

## Environmental impact assessment of smart grid innovative solutions

### INTRODUCTION

Renewable energy actually represent around 20% of the total energy demand.

Price of renewable has drop these last years which allows small domestic production and inducing more smart grid systems.

Swiss council and Parliament has decided to replace de nuclear energy for 2050.

The aim of this study is to evaluate the socio-economic and environmental impacts of a smart grid system including all the technologies of the grid.



Sources: <http://www.batiweb.com/actualites>

### 01 Renewable energy & Grid aspects

#### Social

Job opportunities and scientific researches  
More self reliance  
Require some parameter evaluation such as population growth, future energy demand and technical progress

#### Environment

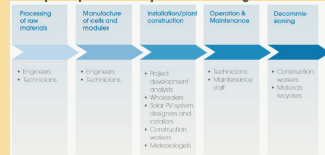
Most of the pollution released in the environmental is caused by energy consumption, production or distribution.  
Replacement of nuclear by renewable will cause a reduction of the greenhouse gas emissions.  
There are already several prescription for environment protection: LAI, prescription for sound, cultural estate, the landscape, the underground and surface water, the soil fauna flora, etc...  
Electromagnetic fields produced by transmission lines.

#### Economic

Job creation: processing of raw materials, manufacture of technology, project design and management, installation and plant construction, operations & maintenance, eventual decommissioning,  
Fuel based implies job in agriculture, pre-treatment for crop production while the transformation part will need chemists, engineers and machine operators.  
Multiplier effect: benefits will extend beyond job creation, the local economy is redistributed in other sectors such as leisure restoration and administration responsible.  
Diversify the economy which makes it stronger.  
The development of renewable energy production would cause the electric market to be more volatile.



#### Example of job induced by renewable energies:



#### Direct jobs across the solar PV value chain

In this case of direct jobs related to PV, engineers and technicians are required to process raw materials (silicon) and for the assembling of the system components at the manufacturing stage. The project development stage needs qualified personnel to conduct solar resource assessments, solar PV system designers, energy experts and business managers, financial analysts, as well as wholesalers. Construction workers, technical personnel and electricians will then be required for installation purposes. Maintenance during the lifecycle of the project will also involve technical staff. Finally, at the decommissioning stage, construction workers are needed, as well as jobs related to materials recycling..

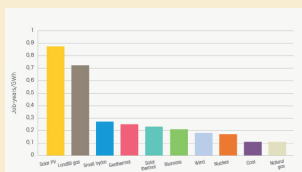
### 02 Outputs for impact evaluation

#### Environmental impacts

- Equivalent CO2 in energy production
- CO2 emissions intensity in energy production
- Biodiversity
- Chemical pollutants
- Surface utilization
- Landscape alteration
- Noise
- Hazards

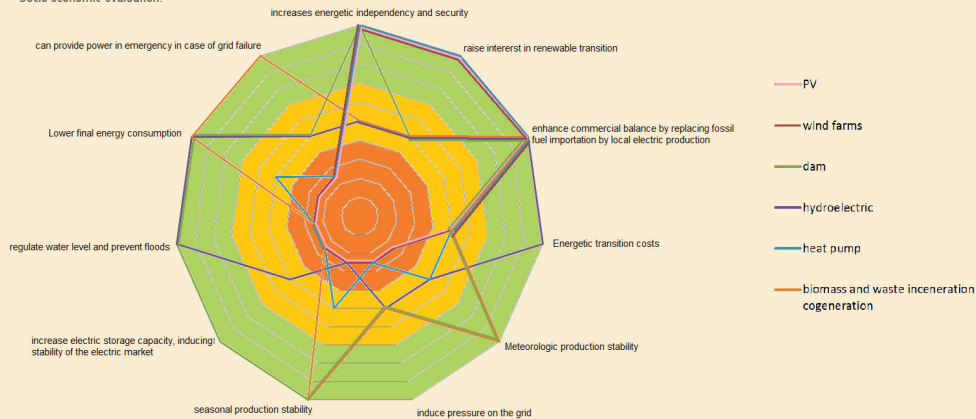
#### Socio-economic impacts

- Employment factor
- Direct and indirect jobs
- Direct, indirect and induced jobs

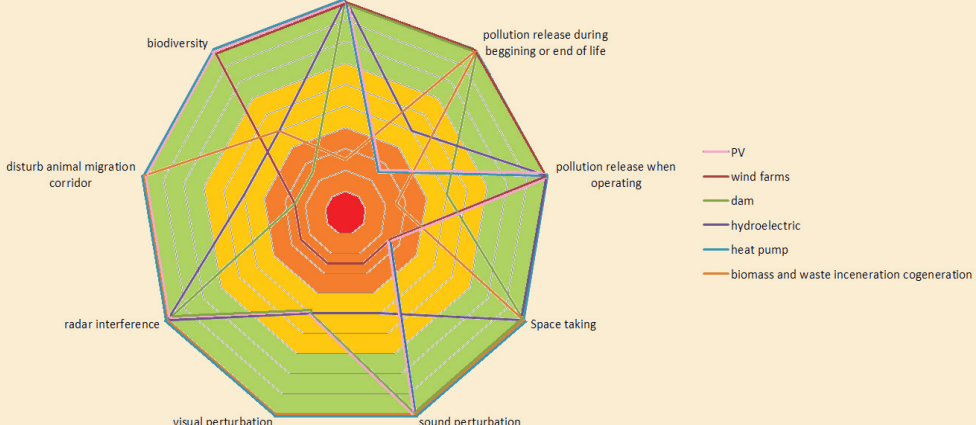


### 03 General impact evaluation

#### Socio-economic evaluation:



#### Environmental evaluation:



### 04 CONCLUSION

- Emissions resulting from the renewable energies should be lower than what would have occurred had the predicted technology been used.
- Emission reductions from renewable on grid are expected to be real, measurable and long term.
- On a global scale renewable energetic grids bring clean electricity to end-user, thus reducing even neglecting fossil fuel import dependence if any.
- The development of smart grids will permit a reductions of the impacts of energetic systems by reducing the energy consumption for end-users and thus reducing proportionally the impacts of energy production.
- This impact evaluation method can contribute to sustainable development for Switzerland or any other country.

#### References:

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- A.K. Akella, R.P.Saini, M.P.Sharma , "Renewable Energy 34 (2009) 390396", Social, economical and environmental impacts of renewable energy systems

#### Web sources:

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- Wind farm implantation , legislation: [http://www.vd.ch/fileadmin/user\\_upload/themes/territoire/amenagement/fichiers\\_pdf/Guides\\_et\\_directives\\_DCE/Directives\\_%20C3%A9oliennes\\_V3.3-finale.pdf](http://www.vd.ch/fileadmin/user_upload/themes/territoire/amenagement/fichiers_pdf/Guides_et_directives_DCE/Directives_%20C3%A9oliennes_V3.3-finale.pdf)

#### Electricity storage:

- <https://www.sbc.sls.ch/SBCInstitute/Publications/ElectricityStorage.aspx>
- Renewable energy jobs: <http://www.irena.org/documentdownloads/publications/renewableenergyjobs.pdf>
- Energyscope: <http://www.energyscope.ch/>
- Environmental impacts of renewable energy technologies: [http://www.ucusa.org/clean\\_energy/ouenergychoices/renewableenergy/environmentalimpacts.pdf](http://www.ucusa.org/clean_energy/ouenergychoices/renewableenergy/environmentalimpacts.pdf)

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