# Romania Vision for Sustainable Energy

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This paper describes a Romania Sustainable Energy Vision. It includes a transition of the energy supply and demand with phase-out of fossil energy and energy imports over a 50-year period.

If this vision is turned into reality it will have a number of positive effects for Romania that is increasingly dependant on imports for its fossil fuel supply. With a transition to domestic energy sources, Romania will no longer be hurt directly by the energy prices increases of fossil fuels that many expect will come as a result of the dwindling resources of fossil fuels. With realisation of the vision, Romania would also be in the front in the reduction of climate change, a position that can be very valuable in the future. Further, the emphasis on local resources will also benefit the Romania economy with increased employment and a more positive trade balance.

The vision includes increased use of renewable energy, strong emphasis on energy efficiency, and reduction of natural gas after 2010.

Comments are welcome, see end.

**Factor 4 for Energy Efficiency**

In line with INFORSE's[1] global vision for sustainable energy, the Romania Vision is based on increase of energy efficiency to reach an average level in 2050 similar to best available technologies today. A number of studies have shown that with best available technology, on the market or close to market introduction, it is possible to increase energy efficiency with a factor four or more for most energy uses. Most energy consuming equipments will be changed several times until 2050, and if new generations of equipment are made with optimal energy performance, and markets are made to promote the most efficient technology, it will not be a problem to reach today's best available technology, even though the efficiency gains achieved are very large, - in the order of 4 times, similar to an annual increase of efficiency of about 3.3% per year from 2010 in average. This will not happen by itself, given that the "natural" technological development in EU countries has been about 1% per year. It will require concerted actions from stakeholders involved, but if it is done on EU-scale, and the market therefore is large for each new generation of efficient equipment, the changes will be cost-effective. The extra equipment costs will be off-set by energy savings. To realise this, it is, however, necessary to go beyond the conservatism of many market players in this field, and develop a truly enabling market for energy efficiency throughout the society. The factor four increase of efficiency is possible in Romanian road transport and, industrial heat and fuel demands, as well as electricity demand, except for construction and agricultural sectors that has little electric intensity today.

**The Challenge of Reducing Heat Consumption**

For buildings the situation is different from equipment and vehicles because buildings often have lifetimes of 100 years or more. Many of the houses to be heated in 2050 are already built. On the other hand, the need for large replacement or major renovation of block houses build during the socialist period gives an opportunity for large increases in efficiency, if appropriate standards and support is in place. For Romania the proposed energy conservation targets for domestic and service sectors are 25% reduction in specific energy consumption 2000 – 2020. In parallel, efforts to stop electric heating should be introduced. After 2020, efforts should be continued following EU regulation, leading to specific, final heat consumption of 2050 of 41% of the level in 2000. This is expected to be a combination of improved heating installations in houses and improved buildings.

**Efficient Transport**

For transport is assumed that the conversion-efficiency from fuel to transport-work is increased 2.5 times (from current 15- 20% in combustion engine systems to 50% in fuel cell systems with break-energy recoverage; direct electrically driven vehicles have even higher efficiency), and that the vehicles will be equipped with recoverage of break-energy, so the "end-use" of energy in transport is limited to the unavoidable friction losses in transport (except for aviation). This increase is

[1] International Network for Sustainable Energy, see www.inforse.org

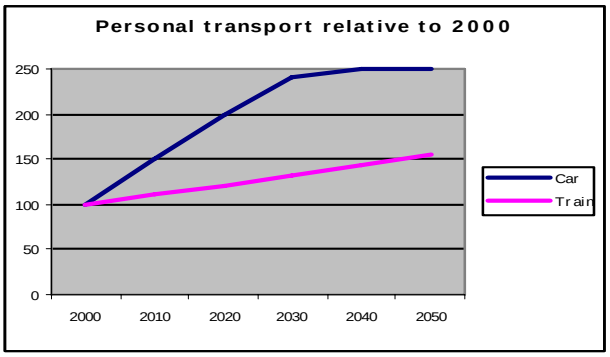
expected to happen until 2050. Most of the changes are only expected after 2020, and the efficiency increase 2000 – 2020 is only expected to be 22%.

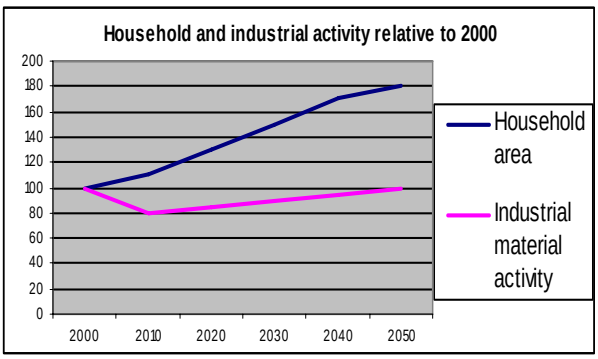
**Growth Factors**

The growth of energy services, i.e. heated floor space, transported goods and people, energy consuming production, is expected to be substantial for 2-3 decades and then level off for most sectors towards the end of the 50-year period of the vision. This corresponds with more rapid growth following the entrance into the EU and later approximation to the slower growth in the EU countries. The development is in general not "business as usual"; but will require policies to redirect economic development to less resource-demanding sectors and solutions, such as train transport instead of road transport for personal transport. Assumed growth in activities for Romania are:

- Floor space, households: 10% increase 2000 – 2010, then an increase per decade of 20% of the 2000-level 2010-2040, but 2040-2050 an increase of only 10% of the 2000 level, reacing a level in 2050 of 1.8 times the 2000-level
  Floor space service sectors: 60% increase 2000 – 2020 and then 25% 2020-2040 and 5% increase 2040-2050. The 2050 level will then be 2.1 times the 2000 – level.
- Electric appliances in households and service: 40% increase 2000 – 2010 because of the low current level and EU approximation, then 10% higher growth than in heated floorspace 2010-2020 and the similar growth as in heated floorspace. This will lead to an electric energy service level in 2050 of 2.2 times the 2000 level.
- Electric appliances in service sector: 50% increase 2000 – 2010 because of EU approximation the same growth as for heated floorspace. This will lead to an energy service level for electricity-using equipment in 2050 of 2.3 times the 2000 level.
- Industry: reduction in 2010 to 80% of the 2000-level following current trends, the gradually return to the 2000-level by 2050. This follows expected trends for other EU countries with no growth in processes demanding heat and fuels i.e. no growth in drivers for energy demand; assuming that future increased value in will come from improved quality instead of increased quantity, following trends in Western Europe. In spite this, we expect electricity service demand in the industry to grow to 1.8 times the 2000 – level by 2050.
- Personal transport: the vision includes a doubling of private car use 2000 – 2020, following current high growth and then slower growth to reach stabilisation in 2040 of 2.5 times the 2000-level.
- The use of trains is expected to grow slower with 1%/year increase during the period to reach 155% of the 2000-level by 2050.
- Other public transport (buses) is expected to increase 20% from 2000 until 2010 and then level off to reach 150% of the 2000-level by 2030 and the remain stable.
- Freight transport: We expect a growth of road freight of 150% 2000 – 2010, followed by a gradually slower increase 2010-2030 to reach 250% of the 2000-level and then remain stable. Rail freight is expected to increase slower to reach 150% of the 2000-level by 2050.

*Graphs: Development of selected activities 2000 - 2050 for Romania*



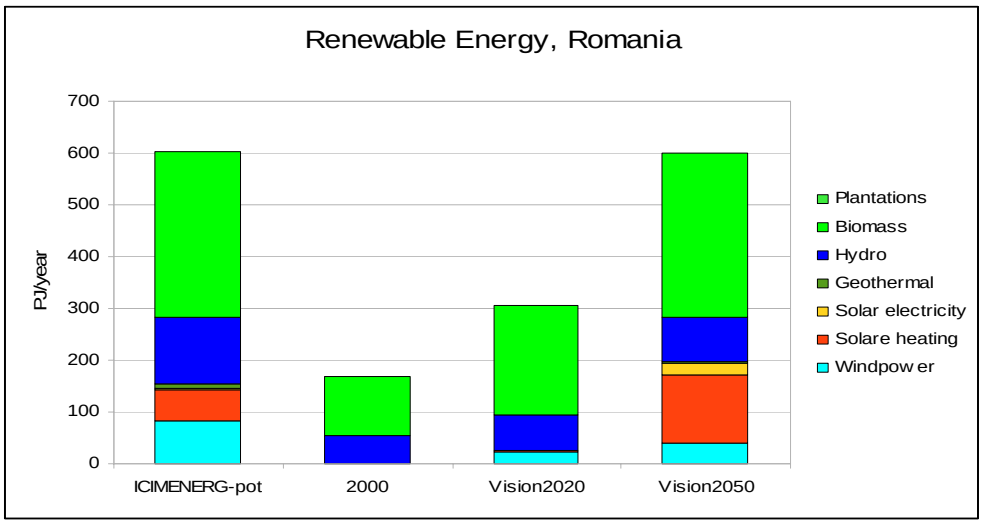



An underlining assumption for this development is a generally stable population, with fluctuations below approx. 10%.

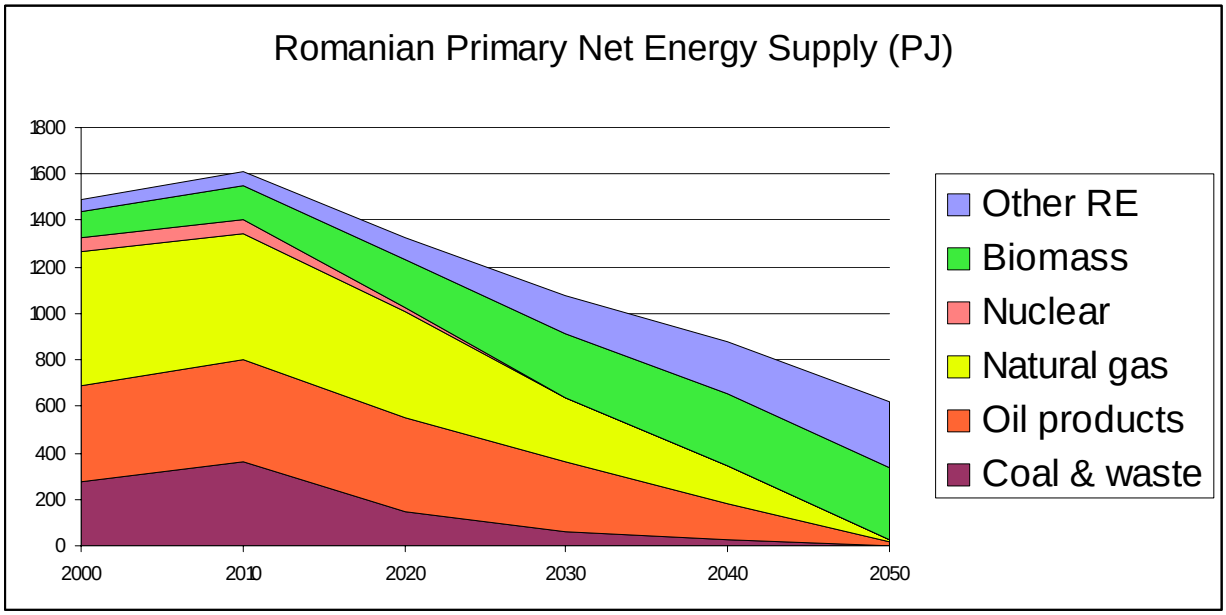
**Renewable Energy**
As a fraction of primary energy, renewable energy use is expected to grow from the 2000-level of 11% to 13% in 2010, to 23% in 2020, 40% in 2030, 61% in 2040 and over 95% in 2050. For electricity the renewable share is above the share of primary energy, starting with 36% of electricity demand in 2000 and increasing to 52% in 2020 and 94% in 2040.

The most important developments are in windpower and biomass use. Windpower is expected to grow to 1900 MW in 2020 ad 3400 MW in 2040 while biomass use is expected to grow from current 115 PJ/year to 318 PJ/year, equal to the sustainable potential. Also increased use of solar is including in the vision, with a total of 7 $m^2$ per capita of solar collectors and PV modules by 2050. Hydropower is expected to grow 62%, following official estimates of future hydropower use. Geothermal is also expected to grow; but not to play a major role.

*Graph: Increase in renewable energy supply, following this vision, compared with potentials from ICIMENERG, study 2007*

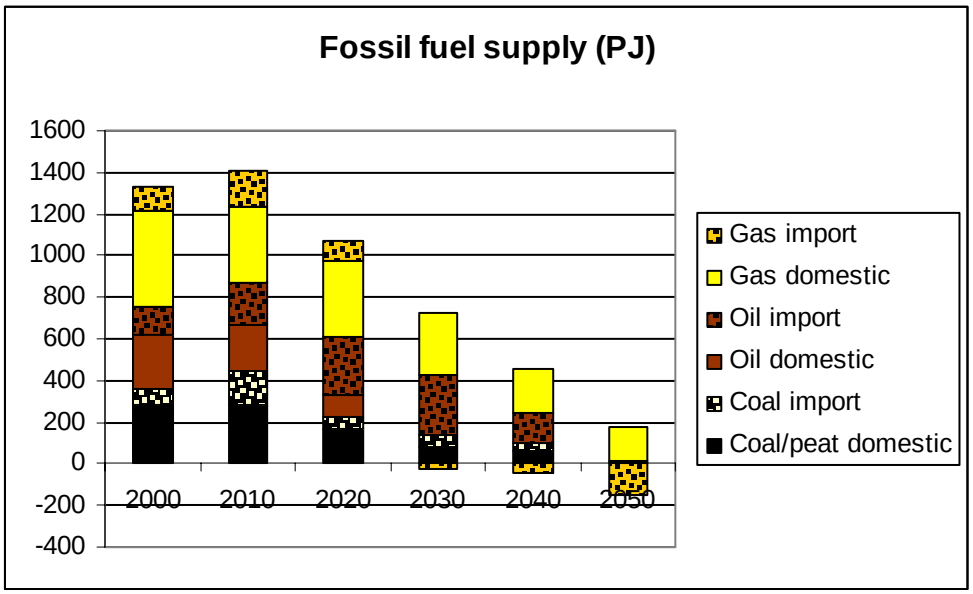



*Graph: Change in primary energy supply, following this vision. The decrease after 2010 is because assumptions of a strong emphasis on energy efficiency in the end-use and well as in supply.*



**Fossil Energy**
Fossil fuel use is expected to grow until 2010 to cover electricity production and increasing heat and transport demands and then gradually be phased out until 2050.

*Graph: Fossil fuel supply according to Vision2050. With the vision a small gas export is possible after 2040.*

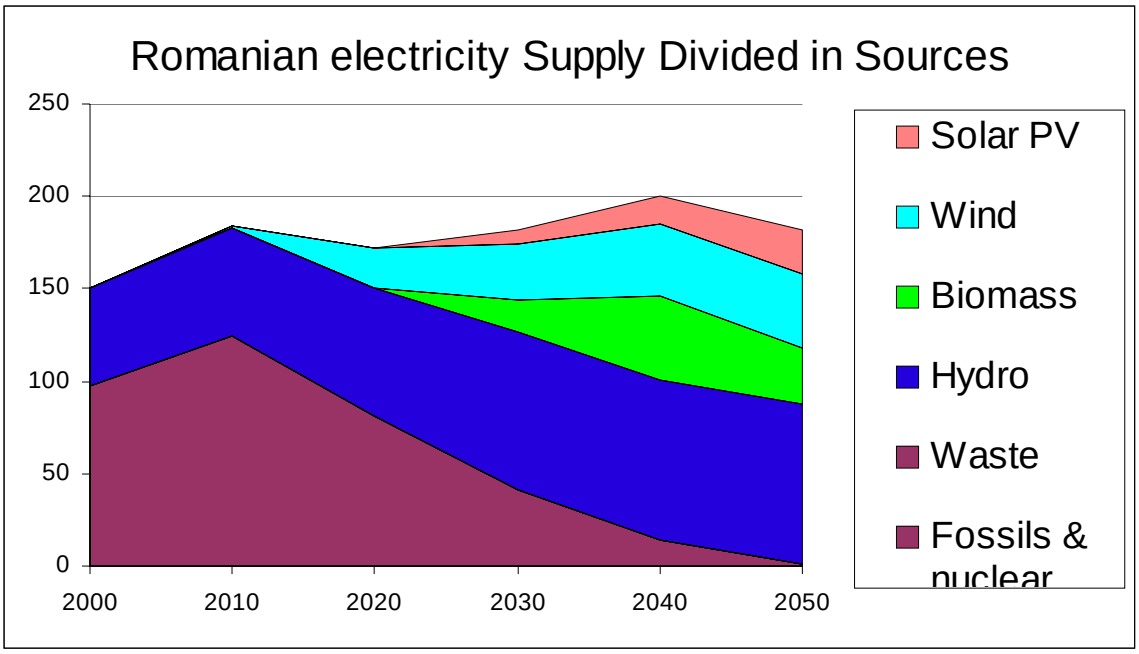



**Energy Conversion, Hydrogen**
The energy conversion system will also have to be changed. The electric grid is likely to increase in importance, because electricity will also be used for transport, directly or via conversion to hydrogen. The increase in electricity demand and the change to biomass power will require construction of biomass CHP plants to produce 12 TWh (45 PJ) of electricity and 40 PJ heat. This will require construction of about 2000 MW of biomass CHP plants as base load plants (operation 6000 hours full load electricity). Most of the capacity will be needed 2020-2040; but ¼ (i.e. about 500 MW) will be needed before 2020.

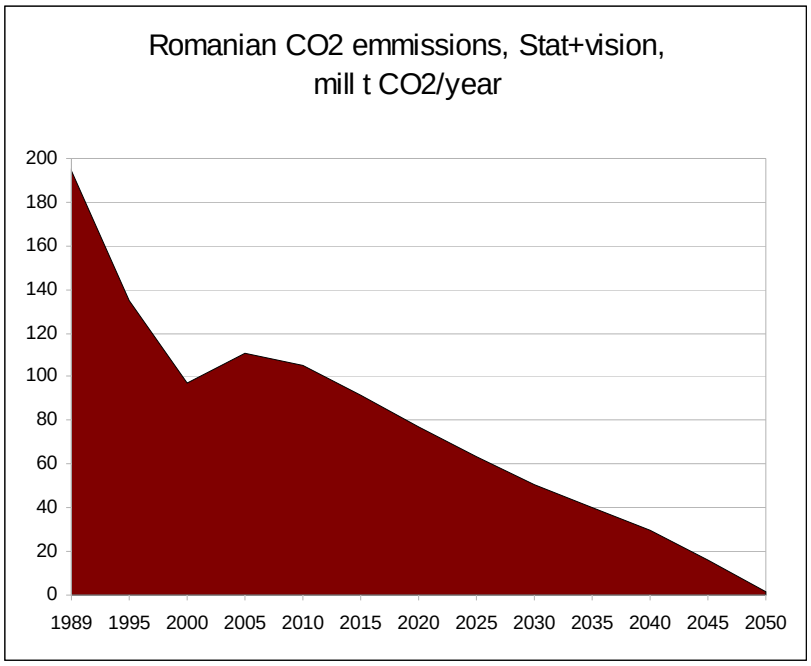
The increasing dependence on intermittent electricity supply from windpower and later solar PV can be managed with regulation on thermal and hydropower plants; but it might be necessary to construct heat storages in the form of hot water tanks to the CHP plants to decouple heat production and heat demand. With such storages CHP plants can better follow electricity demand. The intermittent electricity production from windpower will only be 12% of demand in 2020, according to the vision; and will increase to 27% in 2040 and 35% in 2050.

District heating is currently decreasing in importance, but this is expected to change, so it will cover 66% of service sector heat demand and 49% of household heat demand in 2050. The levels were 52% and 33% respectively in 2000 and are expected to decrease to 46% and 24% respectively in 2010.
Gas networks are expected to have decreasing importance. Some might play new roles for transportation of hydrogen or biogas.

*Graph: Development of electricity production and sources, following Vision2050*




**Energy Trade**
Energy trade is expected to be much less than today, only a moderate electricity exchange is expected with continued export of 1 TWh/year as today. If the efficiency assumptions are realised, there will be surplus gas from 2040 for export.




*Graph: Phase out of $CO_2$ emissions from energy*

The above graph shows the $CO_2$ emissions from energy resulting from realisation of this vision. There will still be greenhouse gas emissions from other activities such as agriculture, probably including $CO_2$ emissions.

The assumptions used in the vision are described in more details in the documents:

A vision for Romania based on INFORSE's Vision2050,
-Background note, Nov. 2007

and

Vision for a sustainable energy development for EU – 25, 2000 – 2050

The information is available on www.inforse.org/europe

Comments should be sent to ove@inforse.org