imported | ktoe | : | : | : | : | : | : |
| Biofuels from wastes, residues, non-food cellulosic material, and ligno-cellulosic material | ktoe | : | 0.0 | 0.0 | 0.0 | 0.0 | 8.5 |
| Of which imported | ktoe | : | : | : | : | : | : |
| Hydrogen from RES | ktoe | : | : | : | : | : | : |
| Renewable electricity | ktoe | : | : | : | : | : | : |
| Biofuel import | ktoe | : | 29.6 | 38.4 | 56.4 | 76.6 | 91.6 |
| Final energy from renewable sources consumed in transport | ktoe | 3.0 | 51.4 | 72.1 | 83.7 | 98.8 | 132.5 |

**Source:** Green-X Model (2009)

## 1.3 Measures for achieving the targets

### 1.3.1 Policy measures

**Measures on administrative procedures, regulations and codes:**

- **Should authorization procedure take into account the specificities of different renewable energy technologies? If yes, how?**

The specifics of different RES sources should be considered for the design of authorisation procedures, as well as the size and type of project should be differentiated. An extremely simple authorisation system (for example an internet application) should be created for very simple and small projects like the installation of thermal solar collector on private house and multifamily houses.

For small grid connected project, like PV system, or private small wind turbines a very simple application form should be elaborated for the connection to the grid. As well as in this case an internet tool with a template form would help, (this same tool could be used as well as for mini and micro cogeneration system even if gas-fired). However in this case the grid and metering system in Latvia should be further modernized.

For bigger projects the authorization procedure should be facilitated and reorganised with easier access to information for investors and developers. Eventually a platform gathering information and description of all requirement needed for the authorisation of a specific RES project would help.

Additionally the specificities of different renewable energy technologies should be taken into account as well as prioritizing renewable energy technologies according to their potential contribution for achieving not only RES targets but also environmental targets. For example, biogas could be prioritised since the impact of biogas production is related not only to the RES targets, but also allows reducing the impacts on environment (minimization of waste flows, avoiding GHG emissions, fulfilling the Nitrates directive etc.). As well as the use of RES directly replacing fossil fuels and/or increasing energy efficiency aspects should be prioritized compared to installation of new RES capacity.

- **Should the renewable energy potential be taken into account in spatial planning?**

Generally RES, and their respective potential, are insufficiently taken into account in spatial planning. In many countries and regions future development of RES projects is not taken into account at the moment of drawing up spatial planning programs. This means that spatial planning programmes have to be adopted in order to allow for the implementation of a RES project in a specific area (e.g. RES-E), especially when there is a high RES potential involved in that particular area. This process can take a very long time. Often the acquirement of permits related to spatial planning is the longest trajectory of the overall period needed for development of the project. This is especially the case for projects in the field of wind and biomass. Responsible authorities should be stimulated to anticipate the development of future RES projects in their region, by allocating suitable areas.

Surveys show that spatial planning, construction permits and EIA (environmental impact assessment) procedures are key problems for regulators. In the RES-E sector to obtain the necessary permits can take years in countries where the authorities take into account the opinion of many stakeholders that are hard to harmonise. Since RES-E development is not taken into consideration in the special planning, every project and project variants have to be evaluated on an individual basis.

The number of the often long lasting appeal procedures could be effectively decreased by including RES-E development plans in local and regional spatial planning. In Germany for example these problems have been solved to a large extent. In the case of onshore wind projects the administrative barriers regarding spatial planning are low thanks to the Building Code (1996), which made states designate areas for onshore wind parks. Thanks to this, a wind farm can be implemented within 1 year. A similar approach is being followed for offshore wind parks. The federal states and the Bundesamt für Seeschifffahrt und Hydrographie (Federal Maritime and Hydrographic Agency) are responsible for designating areas and issuing permits for offshore wind installations.

Based on the experience gained in the Energy4Cohesion[15] project and in the Innovative Thinking[16] project, it is clear that addressing RES in regional and local spatial planning is a necessary measure to firstly correctly assess the RES potential and secondly to enable the

[15] http://www.e4c.org/ - .

[16] http://innovativethinking.eu/

best use of this potential. For example - in the specific case of biogas- it is very important because it allows identifying the best locations (also from the heat use point of view) of new biogas plants and to avoid potential conflicts with society, e.g., because of smells or inappropriate logistics.

However, data collection takes time and proper information is in many parts not available. For the preparation of a proper spatial panning addressing RES, there is a paramount importance of involving local and regional stakeholders. However the dialogue with stakeholder and local authorities should be enhanced, including the development of local/regional agencies.

To establish a general willingness within the municipal/regional authorities, to set up and execute an energy policy, different tools are needed, for example: workshops, trainings and local good practice examples.

- **Should timetables for processing applications be communicated in advance?**

Usually long lead times are needed to obtain necessary permits. Time needed to obtain all necessary permits for the construction of a RES plant can take many years (e.g. RES-E). Also it can be unclear what the exact length of a procedure will be. Clear guidelines for authorization procedures are highly recommended together with obligatory response periods for authorities involved in such procedures.

A clear and transparent authorisation process also indicating a time limit for each step should be created. The time limit should vary from project to project depending for type of RES, size, etc.. (to approve the installation of solar thermal collector on the roof of a single family house should not take more than a week. On the other hand, a wind park in sensitive area must be assessed with more detail resulting in longer processing times).

In general, timetables would facilitate and make more efficient the overall project administration process.

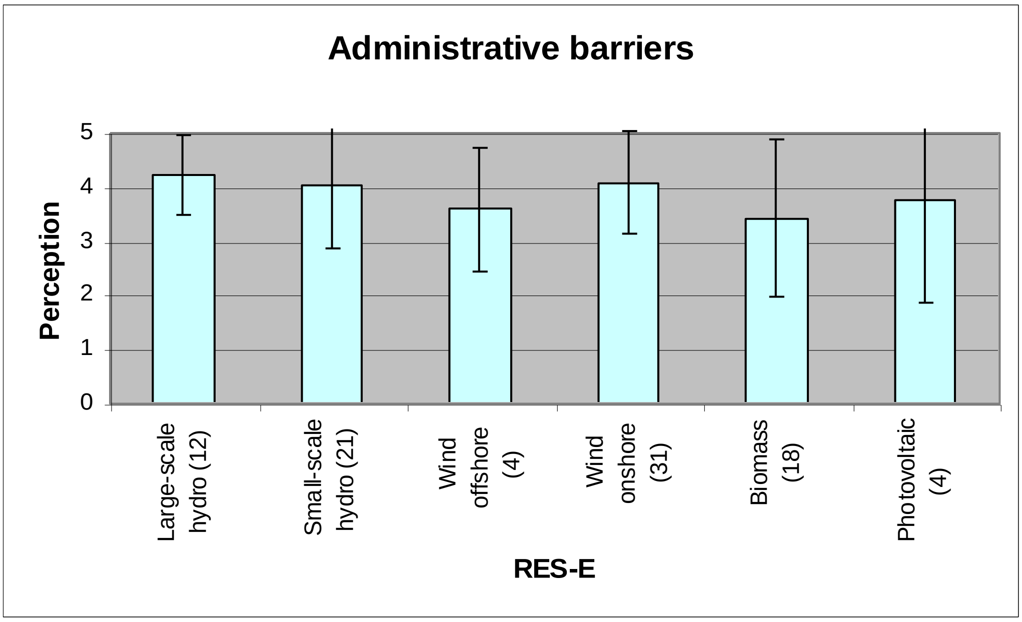
- **How many steps should be needed to obtain the final authorization? Should there be a one-stop shop for coordinating all the steps?**

Generally, a high number of authorities are involved to obtain the final authorization. Often many authorities are involved in both permitting as well as support related procedures for renewable energy projects. Responsible authorities usually comprise several administrative bodies at national, regional and local level. An important improvement would be to reduce the number of local, regional and national administrations involved in the authorization processes for permits and financial support. Project developers are much more positive in situations where a single administrative body has been made responsible for co-ordination of several administrative procedures, such as the Bundesamt for off-shore wind in Germany.

Furthermore, there is a lack of co-ordination between different authorities. In many cases project developers need to submit similar information multiple times to different authorities. A suggestion to reduce the administrative burden for RES development would be to standardize procedures, such as standardized administrative requirements and application forms between different authorities.

In **Figure 1-3** we present the perception of administrative barriers per renewable energy source, as identified by the stakeholder consultation.[17]

**Figure 1-3:** Perception of administrative barriers




**Source:** OPTRES (2007)

Perception from 0 (no perceived barrier) to 5 (high perceived barrier). Number of received answers per source is provided in brackets, while standard deviation is marked by bars. Only those RES-E types with at least 4 answers have been depicted.

**Figure 1-3** shows that the respondents of the stakeholder consultation perceived the administrative problems to be highest for hydropower projects and on-shore wind. However, also for the other renewable energy sources the administrative barriers are perceived an important obstacle in the development of renewable energy projects.

Communication and coordination in the authorization process between all actors is necessary. From a developer point of view, once the authorization procedures, list of necessary documents and timetables are set, it is not a big issue to stop in one office or more. What it is important is to eliminate bureaucratic circles i.e. to avoid the process of being sent from one office to another.

[17] OPTRES (2007).

**Measures concerning Buildings:**

- **What measures should be introduced into the building codes to ensure the share of renewable energy used in the building sector will increase?**

Policy instruments should be introduced that provide incentives for integrating a RES-H/C device into the heating/cooling system. But since RES-H/C applications operate only effectively if they are fitted to the overall system design, the chosen policy instrument should create incentives for a good overall system performance. Hence, it should also support the reduction of a building's energy consumption (e.g. by improving its insulation) and motivate for an efficient use of the RES-H/C equipment.

As far a possible the policy instrument should motivate the utilization of high efficiency equipment, e.g. through linking the financial incentives to quality standards of a determined minimum rate of efficiency.

In the residential sector in the existing building stock the first priority is definitely on energy efficiency. Mainly in Latvia, multifamily residential buildings are connected to district heating (DH) network for heat supply. In this case RES-H (eventually cogeneration) should be addressed at district heating level. In this concern a clearer regulation and/or energy planning should be worked out.

The use of natural gas in heat only boilers in residential and tertiary sector building should be strongly penalized by policy measures to incentive the introduction of mini/micro CHP or the use of RES-H. For building not connected to DH and using fossil fuel the building code could set minimum RES targets (this could apply to both new and existing buildings). For existing building the first target should be set on Energy efficiency levels while only in a second step for RES. However the financial coverage for this solution should be assessed.

- **How should an obligation for minimum levels of renewable energy in new and newly refurbished buildings be drafted to best ensure renewable energy integration in buildings? At what levels should it be set?**

The obligation should take the different target groups and their different needs into account and might be different for each of these groups. The target groups are private homeowners living in their own home, homeowners renting to others as well as private, municipal and social housing organizations. As such companies often own and manage a large number of buildings they can become a key driver (but also key barrier) for switching buildings to RES-H/C.

Housing companies generally base their economic calculation on short pay back times e.g. private building owners in the domestic sector. In addition, the level of willingness to pay might generally be lower than with small scale investors. These circumstances should be considered in the setting of minimum levels for RES and in the corresponding support schemes.

From the perspective of the building owner (investor) apart from the level of support one of the main indicators is the share of the investment costs he can and/or legally is allowed to allocate to the tenants (by increasing the rent). From the perspective of tenants the crucial question concerns the relationship between the financial burden that might derive from an allocation of the investment costs on the rent and potentially reduced costs for heating/cooling due to the reduced use of conventional fuel.

The chosen obligation should ensure that investment is still effectively motivated. Costs for building owners and tenants shall not be too high to discourage investments (e.g. by postponing the reconstruction of heating systems as long as possible).

Regarding RES-H, the starting point for an obligation for minimum levels of renewable energy in new and newly refurbished buildings should target buildings that are not connected to district heating. In the case these buildings are planning to use fossil fuels for space heating and domestic hot water preparation the obligation for level of RES-H should be calculated so that at least a certain percentage of the total heat energy demand is covered by RES. This percentage could be gradually increased time by time. The starting value could be at the level of 10% of the total heat energy demand.

This obligation could be extended to building connected to district heating system that are not using renewable energy sources, or have a low share of RES.

Regarding RES-E a certain level of obligation should be assessed for large tertiary sector buildings, in particular in relation to the use of PV.

- **What is the projected increase of renewable energy use in the building sector until 2020?**

Currently there are no official projections and a law of RES is under development.

**Measures on information:**

- **How should specific information be targeted at different groups, as end consumers, builders, property managers, property agents, installers, architects, farmers, suppliers of equipment using renewable energy sources, public administration?**

The question is basically about information sharing to all stakeholders. General information for example about subsidies for renewable technologies needs to be broadcasted to all stakeholders. As the internet offers 24 hours access to information and can be updated easily, a base for general information would be a web page. A best practice examples is given in Luxembourg, where Subsidies for heat in households are communicated with the information paper "Förderprogramm zur Energieeinsparung und Nutzung erneuerbarer Energien im Wohnbereich" of the Ministère de l'Environnement of Luxembourg in an easy manner. Thereby, the paper targets not only public administration, but also especially end consumers, property managers and agents, installers and architects and is kept in an understandable and clear style.

End users can be informed by customer information brochures about the possibility to make use of support for renewables. The information brochures can be shared among installers, property managers and suppliers of equipment to hand them over to the end consumers.

Furthermore, there could be a subsidy for consultancy on renewable energy and energy efficiency related tops for end consumers. This would give the advantage, that consumers would choose the most appropriate efficiency and renewable energy option according to an energy expert.

Renewable energy and energy efficiency exhibitions are a great possibility to get to know information physically and are therefore for energy experts as well as for technology end consumers adequate. With expositions, it is possible to share specific information as well. For instance, the SOLTEC exhibition in Germany is mainly focusing in solar technologies and through this focus, information can be shared in more detail.[18]

Workshops and speeches provide the possibility to share specific information only of major interest for a small target group. Workshops and speeches can be integrated to exhibitions as well.

Experts and public administration members need the most up to date information having a higher degree of details than the ones for example for end users. Regularly reports published by the responsible administrative bodies keep the legal framework up-to-date. A best practice example is the German "Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit", which published a brochure of the environment policy from 2005 to 2009 in July 2009 being detailed and giving an overview of the topic as well.19 With published articles in RES journals, the dynamics of the market can be analyzed in detail.

Specific information for a smaller target group can be shared via internet as well. It would be possible to establish a work group in a small field of work being responsible for specific field publishing news on their own internet platform.

Currently in Latvia there is a strong need of information about RES due mainly to a rising public interest about this topic. That is why specific measures on information should be focused in the following objectives:  sensitize all relevant stakeholders and create public campaigns about the different available RES solutions.

The approach should be based on broad information campaigns taken at local level placing RES as an enabler for climate protection.

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[18] Information about the exhibition is given on the web page: http://www.soltec.de/s

[19] Document available on http://www.bmu.de/ministerium/aufgaben/aufgaben/doc/44214.php

These actions should be designed at two levels: the first level would be communication to the general public (Press conferences, Websites, Posters and ads, Brochures) and the second level would be communication to special target groups (teaching material, symposia, pilot project). Each campaign should target a specific RES source.

It is important that the information sent to the public comes from trusted and "independent" organizations and based on solid research basis.

- **How should guidance for planners and architects be provided to help them consider the optimal combination of renewable energy sources, high efficiency technologies and district heating and cooling when planning, designing, building and renovating industrial or residential areas?**

Planners and architects should be provided with an internet platform that holds information on possible options of including renewable energy, high efficiency technologies and districts heating and cooling into new or existing buildings. It should not only contain up-to-date information on technology, how it can be installed and how profitable such investments are on the long run. It should also include detailed information on successfully completed exemplary projects, legislation and events related to the topic. Local information on the applicability of solar technology and the availability of district heating and cooling is desirable. Furthermore it should be possible to order printed copies of the contained information as well as publications explaining the various concerns in greater detail. Contact information to all relevant professional associations and their local members would complete the web page's content.

The information should be gathered in consultation with experts in energy, technology, construction and installation and be updated continuously to secure a high level of relevance and actuality. The web page should be supervised with the help of the chambers of architects as well as planners associations respectively consumers advice centers to secure that the target groups are addressed properly. These organizations could also contact their members and customers to raise the web page's awareness level within the target groups.

The technical designs of buildings have to include also an integrated energy plan and energy performance calculation. This should be linked to the minimum targets set in a new building code both regarding energy efficiency and share of RES-H and RES-E.

It can be done by organizing trainings for planners and architects on specific issues, like for example integrated energy design of building, or on detailed climate studies, building physics. Also it is important that requirements for taking into account RES when planning, designing, building and renovating industrial or residential areas are introduced in the legislation.

**Measures on electricity infrastructure development:**

- **Should there be priority connection rights or reserved connection capacities provided for new installations producing electricity from renewable energy sources?**

In general and according to stakeholder consultation, the legally guaranteed access to the grid for RES-E sources and priority transmission and distribution is not considered as a key barrier in countries where this guarantee is currently not applied.

Introduction of positive discrimination of RES-E as regards the guarantee of grid access or transmission and distribution of RES-E, however, may become an additional motivating factor for reasons of investment security, low transaction costs and the acknowledgement of RES-E system benefits.

**Priority/Guaranteed Access to the grid:**

- **Should priority or guaranteed access be ensured? Explain.**

Priority grid access is an essential condition for the rapid expansion of renewable energies. In Member States in which it is applied it has enabled new entrants to the market in particular to supply and sell the power they have generated under clear-cut conditions and at foreseeable costs. Priority grid connection prevents the existing oligopolies from squeezing out renewable energy producers, especially in markets where networks and generation capacity are largely in the hands of similarly-sized companies.

In the case of Latvia, grid access is a critical issue and is considered as one of the main barriers for the development of new RES-E plants. The grid access procedure is currently either too expensive or too bureaucratic for RES plants, taking a lot of time and resources.

- **How should it be ensured that transmission system operators, when dispatching electricity generating installations give priority to those using renewable energy sources?**

Clear statutory regulations and consistent enforcement are required.

- **How should the transmission and distribution of electricity from renewable energy sources be guaranteed by the transmission and distribution system operators?**

## 1.3.2 Financial support

**Table 1-17** gives an indication on the necessary financial support by illustrating the weighted average (2011 to 2020) levelised (to a period of 15 years) total remuneration per MWh of RES generation for new installations in the investigated cases (NAT and ACT). This shows the gross support requirements as besides the financial premium offered by a RES support scheme also default revenues from the selling of the produced energy on the related energy market are included.[20] Gross figures were selected here as net expenditures largely depend on the future development of energy and carbon prices at European as well as at global scale.[21]

A comparison of the technology- or sector-specific figures by scenario shows significant differences between both cases. This illustrates the need to increase support levels if an ambitious and accelerated RES deployment is targeted. However, the figures of the ACT case represent the upper limit of such support requirements, where a fine tuning of the EU-wide equally conditioned technology-specific support levels to the circumstances in Latvia offers a significant potential for cost reduction.[22]

Consequently, if Latvia follows the NAT policy track the support requirements would decrease significantly. An important precondition for that is however that the implemented RES policy needs to be classified as stable and the investor's risk is reduced to a low level (e.g. by offering a guaranteed duration of support (incl. support levels)).

**Table 1-17:** Weighted average (2011 to 2020) total remuneration for yearly new RES installation in Latvia – NAT and ACT scenario

[20] For the case of small-scale RES heating systems this shall mean the price of heat supply based on a typical conventional reference technology.

[21] Obviously, also gross figures are not independent from the future development of energy prices. As the price development for energy related equipment in the years before the financial crisis (2008) has shown, prices (and largely also cost) for most types of power plants coincided to a large extent with rising energy and raw material prices.

The overall impact of energy prices on support cost is however seen larger on net compared to gross figures.

[22] Compare e.g. total remuneration for RES in the heat sector: Although support is significantly higher in the ACT case differences in terms of resulting RES deployment are comparatively small.

| *RES policy indicator (i.e. required total remuneration)* | Weighted average (2011 to 2020) total remuneration for yearly new RES installations [€/MWh$_{RES}$] | Weighted average (2011 to 2020) total remuneration for yearly new RES installations [€/MWh$_{RES}$] |
|---|---|---|
| | NAT (National target fulfillment) | ACT (proactive support - realisable deployment) |
| Biogas | 140.3 | 145.4 |
| (Solid) Biomass | 137.3 | 144.3 |
| Biowaste | 102.3 | 111.2 |
| Geothermal electricity | 0.0 | 0.0 |
| Hydro large-scale | 82.2 | 121.5 |
| Hydro small-scale | 97.0 | 125.2 |
| Photovoltaics | 340.3 | 371.1 |
| Solar thermal electricity | 0.0 | 0.0 |
| Tide & Wave | 0.0 | 0.0 |
| Wind onshore | 100.0 | 102.0 |
| Wind offshore | 114.9 | 119.8 |
| RES-E (average) | 116.1 | 123.4 |
| RES heat (district heat) | 60.1 | 79.6 |
| RES heat (decentral) | 95.6 | 118.4 |
| Biofuel (average) | 113.6 | 113.6 |

**Source:** Green-X Model (2009)

### 1.3.3 Increasing biomass availability

As **Tables 1-18** and **1-19** depict, the use of biomass in terms of primary energy will be 1,757 ktoe in 2015. Until 2020, this amount will grow to almost 2,100 ktoe. It is noticeable that variations between scenarios are rather small and imports will only play a minor role under all scenarios. Forestry products strongly dominate the biomass market.

**Table 1-18:** Availability of biomass in Latvia – NAT scenario

| Latvia | | NAT (National target fulfillment) | | | |
|---|---|---|---|---|---|
| Feedstock category | Unit | Total 2015 | Imports 2015 | Total 2020 | Imports 2020 |
| Agricultural products | [ktoe] | 92 | 8 | 159 | 17 |
| Agricultural residues | [ktoe] | 111 | : | 183 | : |
| Forestry products | [ktoe] | 1,115 | : | 1,285 | : |
| Forestry residues | [ktoe] | 402 | 5 | 415 | 8 |
| Biowaste | [ktoe] | 24 | : | 27 | : |
| Total biomass availibility | [ktoe] | 1,757 | | 2,094 | |

**Source:** Green-X Model (2009)

**Table 1-19:** Availability of biomass in Latvia – ACT scenario

| Latvia | | ACT (proactive support - realisable deployment) | | | |
|---|---|---|---|---|---|
| Feedstock category | Unit | Total 2015 | Imports 2015 | Total 2020 | Imports 2020 |
| Agricultural products | [ktoe] | 92 | 8 | 164 | 17 |
| Agricultural residues | [ktoe] | 111 | : | 183 | : |
| Forestry products | [ktoe] | 1,115 | : | 1,285 | : |
| Forestry residues | [ktoe] | 402 | 5 | 415 | 8 |
| Biowaste | [ktoe] | 24 | : | 27 | : |
| Total biomass availibility | [ktoe] | 1,757 | | 2,099 | |

**Source:** Green-X Model (2009)

### 1.3.4 Flexibility/Joint projects/European perspective

**Table 1-20:** Excess and deficit production of renewables compared to the indicative trajectory in Latvia – EU scenario

| Latvia | | EU (European perspercitve) vs.Indicative trajectory | | | | |
|---|---|---|---|---|---|---|
| Sector | Unit | Average 2011 - 2012 | Average 2013 - 2014 | Average 2015 - 2016 | Average 2017 - 2018 | 2020 |
| Excess | [ktoe] | 38 | 20 | : | : | : |
| Deficit | [ktoe] | : | : | 7 | 19 | 93 |

**Source:** Green-X Model (2009)

**Table 1-21:** Excess and deficit production of renewables compared to the indicative trajectory in Latvia – NAT scenario

| Latvia | | NAT (National target fulfillment) | | | | |
|---|---|---|---|---|---|---|
| Sector | Unit | Average 2011 - 2012 | Average 2013 - 2014 | Average 2015 - 2016 | Average 2017 - 2018 | 2020 |
| Excess | [ktoe] | 44 | 27 | 9 | 10 | : |
| Deficit | [ktoe] | : | : | : | : | 46 |

**Source:** Green-X Model (2009)

**Table 1-22:** Excess and deficit production of renewables compared to the indicative trajectory in Latvia – ACT scenario

| Latvia | | ACT (proactive support - realisable deployment) | | | | |
|---|---|---|---|---|---|---|
| Sector | Unit | Average 2011 - 2012 | Average 2013 - 2014 | Average 2015 - 2016 | Average 2017 - 2018 | 2020 |
| Excess | [ktoe] | 44 | 32 | 20 | 28 | : |
| Deficit | [ktoe] | : | : | : | : | 24 |

**Source:** Green-X Model (2009)

## 1.4 Estimated costs & benefits of RES policy support measures

### Expected renewable energy use

Until 2020, renewable energy use will rise by about 65% compared to 2005 and will reach 2,264 ktoe in the NAT and 2,286 ktoe in the ACT scenario.

Under each scenario, the heating sector will be the main contributor the renewable energy production with a share of 72% of all renewable energy produced. Renewable electricity will make up more than 20% of all renewable energy produced. The transport sector will remain of lower importance, with just around 6% of all renewable energy produced under all scenarios.

### Expected GHG reduction

GHG emissions will be reduced substantially under both scenarios. Under the NAT and the ACT scenario, 25 Mt $CO_2$ and 26 Mt $CO_2$ will be saved until 2020.

Around 60% of the $CO_2$ reduction will come from the heating sector, while around 30% will be contributed be the electricity sector. Renewable transport fuels will only play a minor role in reducing $CO_2$ emissions.

### Expected job creation

The effects on the job market are based on the study EmployRES published by Fraunhofer ISI, EEG, Rütter + Partner, LEI and SEURECO. In this study, the total gross employees due to the renewable energy field are analysed in three scenarios. The first scenario is a business as usual scenario (BAU scenario) assuming the current renewable energy policy will be retained. The second scenario assumes a stronger RES policy (advanced policy scenario) and is comparable to the EU scenario of Green-X. The third scenario is a hypothetical scenario assuming that no further support for renewables is given after 2006.

The efforts to achieve the target to produce 40% of

Latvia's energy from renewable sources will add in the BAU and advanced policy scenario the following total gross jobs figures:

**Table 1-23:** Additional employees in the renewable energy sector of Latvia

| Latvia | Unit | 2010 | 2015 | 2020 |
|---|---|---|---|---|
| BAU scenario | 1000 Empl. | 45.4 | 45.1 | 44.0 |
| Advanced policy scenario | 1000 Empl. | 46.0 | 54.8 | 49.9 |

**Source:** Fraunhofer ISI; EEG; Rütter + Partner; LEI; SEURECO (2009)

### Avoided fossil fuel imports

The avoidance of fossil fuel imports will be similarly drastic under both scenarios. When the ACT scenario is assumed, cumulative avoidance of fossil fuel imports will rise to 10,372 ktoe equaling 4,448 M€. Similarly, in the NAT scenario are 10,140 ktoe or 4,350 M€ saved until 2020.

In general, slightly less than 60% of all savings will be due to the heating sector. Avoided fossil fuel imports in the electricity sector will contribute around one third to all savings. Although contributing only relatively little to the total avoided fossil fuel imports, biofuels will still play a minor role in absolute numbers.

### Expected capital expenditures

Capital expenditures, i.e. the investments in RES related technology, will cumulate to 3,959 M€ until 2020 under the NAT scenario. They will sum up to 4,117 M€ under the ACT scenario until 2020. It can generally be stated, that investments in the heating sector will be the highest making up slightly less than 60% of all investment expenditures in both scenarios, followed by the electricity sector with around 40% of all investments.

### Expected costs of achieving the 2020 target

*Policy cost:*

Policy costs, i.e. consumer expenditures due to RES support, will cumulate to 2,363 M€ under the NAT and to 3,855 M€ under the ACT scenario until 2020. Policy costs generated in the heating sector will make up two thirds of all policy costs under the NAT scenario, while their share rises to 75% under the ACT scenario.

*Additional generation costs:*

Additional generation costs will cumulate to 281 M€ under the NAT scenario and to 308 M€ under the ACT scenario.

### Avoided external costs

The avoided external costs are the avoided GHG emissions expressed in monetary terms.

722 M€ are saved in the NAT and 738 M€ in the ACT scenario cumulatively from 2006 to 2020, of which the main contributor is the heat sector.

## 1.5 Outline of RES industry

The comments gathered from the RES industry have highlighted that in general the targets developed using the Green-X model are challenging but possible. However for reaching these targets it will be necessary that the Latvian government set up appropriate and transparent support schemes with a clear regulatory framework. In this respect the availability of financial coverage for support schemes looks a serious barrier in particular for the next years. The policy should be properly developed to promote the use of all RES in the most effective and costs efficient way.

Hidden support to fossil fuels, in particular natural gas, should be properly addressed, for example re-designing the feed-in tariff system or introducing higher taxation on the use of fossil fuels (closer to EU levels).

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# Appendix 1 - Overview on investigated cases

Within this project we have calculated three different scenarios of the future renewable energy development up to 2020. These scenarios are meant to form a basis for establishing the 27 national energy roadmaps. The following gives an overview of the three aims of the scenarios. Generally, in all scenarios it is preconditioned to pursue the overall 20% RES by 2020 on EU scale. All results of the scenario calculations are depicted in terms of RES deployment as well as the associated costs and benefits.

NAT – National target fulfillment:

Within the NAT scenario each Member States tries to fulfil its national RES target by its own. The use of cooperation mechanisms as agreed in the RES Directive is reduced to necessary minimum: For the exceptional case that a member state would not possess sufficient RES potentials, cooperation mechanisms would serve as a complementary option. Additionally, if a member state possesses barely sufficient RES potentials, but their exploitation would cause significantly higher consumer expenditures compared to the EU average, cooperation would serve as complementary tool to assure target achievement. As a consequence of above, the required RES support will differ comparatively large among the countries.

EU – European perspective:

In contrast to the NAT case, within the EU scenario the use of cooperation mechanisms does not represent the exceptional case: If a member state would not possess sufficient potentials that can be economically exploited, cooperation mechanisms as defined in the RES directive would serve as a complementary option. Consequently, the prior aim of the EU scenario is to fulfil the 20% RES target on EU level, rather than fulfilling each national RES target purely domestically. Generally, it reflects a "least cost" strategy in terms of consumer expenditures (due to RES support). In contrast to simple short-term least cost policy approaches, the applied technology-specification of RES support does however still allow an EU-wide well balanced RES portfolio.

ACT – proactive support – realizable deployment:

Finally, the ACT scenario depicts an optimistic future with respect to RES exploitation. The assumption is taken that all EU member states apply proactive RES support whereby EU-wide equal incentives are preconditioned for individual RES technologies (e.g. by applying a harmonised but technology-specific premium feed-in system to support RES-E). With EU-wide effective and efficient RES support this scenario ends up with a higher RES exploitation as foreseen in the RES directive.

# Appendix 2 - Results and figures for a low energy demand

<u>Based on PRIMES high energy efficiency case scenario</u>

Sectoral targets and trajectories – NAT scenario Latvia

| Latvia | | NAT (National target fulfillment) | | | | | |
|---|---|---|---|---|---|---|---|
| Indicator | Unit | 2005 | Average 2011 - 2012 | Average 2013 - 2014 | Average 2015 - 2016 | Average 2017 - 2018 | 2020 Targets |
| Expected Gross Final energy consumption | Ktoe | 4,292 | 5,099 | 5,161 | 5,231 | 5,319 | 5,433 |
| Total share of RES in final energy consumption | % | 32.3% | 34.6% | 35.5% | 36.6% | 38.2% | 40.3% |
| Gross Final Consumption of RES-E | Ktoe | 261 | 315 | 353 | 396 | 435 | 465 |
| Share of RES-E in gross final electricity consumption | % | 43.0% | 41.5% | 45.5% | 49.6% | 52.1% | 52.6% |
| Gross final energy consumption RES-H | Ktoe | 1,124 | 1,395 | 1,405 | 1,431 | 1,495 | 1,595 |
| Share of RES-H in final Heating and Cooling consumption | % | 42.9% | 46.0% | 46.4% | 47.1% | 48.7% | 51.2% |
| Final energy from renewable sources consumed in transport | Ktoe | 2 | 52 | 74 | 85 | 100 | 132 |
| Share of RES in gross final transport energy consumption | % | 0.3% | 4.4% | 6.0% | 6.7% | 7.7% | 10.0% |

**Source:** Green-X Model (2009)

Sectoral targets and trajectories – ACT scenario Latvia

| Latvia | | ACT (proactive support - realisable deployment) | | | | | |
|---|---|---|---|---|---|---|---|
| Indicator | Unit | 2005 | Average 2011 - 2012 | Average 2013 - 2014 | Average 2015 - 2016 | Average 2017 - 2018 | 2020 Targets |
| Expected Gross Final energy consumption | Ktoe | 4,292 | 5,099 | 5,161 | 5,231 | 5,319 | 5,433 |
| Total share of RES in final energy consumption | % | 32.3% | 34.8% | 36.0% | 37.5% | 39.7% | 42.0% |
| Gross Final Consumption of RES-E | Ktoe | 261 | 318 | 363 | 420 | 477 | 517 |
| Share of RES-E in gross final electricity consumption | % | 43.0% | 41.9% | 46.8% | 52.6% | 57.2% | 58.5% |
| Gross final energy consumption RES-H | Ktoe | 1,124 | 1,407 | 1,422 | 1,458 | 1,535 | 1,636 |
| Share of RES-H in final Heating and Cooling consumption | % | 42.9% | 46.3% | 46.9% | 48.0% | 50.0% | 52.5% |
| Final energy from renewable sources consumed in transport | Ktoe | 2 | 52 | 74 | 85 | 100 | 132 |
| Share of RES in gross final transport energy consumption | % | 0.3% | 4.4% | 6.0% | 6.7% | 7.7% | 10.0% |

**Source:** Green-X Model (2009)

Contribution of renewables to electricity consumption – NAT scenario Latvia

| Latvia | NAT (National target fulfillment) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Technology | 2005 | | Average 2011 - 2012 | | Average 2013 - 2014 | | Average 2015 - 2016 | | Average 2017 - 2018 | | 2020 Targets | |
| | MW | GWh | MW | GWh | MW | GWh | MW | GWh | MW | GWh | MW | GWh |
| Biomass | 10.0 | 42 | 60.3 | 337 | 78.6 | 455 | 95.0 | 562 | 112.3 | 673 | 144.7 | 866 |
| Solid | 3.0 | 6 | 43.7 | 260 | 57.4 | 349 | 67.2 | 413 | 73.2 | 452 | 80.7 | 501 |
| Biogas | 7.0 | 36 | 14.6 | 64 | 18.2 | 87 | 24.8 | 129 | 36.1 | 202 | 61.0 | 346 |
| MSW | 0.0 | 0 | 2.1 | 13 | 3.0 | 19 | 3.0 | 19 | 3.0 | 19 | 3.0 | 19 |
| Liquid | : | : | : | : | : | : | : | : | : | : | : | : |
| Concentrated Solar | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 |
| Geothermal | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 |
| Hydro, total | 1,536.0 | 2,947 | 1,613.8 | 3,078 | 1,637.9 | 3,132 | 1,652.1 | 3,165 | 1,660.8 | 3,188 | 1,661.6 | 3,189 |
| >10MW | 1,511.0 | 2,895 | 1,570.9 | 2,966 | 1,580.8 | 2,985 | 1,580.8 | 2,985 | 1,580.8 | 2,985 | 1,580.8 | 2,985 |
| <10MW | 25.0 | 52 | 42.9 | 112 | 57.1 | 147 | 71.2 | 180 | 80.0 | 203 | 80.7 | 205 |
| Of which pumping | : | : | : | : | : | : | : | : | : | : | : | : |
| Photovoltaic | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 |
| Ocean | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 |
| Wind | 26.0 | 45 | 97.8 | 247 | 205.5 | 516 | 364.8 | 883 | 513.6 | 1,201 | 581.5 | 1,350 |
| Onshore | 26.0 | 45 | 94.4 | 237 | 197.6 | 491 | 352.4 | 844 | 496.9 | 1,147 | 557.8 | 1,272 |
| Offshore | 0.0 | 0 | 3.4 | 11 | 7.9 | 25 | 12.4 | 39 | 16.7 | 54 | 23.7 | 78 |
| Gross Final Consumption of electricity from RES | 1,572.0 | 3,034 | 1,771.9 | 3,662 | 1,922.0 | 4,103 | 2,111.9 | 4,609 | 2,286.8 | 5,062 | 2,387.7 | 5,405 |

**Source:** Green-X Model (2009)

Contribution of renewables to electricity consumption – ACT scenario Latvia

| Latvia | ACT (proactive support - realisable deployment) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Technology | 2005 | | Average 2011 - 2012 | | Average 2013 - 2014 | | Average 2015 - 2016 | | Average 2017 - 2018 | | 2020 | |
| | MW | GWh | MW | GWh | MW | GWh | MW | GWh | MW | GWh | MW | GWh |
| Biomass | 10.0 | 42 | 63.4 | 351 | 85.7 | 488 | 114.4 | 664 | 150.3 | 886 | 186.0 | 1,085 |
| Solid | 3.0 | 6 | 46.7 | 274 | 64.5 | 381 | 86.5 | 515 | 111.2 | 665 | 121.7 | 718 |
| Biogas | 7.0 | 36 | 14.6 | 64 | 18.2 | 87 | 24.8 | 129 | 36.1 | 202 | 61.3 | 348 |
| MSW | 0.0 | 0 | 2.1 | 13 | 3.0 | 19 | 3.0 | 19 | 3.0 | 19 | 3.0 | 19 |
| Liquid | : | : | : | : | : | : | : | : | : | : | : | : |
| Concentrated Solar | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 |
| Geothermal | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 |
| Hydro, total | 1,536.0 | 2,947 | 1,624.4 | 3,097 | 1,684.0 | 3,214 | 1,739.6 | 3,329 | 1,793.7 | 3,438 | 1,821.1 | 3,493 |
| >10MW | 1,511.0 | 2,895 | 1,581.6 | 2,985 | 1,626.9 | 3,067 | 1,668.4 | 3,149 | 1,712.4 | 3,231 | 1,731.3 | 3,266 |
| <10MW | 25.0 | 52 | 42.9 | 112 | 57.1 | 147 | 71.2 | 180 | 81.3 | 206 | 89.8 | 227 |
| Of which pumping | : | : | : | : | : | : | : | : | : | : | : | : |
| Photovoltaic | 0.0 | 0 | 3.5 | 3 | 8.3 | 6 | 14.3 | 11 | 24.6 | 18 | 47.6 | 35 |
| Ocean | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 |
| Wind | 26.0 | 45 | 97.8 | 247 | 205.5 | 516 | 364.8 | 883 | 518.5 | 1,209 | 606.4 | 1,393 |
| Onshore | 26.0 | 45 | 94.4 | 237 | 197.6 | 491 | 352.4 | 844 | 501.8 | 1,156 | 582.8 | 1,315 |
| Offshore | 0.0 | 0 | 3.4 | 11 | 7.9 | 25 | 12.4 | 39 | 16.7 | 54 | 23.7 | 78 |
| Gross Final Consumption of electricity from RES | 1,572.0 | 3,034 | 1,789.1 | 3,698 | 1,983.5 | 4,224 | 2,233.1 | 4,886 | 2,487.1 | 5,551 | 2,661.1 | 6,007 |

**Source:** Green-X Model (2009)

Contribution of renewables to heating and cooling consumption – NAT scenario Latvia

| Latvia | NAT (National target fulfillment) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Technology | 2005 | | Average 2011 - 2012 | | Average 2013 - 2014 | | Average 2015 - 2016 | | Average 2017 - 2018 | | 2020 | |
| | MWth | Ktoe | MWth | Ktoe | MWth | Ktoe | MWth | Ktoe | MWth | Ktoe | MWth | Ktoe |
| Biomass | 0 | 1,124 | 8,284 | 1,393 | 8,171 | 1,402 | 8,176 | 1,425 | 8,424 | 1,485 | 8,859 | 1,580 |
| Solid | 0 | 1,122 | 8,261 | 1,388 | 8,142 | 1,395 | 8,144 | 1,418 | 8,387 | 1,477 | 8,810 | 1,571 |
| Biogas | : | 2 | 13 | 3 | 15 | 4 | 18 | 4 | 24 | 4 | 36 | 6 |
| Biowaste | : | 0 | 10 | 2 | 14 | 4 | 14 | 4 | 14 | 4 | 14 | 4 |
| Geothermal | : | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Solar Thermal | : | 0 | 2 | 0 | 2 | 0 | 15 | 1 | 68 | 3 | 134 | 5 |
| Heat pumps | : | 0 | 9 | 1 | 20 | 3 | 32 | 5 | 44 | 7 | 64 | 10 |
| Gross final energy consumption from RES in heating and cooling | 0 | 1,124 | 8,295 | 1,395 | 8,193 | 1,405 | 8,223 | 1,431 | 8,536 | 1,495 | 9,057 | 1,595 |

**Source:** Green-X Model (2009)

Contribution of renewables to heating and cooling consumption – ACT scenario Latvia

| Latvia | ACT (proactive support - realisable deployment) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Technology | 2005 | | Average 2011 - 2012 | | Average 2013 - 2014 | | Average 2015 - 2016 | | Average 2017 - 2018 | | 2020 | |
| | MWth | Ktoe | MWth | Ktoe | MWth | Ktoe | MWth | Ktoe | MWth | Ktoe | MWth | Ktoe |
| Biomass | 0 | 1,124 | 8,339 | 1,404 | 8,250 | 1,415 | 8,301 | 1,448 | 8,605 | 1,520 | 9,019 | 1,614 |
| Solid | 0 | 1,122 | 8,316 | 1,398 | 8,221 | 1,408 | 8,269 | 1,441 | 8,568 | 1,512 | 8,969 | 1,605 |
| Biogas | : | 2 | 13 | 3 | 15 | 4 | 18 | 4 | 24 | 4 | 36 | 6 |
| Biowaste | : | 0 | 10 | 2 | 14 | 4 | 14 | 4 | 14 | 4 | 14 | 4 |
| Geothermal | : | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Solar Thermal | : | 0 | 42 | 2 | 94 | 4 | 147 | 6 | 205 | 8 | 305 | 11 |
| Heat pumps | : | 0 | 9 | 1 | 20 | 3 | 32 | 5 | 44 | 7 | 64 | 10 |
| Gross final energy consumption from RES in heating and cooling | 0 | 1,124 | 8,390 | 1,407 | 8,365 | 1,422 | 8,480 | 1,458 | 8,854 | 1,535 | 9,387 | 1,636 |

**Source:** Green-X Model (2009)

Contribution of renewables to transport consumption – all scenarios Latvia

| Latvia | | NAT | | | ACT | | |
|---|---|---|---|---|---|---|---|
| Technology | Unit | 2005 | Average 2011 - 2012 | Average 2013 - 2014 | Average 2015 - 2016 | Average 2017 - 2018 | 2020 |
| Bioethanol | ktoe | 0.0 | 14.1 | 22.1 | 22.1 | 22.1 | 22.1 |
| Of which imported | ktoe | : | : | : | : | : | : |
| Biodiesel | ktoe | 3.0 | 7.7 | 11.6 | 3.6 | 0.0 | 7.1 |
| Of which imported | ktoe | : | : | : | : | : | : |
| Biofuels from wastes, residues, non-food cellulosic material, and ligno-cellulosic material | ktoe | : | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Of which imported | ktoe | : | : | : | : | : | : |
| Hydrogen from RES | ktoe | : | : | : | : | : | : |
| Renewable electricity | ktoe | : | : | : | : | : | : |
| Biofuel import | ktoe | : | 30.6 | 40.1 | 59.6 | 77.4 | 102.4 |
| Final energy from renewable sources consumed in transport | ktoe | 3.0 | 52.4 | 73.9 | 85.3 | 99.5 | 131.7 |

**Source:** Green-X Model (2009)

## Appendix 3 - Short characterization of the Green-X model

As in previous projects such as FORRES 2020, OPTRES or PROGRESS the ***Green-X*** model was applied to again perform a detailed quantitative assessment of the future deployment of renewable energies on country-, sectoral- as well as technology level. The core strength of this tool lies on the detailed RES resource and technology representation accompanied by a thorough energy policy description, which allows assessing various policy options with respect to resulting costs and benefits. A short characterisation of the model is given below, whilst for a detailed description we refer to www.green-x.at.

*Short characterisation of the **Green-X** model*

*The model **Green-X** has been developed by the Energy Economics Group (EEG) at Vienna University of Technology in the research project "Green-X – Deriving optimal promotion strategies for increasing the share of RES-E in a dynamic European electricity market", a joint European research project funded within the 5th framework program of the European Commission, DG Research (Contract No. ENG2-CT-2002-00607). Initially focussed on the electricity sector, this tool and its database on RES potentials and costs have been extended within follow-up activities to incorporate renewable energy technologies within all energy sectors.*

***Green-X** covers geographically the EU-27, and can easily be extended to other countries such as Turkey, Croatia or Norway. It allows to investigate the future deployment of RES as well as accompanying cost – comprising capital expenditures, additional generation cost (of RES compared to conventional options), consumer expenditures due to applied supporting policies, etc. – and benefits – i.e. contribution to supply security (avoidance of fossil fuels) and corresponding carbon emission avoidance. Thereby, results are derived at country- and technology-level on a yearly basis. The time-horizon allows for in-depth assessments up to 2020, accompanied by concise out-looks for the period beyond 2020 (up to 2030).*

*Within the model, the most important RES-Electricity (i.e. biogas, biomass, biowaste, wind on- & offshore, hydropower large- & small-scale, solar thermal electricity, photovoltaics, tidal stream & wave power, geothermal electricity), RES-Heat technologies (i.e. biomass – subdivided into log wood, wood chips, pellets, grid-connected heat -, geothermal (grid-connected) heat, heat pumps and solar thermal heat) and RES-Transport options (e.g. first generation biofuels (biodiesel and bioethanol), second generation biofuels (lignocellulotic bioethanol, BtL) as well as the impact of biofuel imports) are described for each investigated country by means of dynamic cost-resource curves. This allows besides the formal description of potentials and costs a detailed representation of dynamic aspects such as technological learning and technology diffusion.*

*Besides the detailed RES technology representation the core strength of the model is the in-depth energy policy representation. Green-X is fully suitable to investigate the impact of applying (combinations of) different energy policy instruments (e.g. quota obligations based on tradable green certificates / guarantees of origin, (premium) feed-in tariffs, tax incentives, investment incentives, impact of emission trading on reference energy prices) at country- or at European level in a dynamic framework. Sensitivity investigations on key input parameters such as non-economic barriers (influencing the technology diffusion), conventional energy prices, energy demand developments or technological progress (technological learning) typically complement a policy assessment.*

# Appendix 4 - Method of approach / Key assumptions – Latvia

The method of approach and related key assumptions for the scenario elaboration undertaken within the REPAP2020 project will be discussed subsequently, describing the approach and parameters used for the model-based policy assessment undertaken as conducted by means of policy scenarios. Finally, an overview on assessed cases concludes this appendix.

## 1 The policy assessment tool: the *Green-X* model

As in previous projects such as FORRES 2020, OPTRES or PROGRESS the ***Green-X*** model was applied to again perform a detailed quantitative assessment of the future deployment of renewable energies on country-, sectoral- as well as technology level. The core strength of this tool lies on the detailed RES resource and technology representation accompanied by a thorough energy policy description, which allows assessing various policy options with respect to resulting costs and benefits. A detailed characterisation of the model is given in www.green-x.at.

## 2 Overview of key parameters

In order to ensure maximum consistency with existing EU scenarios and projections the key input parameters of the scenarios presented in this report are derived from PRIMES modelling and from an updated edition of the ***Green-X*** database on RES potentials and cost as initially assessed within the 'FORRES 2020' study (see Ragwitz et al., 2005). Table 1 shows which parameters are based on PRIMES and which have been defined for this study. More precisely the PRIMES scenarios used are:

- The PRIMES scenario on meeting both EU targets by 2020 – i.e. on climate change (20% GHG reduction) and renewable energies (20% RES by 2020) / 2008 (PRIMES target case) (NTUA, 2008)
- The European Energy and Transport Trends by 2030 / 2007 / Efficiency Case (NTUA, 2007b)
- The European Energy and Transport Trends by 2030 / 2007 / Baseline Case (NTUA, 2007a)

*Table 1 Main input sources for scenario parameters*

| | |
|---|---|
| Based on PRIMES | Sectoral energy demand by country |
| | Primary energy prices (international) |
| | Conventional supply portfolio by energy sector by country and corresponding conversion efficiencies and $CO_2$ intensities |
| Defined for this study | National 2020 RES targets (based on proposed RES Directive) |
| | Sectoral reference energy prices by country |
| | RES potentials and cost by country (Green-X database) |
| | Biomass import restrictions |
| | Technology diffusion (and corresponding national non-economic RES barriers) |
| | Technological learning (mainly based on a 'global learning system') |

## 2.1 Energy demand

Figure 1 depicts the projected gross final energy demand development for Latvia according to the different PRIMES scenarios.

For the conducted policy assessment the following assumptions are taken: With respect to an ambitious RES exploitation (i.e. 20% RES by 2020 at EU-27 level) the PRIMES target case appears suitable as (default) reference for the policy assessment, whereby an increase in energy efficiency (compared to baseline) is preconditioned.


Figure 1 Comparison of projected gross final energy demand development up to 2020 in Latvia.

Source: PRIMES scenarios

## 2.2 Conventional supply portfolio

The conventional supply portfolio, i.e. the share of the different conversion technologies in each sector, has been based on the PRIMES forecasts on a country specific basis. These projections on the portfolio of conventional technologies have an impact in particular on the calculations done within this study on the avoidance of fossil fuels and $CO_2$ emissions. As it is at least out of the scope of this study to analyse in detail which conventional power plants would actually be replaced by for instance a wind farm installed in the year 2014 in a certain country (i.e. either a less efficient existing coal-fired plant or a possibly new high-efficient combined cycle gas turbine), the following assumptions are made:

- Keeping in mind that, besides renewable energies, fossil energy represents the marginal generation option that determines the prices on energy markets, it was decided to stick on country level to the sector-specific conventional supply portfolio projections as provided by PRIMES. Sector- as well as country-specific conversion efficiencies, as derived on a yearly basis, are used to derive the amount of avoided primary energy based on the renewable generation figures obtained. Assuming that the fuel mix stays unaffected, avoidance can be expressed in units of coal or gas replaced.
- A similar approach is chosen with regard to the avoidance of $CO_2$ emissions, where yearly changing average country- as well as sector-specific $CO_2$ intensities of the fossil-based conventional supply portfolio forms the basis.

In the following the derived data on aggregate conventional conversion efficiencies and the $CO_2$ intensities characterising the conventional reference system is presented.

Figure 2 shows the dynamic development of average conversion efficiencies as projected by PRIMES for conventional electricity generation as well as for grid-connected heat production. Thereby, conversion efficiencies are shown for both the PRIMES baseline and PRIMES efficiency case. Error bars indicate the range in country-specific average efficiencies between EU member states. For the transport sector, where efficiencies are not explicitly expressed in PRIMES results, the average efficiency of the refinery process to derive fossil diesel and gasoline was assumed to be 95%.

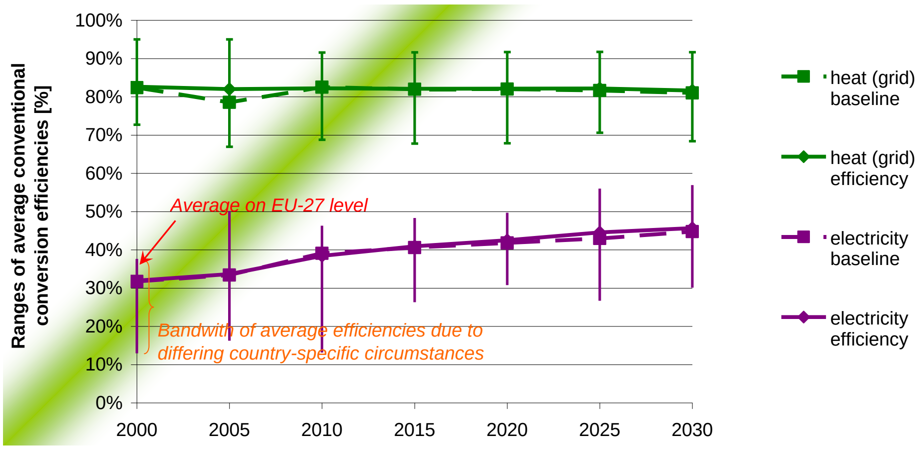


Figure 2 Country-specific average conversion efficiencies of conventional (fossil-based) electricity and grid-connected heat production in the EU27.

*Source: PRIMES scenarios*

The corresponding data on country- as well as sector-specific $CO_2$ intensities of the conventional energy conversion system are shown in Figure 3. Error bars again illustrate the variation over countries.

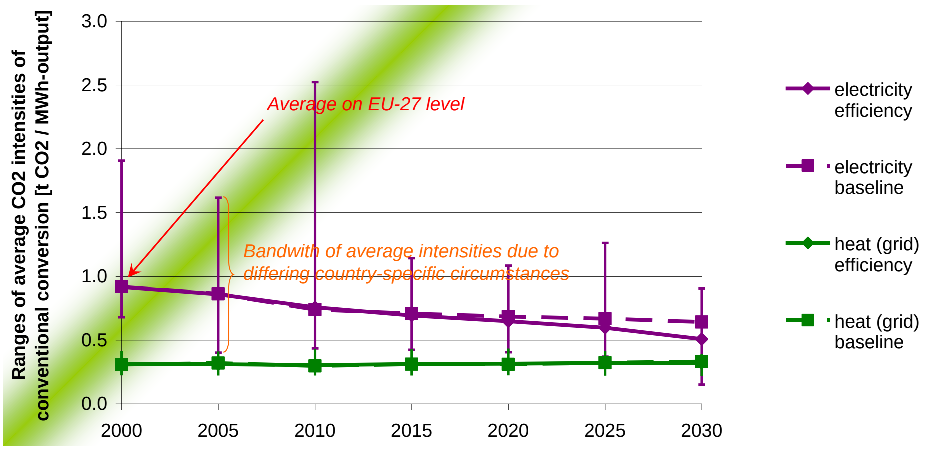


Figure 3 Country-specific average sectoral $CO_2$ intensities of the conventional (fossil-based) energy system in the EU27.

*Note: The differences between the PRIMES efficiency and baseline case for non-grid heat and transport are very small and therefore not shown*

*Source: PRIMES scenarios*

## 2.3 Fossil fuel and reference energy prices

National reference energy prices used in this analysis are based on the primary energy price assumptions as used in the EU energy outlook (as of 2007). The PRIMES data provide two different scenarios on future fossil energy prices: the so called default case and the high price case (as shown in Table 2). The latter case was used as (default) reference for all calculations. Compared to energy prices as observed in 2007 and the first three quarters of 2008 the price assumptions are for both PRIMES scenarios low for the later years up to 2020. In the high price case the oil price for instance goes up to 100 $ per barrel, which is still significantly below past energy prices as observed throughout 2008.

The $CO_2$-price in the scenarios presented in this report is exogenously set as shown in Table 3, again similar to corresponding EU scenarios (as for example in the impact assessment of the Energy and Climate package of the EU). Actual market prices (for 2006 EU Allowances) have fluctuated between 7 and 30 €/t, with averages fluctuating roughly between 15 and 20 €/t. In the model, it is assumed that $CO_2$-prices are directly passed through to electricity prices. This is done fuel-specific based on the PRIMES $CO_2$-emission factors.

Increased RES-deployment can have a $CO_2$-price reducing effect as it reduces the demand for $CO_2$-reductions. As RES-deployment should be anticipated in the EU Emission Trading System and the $CO_2$-price in the ***Green-X*** scenarios is exogenously set, this effect is not included, which represents a rather conservative approach.

*Table 2 International primary energy price assumptions in US$2005/boe, high price case (as used as default reference)*

| **International (fossil) reference energy prices** | | | | | |
|---|---|---|---|---|---|
| (default reference price development for imports to the EU - based on PRIMES high energy prices) | | | | | |
| *(exchange rate: 1€ = 1.25US$)* | [Unit] | 2005 | 2010 | 2015 | 2020 |
| Oil | [US$2005/boe] | 54.5 | 76.4 | 88.1 | 100.0 |
| | *[€/MWh]* | *27.4* | *38.4* | *44.2* | *50.2* |
| Gas | [US$2005/boe] | 34.6 | 59.1 | 67.4 | 77.0 |
| | *[€/MWh]* | *17.4* | *29.7* | *33.8* | *38.7* |
| Coal | [US$2005/boe] | 14.8 | 19.2 | 21.7 | 24.0 |
| | *[€/MWh]* | *7.4* | *9.6* | *10.9* | *12.1* |

Source: PRIMES scenarios

*Table 3 $CO_2$ price assumptions in €2005/ton (source: PRIMES scenarios)*

| **$CO_2$ price assumptions for the European ETS** | | | | | |
|---|---|---|---|---|---|
| | [Unit] | 2005 | 2010 | 2015 | 2020 |
| $CO_2$ price | [€/t $CO_2$] | 20.0 | 20.0 | 26.3 | 34.5 |

Source: PRIMES scenarios

*Table 4 Reference prices for electricity, heat and transport fuels on average at EU-27 level*

| Sectoral reference energy prices - on average at EU-27 level | | | | | | |
|---|---|---|---|---|---|---|
| (default reference price development - based on PRIMES high energy prices & PRIMES target case (demand)) | | | | | | average (06-20) |
| (expressed per MWh output) | [Unit] | 2006 | 2010 | 2015 | 2020 | |
| Electricity price (wholesale) | [€/MWh electricity] | 59.9 | 71.7 | 74.9 | 75.2 | 71.9 |
| Heat price (grid-connected) | [€/MWh heat, grid] | 33.0 | 43.4 | 49.4 | 56.5 | 46.2 |
| Heat price (decentral) | [€/MWh heat, decentral] | 58.0 | 73.1 | 80.5 | 88.4 | 76.0 |
| Transport fuel price | [€/MWh transport fuel] | 46.1 | 60.4 | 69.6 | 79.0 | 64.7 |

Reference prices for the electricity sector are taken from the ***Green-X*** model. Based on the primary energy prices, the $CO_2$-price and the country-specific power sector, the ***Green-X*** model determines country-specific reference electricity prices for each year in the period 2006 to 2020. Reference prices for the heat and transport sector are based on primary energy prices and the typical country-specific conventional conversion portfolio. Default sectoral reference energy prices for the ambitious policy pathways are illustrated in Table 4. More precisely, these prices represent the average at European level (EU-27) and refer to an energy demand development according to the PRIMES target case and the PRIMES high energy prices. Note that heat prices in case of grid-connected heat supply from district heating and CHP-plant do not include the cost of distribution – i.e. they represent the price directly at defined hand over point.

## 2.4 Interest rate / weighted average cost of capital - the role of (investor's) risk

*Table 5 Example of value setting for WACC calculation*

| | | Default risk assessment | | High risk assessment | |
|---|---|---|---|---|---|
| **WACC methodology** | **Abbreviation / Calculation** | Debt (d) | Equity (e) | Debt (d) | Equity (e) |
| Share equity / debt | g | 70.0% | 30.0% | 70.0% | 30.0% |
| Nominal risk free rate | $r_n$ | 4.0% | 4.0% | 4.0% | 4.0% |
| Inflation rate | $i$ | 2.0% | 2.0% | 2.0% | 2.0% |
| Real risk free rate | $r_f = r_n - i$ | 2.0% | 2.0% | 2.0% | 2.0% |
| Expected market rate of return | $r_m$ | 4.0% | 6.5% | 4.5% | 9.5% |
| Risk premium | $r_p = r_m - r_f$ | 2.0% | 4.5% | 2.5% | 7.5% |
| Equity beta | $b$ | | 1.6 | | 1.6 |
| Tax rate (corporation tax) | $r_t$ | | 25.0% | | 25.0% |
| Post-tax cost | $r_{pt}$ | 3.0% | 9.2% | 3.4% | 14.0% |
| Pre-tax cost | $r = r_{pt} / (1-r_t)$ | 4.0% | 12.3% | 4.5% | 18.7% |
| **Weighted average cost of capital** (pre-tax) | ***WACC*** | **6.5%** | | **8.8%** | |

Determining the necessary rate of return is based on the weighted average cost of capital (WACC) methodology. WACC is often used as an estimate of the internal discount rate of a project or the overall rate of return desired by all investors (equity and debt providers). This means that the WACC formula[23] determines the required rate of return on a company's total

[23] The WACC represents the necessary rate a prospective investor requires for investment in a new plant.

asset base and is determined by the Capital Asset Pricing Model (CAPM) and the return on debt. Formally, the pre-tax cost of capital is given by:

$$WACC^{pre\text{-}tax} = g_d \cdot r_d + g_e \cdot r_e = g_d \cdot [r_{fd} + r_{pd}] + g_e \cdot [r_{fe} + \beta \cdot r_{pe}] / (1 - r_t)$$

Table 5 illustrates the determination of the WACC exemplarily for two differing cases – a default and a high risk assessment. Within the model-based analysis a range of settings is applied to reflect investor's risk appropriate. Thereby, risk refers to two different issues:

- A *'policy risk'* related to uncertainty on future earnings caused by the support scheme itself – e.g. referring to the uncertain development of certificate prices within a RES trading system. As shown in Table 5, with respect to policy risk two different settings are used in the analysis, ranging from 6.5 % up to 8.8 %. The different values are based on a different risk assessment, a standard risk level and a set of risk levels characterised by a higher expected market rate of return. 6.5 % is used as the default value for stable planning conditions as given, e.g. under advanced fixed feed-in tariffs. The higher value is applied in scenarios with lower stable planning conditions, i.e. in the cases where support schemes cause a higher risk for investors as associated e.g. with RES trading (and related uncertainty on future earnings on the certificate market).
- A *'technology risk'* referring to uncertainty on future energy production due to unexpected production breaks, technical problems etc.. Such deficits may cause (unexpected) additional operational and maintenance cost or require substantial reinvestments which (after a phase out of operational guarantees) typically have to be born by the investors themselves. In this context, Figure (below) illustrates the default assumptions applied to consider investor's technology risk.

As default both policy and technology risk are considered in the assessment, leading to a higher WACC than the default level of 6.5%.

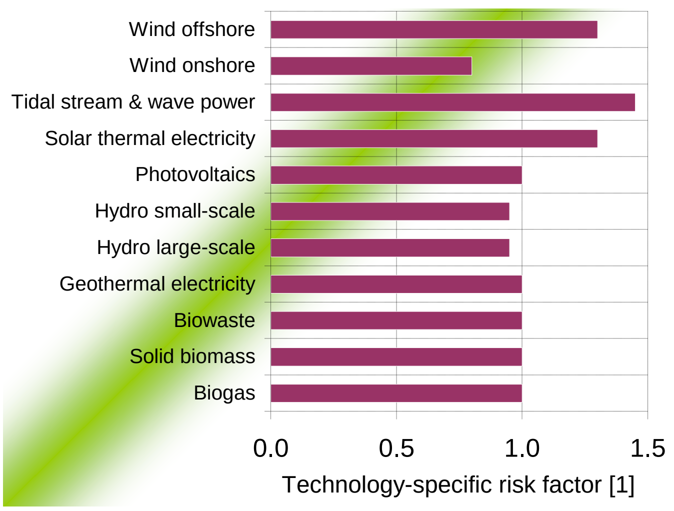


Figure 4 Technology-specific risk factors

## 2.5 Assumptions for simulated support schemes

A number of key input parameters were defined for each of the model runs referring to the specific design of the support instruments as described below.

► *General scenario conditions*

Consumer expenditure is heavily dependent on the design of policy instruments. In the policy variants investigated, it is obvious that the design options of the various instruments were chosen in such a way that expenditure is low. Accordingly, it is assumed that the investigated schemes are characterised by:

- a stable planning horizon
- a continuous RES-E policy / long-term RES-E targets and
- a clear and well defined tariff structure / yearly targets for RES(-E) deployment.

In addition, for all investigated scenarios the following design options are assumed:

- financial support is restricted to new capacity only,[24]
- the guaranteed duration of financial support is limited. [25]

With respect to model parameters reflecting *dynamic aspects such as technology diffusion or technological change*, the following settings are applied:

- *Removal of non-financial barriers and high public acceptance in the long term.*

  In the scenario runs it is assumed that the existing social, market and technical barriers (e.g. grid integration) can be overcome in time. Nevertheless, their impact is still relevant as is reflected in the BAU-settings (referring to a BAU scenario based on current RES support) compared to, e.g. the more optimistic view assumed for reaching an accelerated RES deployment as preconditioned in the policy assessment referring to the ambitious target of 20% RES by 2020.

- *A stimulation of 'technological learning' is considered – leading to reduced investment and O&M costs for RES-E and increased energy efficiency over time.*

  Thereby, moderate technological learning is preconditioned as default for all policy cases.

In the following, the model settings and assumptions are described for each type of support instrument separately. These assumptions refer to advanced support schemes as applied in the discussion of strengthened national and harmonised European wide policy instruments.

► *Feed-in tariffs*

Premium feed-in tariffs are defined as technology-specific; settings are applied so as to achieve an overall low burden for consumers. Tariffs decrease over time reflecting the achieved cost reductions on a technology level, but this annual adjustment in the level of support applies only to new installations. More precisely, whenever a new plant is installed, the level of support is fixed for the guaranteed duration (of 15 years as commonly applied in the case of generation-based support). A low risk premium (leading to a WACC of 6.5 %) is applied to reflect the small degree of uncertainty associated with the well defined design of this instrument.

► *Quota obligations with tradable green certificates (TGC) / guarantees of origin (GO)*[26]

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[24] This means that only plants constructed in the period 2005 to 2020 are eligible to receive support from the new schemes. Existing plants (constructed before 2005) remain in their old scheme.

[25] In the model runs, it is assumed that the time frame in which investors can receive (additional) financial support is restricted to 15 years for all instruments providing generation-based support.

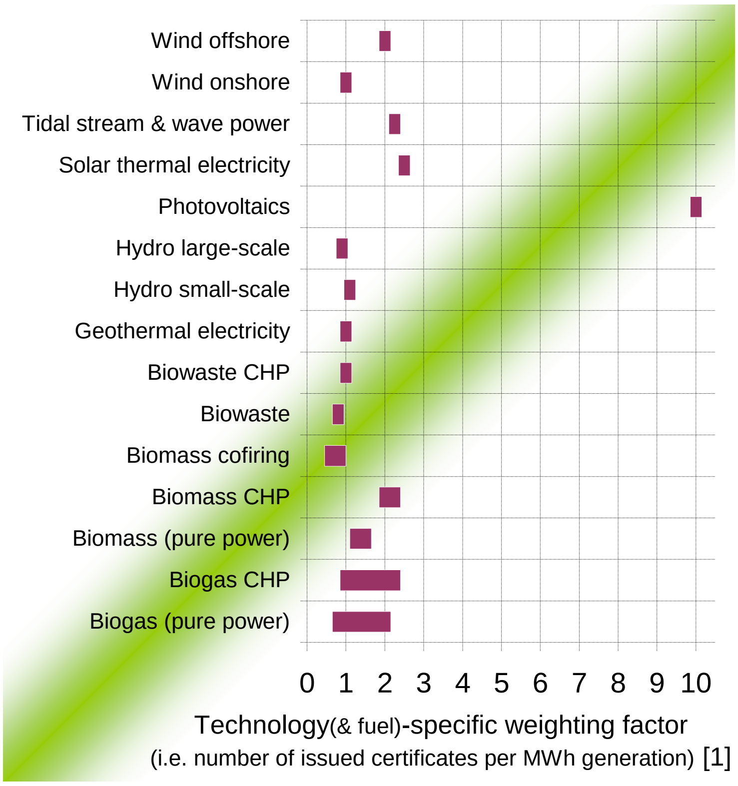


Figure 5 Technology-specific weighting factors (as assumed for the NAT and EU case in countries which currently already use a trading system to support RES-E)

In general, the assumption is taken that an advanced RES trading system where technology-specification of support is introduced via a banding approach will be applied in the future (from 2011 on). Advanced RES trading systems are used in both the NAT and the EU case in those countries which have already implemented a RES trading system to support RES-E, namely Belgium, Italy, Poland, Romania, Sweden and the UK.

Thereby, different weighting is given to different RES technologies in terms of the number of green certificates / guarantees of origin granted per MWh generation, e.g. wind offshore obtains twice the weighting as wind onshore – aiming to reflect the differing cost level or stages of market maturity, respectively, among the involved RES technology options. This approach would be inline with the proposed adaptation of UK's ROC's scheme. The applied assumptions with respect to technology-specific weighting factors are illustrated in Figure 5. Thereby, ranges indicate a further graduation of weighting factors by fuel (biomass) or technology (biomass (cofiring), biogas). Please note further that as default a penalty payment of 33 €/TGC is preconditioned.

Generally, in case of RES trading schemes 'policy risk' is assumed to be at a higher level (leading to a WACC of 8.8 %). Thereby, risk refers to the uncertainty about future earnings (on the power as well as on the TGC / GO market).

# 3 General remarks

[26] Note that in both the NAT and the EU case, the assumption is taken that a technology-specific weighting is introduced in order to achieve the required deployment of novel RES-E options without over-subsidizing mature low-cost RES-E technologies.

- The assessed cases follow the concept of strengthened national support: We assume a continuation of national RES policies until 2020 which will be further optimised in the future with regard to their effectiveness and efficiency. In particular the further fine-tuning of national support schemes will require in case of both (premium) feed-in tariff and quota systems a technology-specification of RES support. Thereby, in both the NAT and the EU case no change of the in prior chosen policy track is assumed – i.e. all countries which currently apply a feed-in tariff or quota system are assumed to use this type of support instrument also in the future.
- All cases build on a continuation of current RES support (BAU case) for the near future. More precisely, it is assumed that assumed policy changes will become effective by 2011.
- The fulfilment of the target of 20% RES by 2020 is preconditioned both at the EU level as well as at the national level for all cases. Moreover, the ACT case goes beyond that level of ambition and illustrates the impact of an EU-wide proactive RES support.
- The NAT and the EU case, both characterised by a strict target fulfilment, differ by the use / need of / for cooperation mechanisms. In the NAT case these flexibility options represent the exceptional case, while in the EU case they are more commonly used to achieve an EU-wide economically efficient RES exploitation. As a consequence of this, the required RES support will differ among the countries.
- The policy framework for biofuels in the transport sector is set equal under all assessed policy variants: An EU-wide trading regime based on physical trade of refined biofuels is assumed to assure an effective and efficient fulfilment of the countries requirement to achieve (at least) 10% RES in the transport sector by 2020. Other novel options in this respect such as e-mobility or hydrogen have not been assessed within this analysis – as also no direct impact on the overall RES target fulfilment can be expected.
- For all cases a removal of non-economic barriers (i.e. administrative deficiencies, grid access, etc.) is presumed for the future. More precisely, a stepwise removal of these deployment constraints, which allows an accelerated RES technology diffusion, is conditioned on the assumption that this process will be launched in 2010.

Results of the scenario calculations comprise details on RES deployment as well as on the associated costs and benefits.