



## *Workshop on Managing Transitions For Sustainability*

# Managing sustainable energy transition from fossil fuel to RES in time of crisis: the case study of the Italian biofuel niche

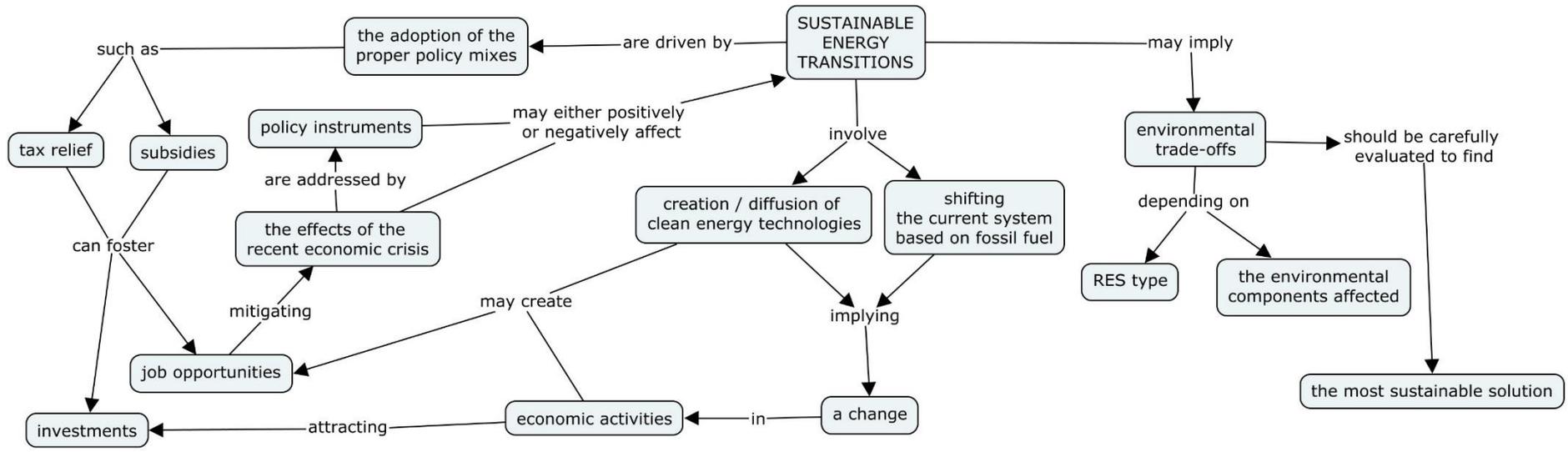
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## ***RES and European energy policy***

- “**Fuel Quality Directive**”– FQD (2009/30/EC) fixed sustainability criteria for biofuels.
- “**Renewables Directive**”– RES (2009/28/EC) aimed to increase the average level of energy derived from RES for public transport by 2020. Each Member State must ensure that at least 10% of their transport fuels come from renewable sources.
- The EU Commission’s policy agenda (2020–2030): **-40%** in overall **greenhouse gas emissions** by 2030 (in comparison with 1990).



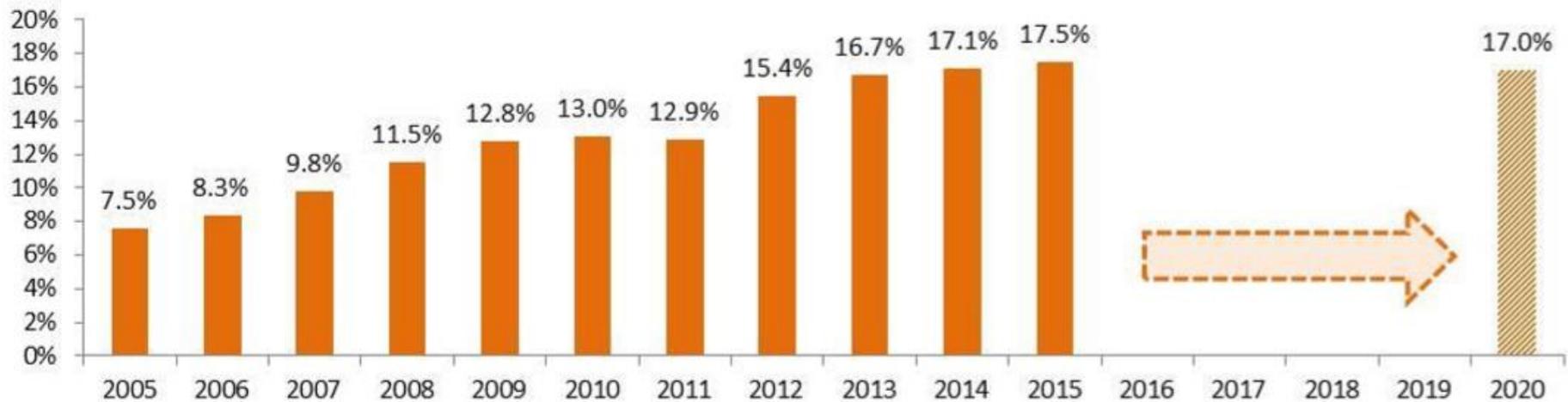
## *Energy transition in Italy*

### Policies in support of renewable energies sector

- D.lgs 28/2011 implements Directive 2009/28/EC to reach the 10% target by 2020
- Since 1998 Italy has promoted the possibility of obtaining a form of tax exemption, in whole or in part, from the excise duties applied to petroleum products
- Increasing energy dependence trend (high share of imported energy).

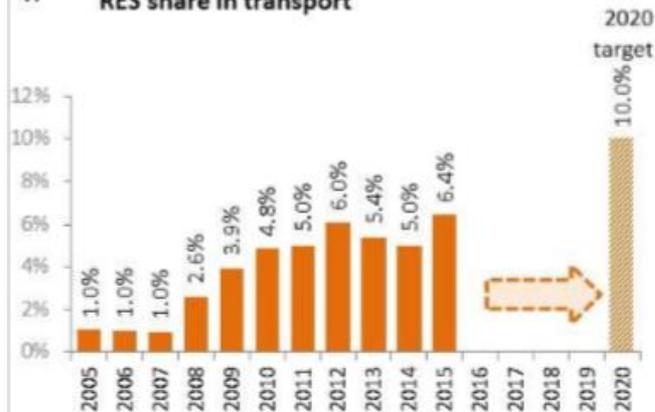
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## Renewable energy share in gross final energy consumption



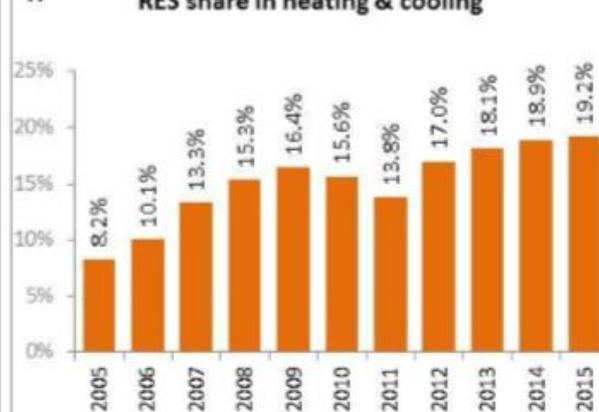
(source: Eurostat-SHARES)

## RES share in transport

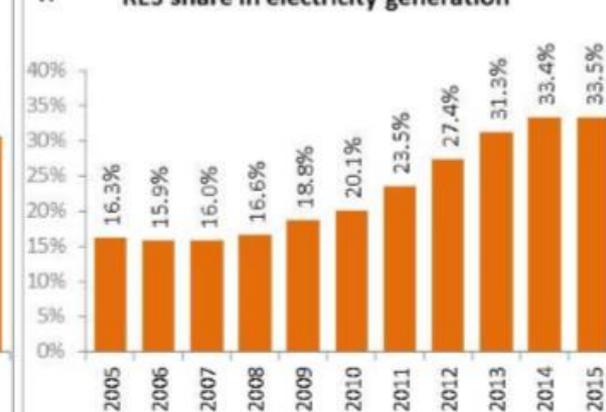


(source: Eurostat-SHARES)

## RES share in heating & cooling



## RES share in electricity generation



(Third Report on the State of the Energy Union, 23/11/2017)



## Trend of biofuel production in Italy during the economic crisis (2008–2014)

- Number of active producers: 21
- 2011: removal of tax incentives
- 2011-2012: decrease of the total production (**-70%**) and consequent increase in biofuel imports to comply with the EU Directive.
- High degree of under-utilization of plants
- 2013-2014: increased production; reduction of imports
- High potential of further development

*Source:* Falcone P.M., Lopolito A., Sica E. 2018. The networking dynamics of the Italian biofuel industry in time of crisis: Finding an effective instrument mix for fostering a sustainable energy transition. *Energy Policy* 112: 334-348 This is an open access article under the CC BY-NC-ND license (<https://creativecommons.org/licenses/by-nc-nd/4.0/legalcode>)



## *Relevant actors for the Italian biofuel niche (\*)*

Italy is one of the most relevant biofuel producers and consumers in the EU.

- 21 active producers
- 6 suppliers
- 7 distributors
- 17 biofuel-related organisations (e.g. national authorities, Universities, NGOs, etc.)

*(\*) Niche: protected space where promising technologies are developed and experimented*

## *Positive / negative factors affecting the Italian biofuel sector (expert judgement)*

### **Negative impacts**

- reduction of public and private investments in research and development
- credit crunch

### **Positive impacts**

- social acceptance of new plants
- green awareness
- positive expectation toward the fossil fuel replacement
- increase of the technical knowledge in the sector
- achieving of the EU targets
- green job opportunities



## *Evolution in the biofuel network during the economic crisis*

- Improvement of the existing connections among actors
- Increasing level of knowledge
- Some actors remained marginal in the network
- Decreasing degree of expectations about the future replacement of the current fossil-based sociotechnical regime



## Major shortcomings in the Italian biofuel niche development process during the economic crisis

1. Decreased level of expectations, particularly for those actors located at the core of the network
2. Increased level of knowledge for actors who are in a peripheral position in the network, providing a limited contribution to the learning process



## *Needs for development and innovation of the Italian biofuel niche*

- 1) Increasing convergence of expectations toward a sustainable energy transition**, necessary especially when the technological niche is in an initial phase of implementation (uncertain effectiveness and social acceptance)
- 2) Improving learning process**, commonly considered as central for a sustainability transition to occur (Kemp et al., 1998)
- 3) Improving networking**, to attract specific actors; especially important when the niche is characterized by a small set of actors (Lopolito et al., 2011; Kemp et al., 1998)



## *Policies that can support a transition to a sustainable energy system in Italy*

- Policy instruments can differentially affect energy transition and biofuel niche development.
- Policies should focus on drivers that positively impact the network and the expectation of fossil fuel replacement.
- Fiscal measures are useful only in the short run, but inefficient in the medium and long term.
- Public procurement and cooperation activities among firms, public organizations and research institutions exert positive effects on networking and convergence of expectations.
- The contemporary use of several driving forces enlarges the positive actions of the policy but can also accentuate possible side effects.



- Governing transitions towards a new sustainable energy regime involves a number of trade-offs in terms of environmental sustainability.**
- While biomass crops provide an environmentally friendly fuel source for generating electrical energy, their cultivation may be detrimental for several environmental components.**
- Environmental issues should be considered in the balance between positive and negative impacts and possible mitigation measures are to be assessed in terms of their effectiveness.**



## Possible environmental issues

- Greenhouse gas (GHG) emissions from biofuels: release of nitrous oxide (more powerful GHG than carbon dioxide) due to increase in nitrogen fertilizers and crop burning.
- Farming practices and conversion of landscapes to biofuel agriculture.
- Diverting land previously used for food crops to biofuel production often leads farmers to clear forests and grasslands to maintain food production (net release of GHG).
- If biofuel crops are grown on cleared forests or grasslands: release of GHG is greater than the reduction due to the use of biofuels for some decades.
- If crops grow on marginal (i.e. unproductive) lands: it is needed to make them productive, i.e. using fertilizers.
- Reduction of soil fertility (e.g. corn crops).
- Using wastes from agriculture and forestry could produce GHG benefits, but also environmental costs, e.g. waste from forestry reduces nutrients needed to sustain carbon and nitrogen cycles).



## Possible environmental issues

- **Air pollution** - Ethanol and biodiesel can reduce the emissions of some pollutants (e.g. fine particles and CO), but increases the emissions of nitrogen gases.
- **Freshwater**
  - Using irrigation to grow biofuel crops would increase water consumption (impacts especially in arid environments and in coastal areas).
  - The processing of biofuel can consume substantial quantities of water.
  - Water pollution from runoff from agricultural fields and from wastes; water eutrophication, oxygen depletion and disruption of ecological functioning in surface waters.
- **Biodiversity**
  - Increasing deforestation and change in land use
  - Need to assess impact also in marginal areas
  - To be evaluated case by case



## **Possible impact mitigation measures** (*source: UNESCO, SCOPE and UNEP*)

- Careful selection of sites suitable for biofuel crop production.
- Biofuels development should be embedded in larger Resource Efficiency and Renewable Energy Strategies and considered in the context of integrated spatial planning.
- Comprehensive land use guidelines are needed that target biofuel production on marginal and degraded lands, and preserve areas for agriculture, forestry, settlements/ infrastructure and nature conservation on the regional, national and international levels to avoid unintended consequences.
- Improving technologies in terms of feed-stocks and conversion technologies as well as more efficient use of biomass.
- Direct use of biomass for electric power and heat generation can be more efficient than conversion to liquid biofuels for transport.
- Further research needed on the use of indigenous crops, including non-food crops.



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# THANKYOU

