Costs and finance of energy transition in the power sector in Europe: a point of view from Italy

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Outline

1. **Energy transition: the general famework**
2. Energy transition in the power sector: Investments and finance (with some references to Italy)
3. Final remarks: trying to learn some general lessons from the new National Energy Strategy of Italy

Energy transition

- The energy transition (ET) in its essence is a transformation of the energy sector (and of the way of life) to limit emissions of CO2 in the atmosphere either by decarbonizing the inputs or by capturing and storing CO2 produced
- Since the atmosphere is a common pool resource without price, its use has to be regulated through public intervention
- Although the preferences and social consensus are important, the selection of technology is not a top-down process of government responsibility
- To maximize social welfare, the government should promote the less expensive solutions to decarbonize the supply of energy services

Energy transition according to EU Commission: vision and goals

- *UE set the targets of climate-energy package in March 2007*. The basic document behind that decision [COM(2007)1] stated:
  - "The point of departure for a European energy policy is threefold: combating climate change, limiting the EU's external vulnerability to imported hydrocarbons, and promoting growth and jobs, thereby providing secure and affordable energy to consumers.
  - Meeting the EU's commitment to act now on greenhouse gases should be at the centre of the new European Energy Policy for three reasons:
    - (i) CO2 emissions from energy make up 80 % of EU GHG emissions, reducing emissions means using less energy and using more clean, locally produced energy,
    - (ii) limiting the EU's growing exposure to increased volatility and prices for oil and gas, ("the days of cheap energy for Europe seem to be over ")
    - (iii) and potentially bringing about a more competitive EU energy market, stimulating innovation technology and jobs".

Energy transition according to EU Commission: the decisions

- EU has enacted the climate-energy package in 2009 which included:
  - the « third energy package » to complement the internal energy market in electricity and gas. And
  - the three “20-20-20 ” « plan-oriented » (quantitative) directives:
    - A new ETS directive (2009/29/EC)
    - A new RES promoting directive (2009/28/EC)
    - A new energy efficiency promoting directive (2012/27/eu)
- These multiple interventions have set the stage for some conflicts between decisions market-oriented and decisions plan-oriented and between actions aimed at different goals but with interacting consequences (e.g RES development and emissions abatement)

What happened since then to the three « points of departure »: CO2 emissions

- CO2 emissions have continued to grow and the center of gravity has shifted sharply to outside of the old industrialized countries
- There was not a post-Kyoto agreement in Copenhagen and that agreement is not yet in sight

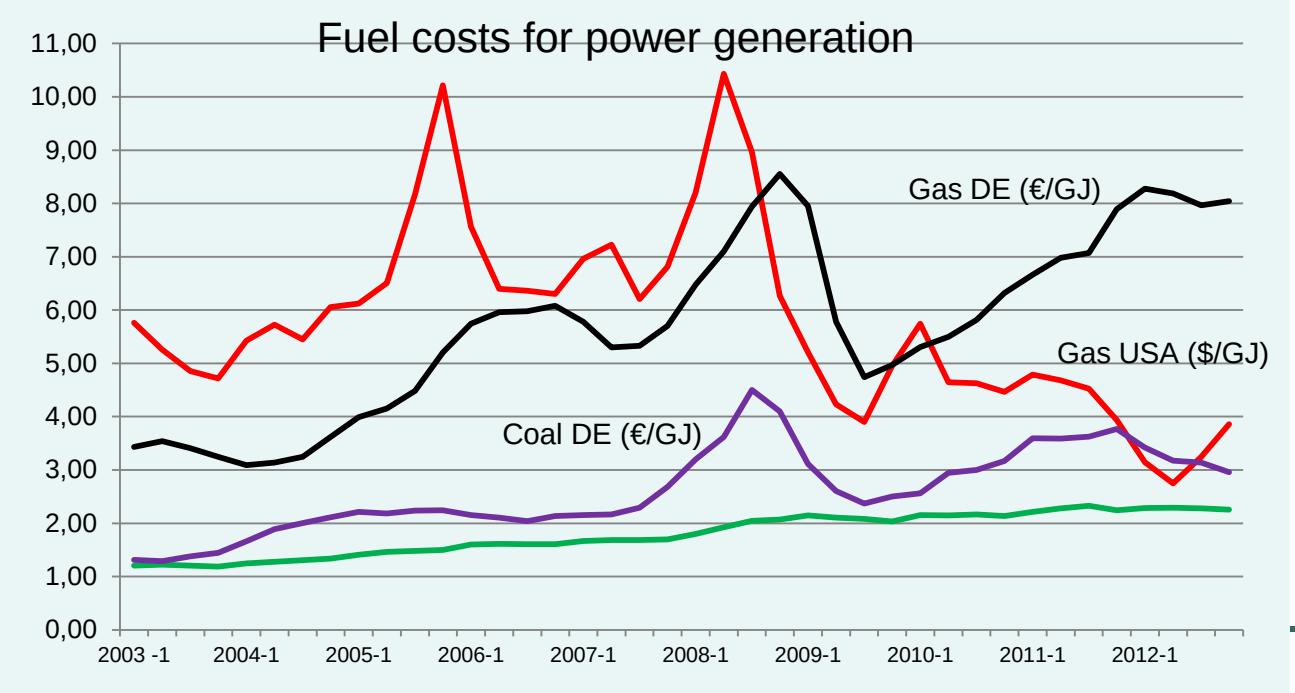
CO2 EMISSIONS FROM FUEL COMBUSTION (Mt of CO2)

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2010/2005
OECD Total	**12 659**	**12 653**	**12 719**	**12 941**	**13 116**	**13 151**	**13 091**	**13 231**	**12 963**	**12 174**	**12 559**	-4,5%
EU - 27	3 873	3 967	3 941	4 042	4 048	4 018	4 021	3 971	3 897	3 616	3 710	-7,7%
USA	5 676	5 617	5 661	5 703	5 808	5 844	5 764	5 852	5 669	5 298	5 415	-7,3%
Non-OECD Total	**10 231**	**10 371**	**10 841**	**11 671**	**12 881**	**13 557**	**14 427**	**14 997**	**15 907**	**16 424**	**17 444**	28,7%
China	3 052	3 008	3 319	3 898	4 663	5 125	5 679	6 037	6 558	7 150	7 669	49,6%
Marine &aviat. bunkers	**839**	**806**	**840**	**853**	**934**	**980**	**1 029**	**1 073**	**1 067**	**1 029**	**1 099**	12,2%
Total	***23 729***	***23 830***	***24 401***	***25 466***	***26 931***	***27 688***	***28 547***	***29 300***	***29 937***	***29 628***	***31 102***	***12,3%***

Source: IEA, 2012

What happened since then: cost of fuels for power generation

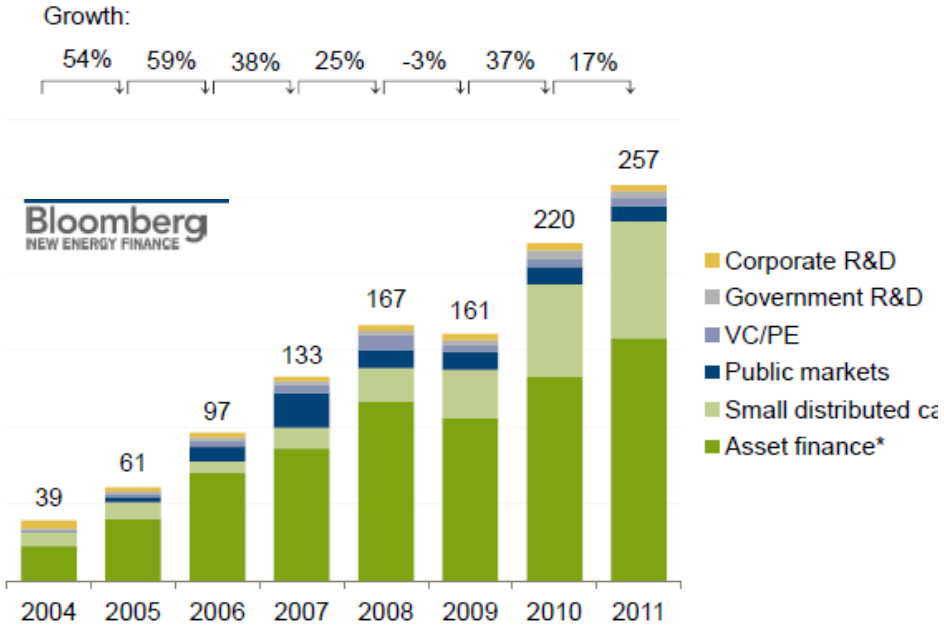
- Price volatility has continued, but for different reasons (demand slowdown -esp. for the crisis- and supply expansion of fossil fuels -esp. shale gas-) the prediction that “the days of cheap energy seem to be over” has not been confirmed, at least not everywhere



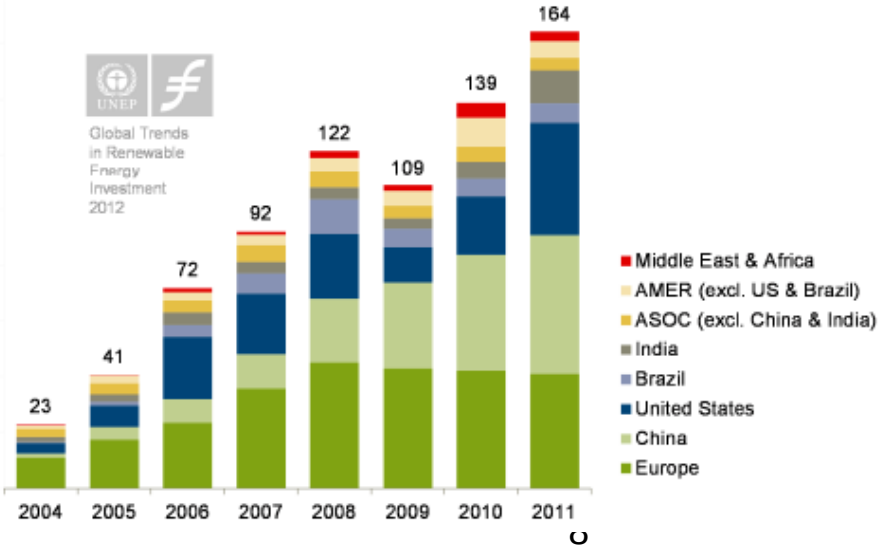
What happened since then: RES development

- World RES investments grew faster than expected
- The EU was the first to move, but now China is taking over and the United States are catching. European exports did not increase in line with market expansion

GLOBAL NEW INVESTMENT IN RENEWABLE ENERGY BY ASSET CLASS, 2004 - 2011 ($BN)



ASSET FINANCING NEW INVESTMENT IN RENEWABLE ENERGY BY REGION, 2004 - 2011 ($BN)



Conclusions from the general framework

- Energy transition is under way, but not exactly as foreseen (as well as it was not expected the severity and the duration of the current economic crisis).
- Power sector is central to the energy transition and even in this case there changes not entirely envisaged (but now of common knowledge) that deserve a more detailed examination

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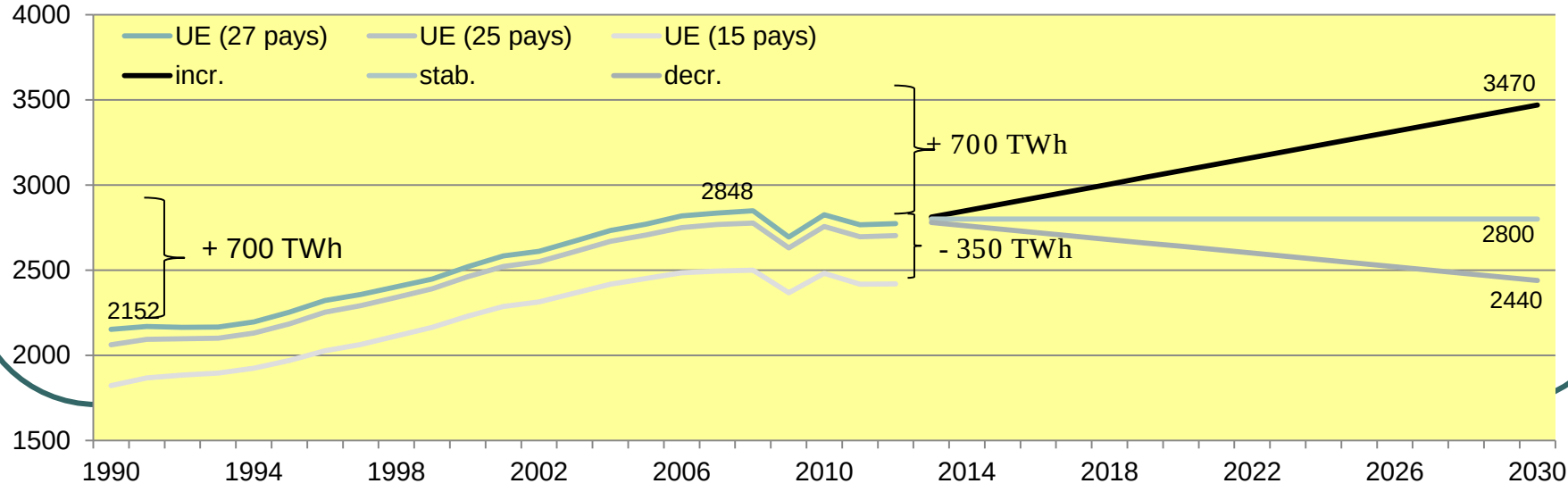
Energy transition in the power sector: costs, investments and finance

- In examining the energy transition in terms of cost, investments and financing of the power sector we will look at:
  - the demand outlook
  - and industry trends divided in three segments with different characteristics and problems:
    - power generation in open markets
    - power generation in protected markets
    - networks extension and adaptation
- We'll take the Italian case as an example to illustrate what happened (or could happen)

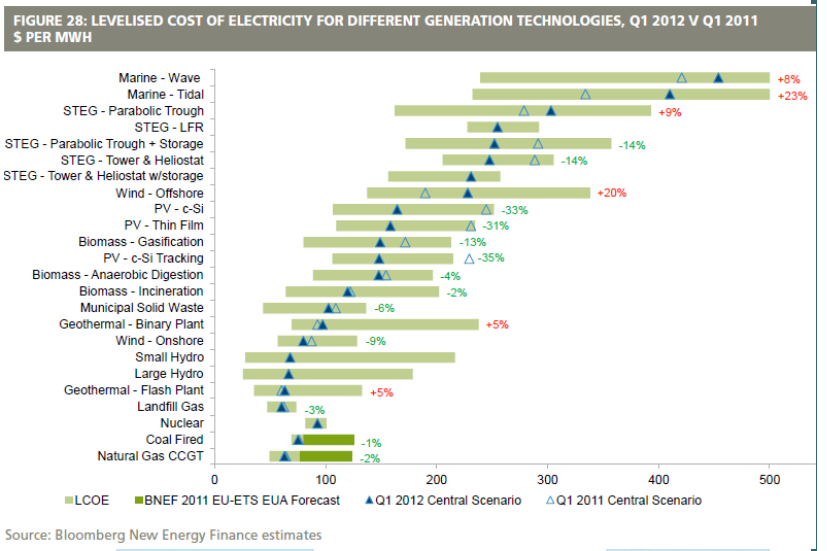
1. Energy efficiency and electricity demand

- European policy aims at reducing energy demand. The same is not true for electricity: all Roadmap 2050 scenarios indicate an increase in electricity consumption, but some countries (Germany) also aim at reducing electricity demand.
- Will conservation or demand for new uses of electricity prevail? How long will the economic crisis last? Uncertainty about the electricity demand can be large and affects producers' decisions.



2. Power generation: a premise on costs and prices

- Current merit order according to SRMC is: RES, nuclear, coal and gas
- *Today prices on PX do not cover full costs (LRMC) of any technology*
- Future generation costs from coal and gas plants vary greatly from case to case and depend on fuel costs. For nuclear power plants there are fewer data and specificity are even greater. However, *there is a good agreement that, without carbon costs, coal-fired and CCGT plants remain the least expensive in the coming years*.
- The question is *when RES will be competitive and what is the carbon price and learning rate that make this possible*



Source: Bloomberg New Energy Finance estimates

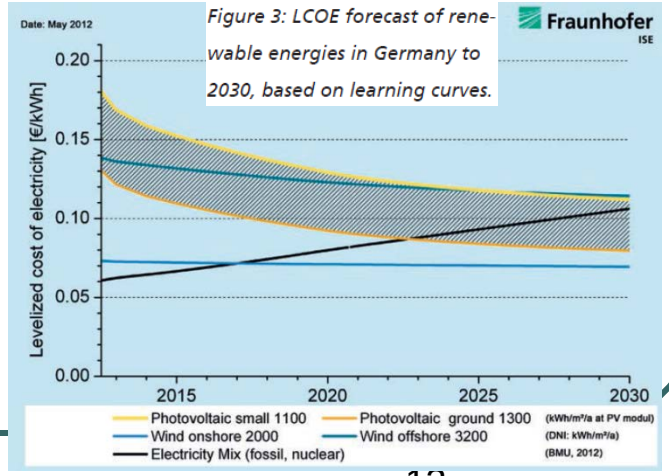


Figure 3: LCOE forecast of renewable energies in Germany to 2030, based on learning curves.

2.1 Power generation in competitive markets: investments and finance

- The fossil-fueled generation is caught in a pincer between a stagnating demand and a growing installed RES capacity and production that creates overcapacity
- No surprise then if new plants under construction are very rare indeed and there are many plants closures in Europe
- Anyway, these investments should be funded by the ability to borrow of producers, but today the traditional power companies raise funds with more difficulty because they are heavily indebted (partially because of the past M&A) and present low profitability of generation (see previous slide)
- If there was a need to start an investment cycle to replace old plants (eg nuclear power plants) or to provide new reserve capacity to the intermittent RES generation funding problems may arise

Power generation in competitive markets: the Italian experience

The decease in electricity demand (same level in 2012 as in 2004, with modest growth prospects up to 2020) and the strong development of RES have not only made new investment not required, but they also challenged those made in the past.

In the past decade 32 GW of CCGT plants have been built and 25 billion euros invested

Type of CCGT plant	gross capacity installed (MW) **31.12.2001**	gross capacity installed (MW) **31.12.2006**	Increase 2001-2006 (MW)	gross capacity installed (MW) **31.12.2011**	Increase 2006-2011 (MW)	Increase 2001-2011 (MW)
Electricity only	2 365	15 534	13 169	25 007	9 473	22 642
CHP	6 162	13 133	6 971	15 949	2 816	9 787
Total	**8 527**	**28 667**	**20 140**	**40 956**	**12 289**	**32 429**

The current low spark spread and capacity factors do not allow to recover the fixed costs (including depreciation)

One of the hypotheses under discussion is to reform the CRM to allow the plants to cover their fixed costs and not be closed.

2.2 Power generation in protected markets: investments and finance

- EU directives oblige to give priority of dispatching to RES and CHP
- Directive 2009/28/ec sets mandatory national targets for the overall share of energy from renewable sources in gross final consumption of energy
- Member States (MS) have introduced RES different support schemes mainly based on FIT, FIP or RPS with TGC.
- The splitting of European target by MS and the different choices made by MS have made missing an orderly development of RES in Europe (from least expensive to most expensive, from the places where they cost less to those where they cost more)
- The results of this policy have been impressive (see next slide).
- No problem of financing has been and investments can continue until generous promotion systems remain in force

Power generation in protected markets: the results (cont.)

According to Bloomberg-UNEP reports, RES investments in Europe totalled 345 G€ between 2004-2011 (>70 G€ in 2011)

All forms of financing have been used: company balance sheets, equity, project finance and loans (especially for families to finance rooftop PV)

The cost of subsidies is exploding

RES-E support expenditures in Europe (million €)

	ECOFYS estimate			CEER calculation*		
	2007	2008	2009	2009	2010	2011
Germany	3 564	4 058	6 148	5 618	9 512	16 763
Italy	1 752	2 191	2 473	2 638	3 427	6 991
Spain	942	1 832	3 804	6 035	5 371	5 044
United Kingdom	1 061	1 159	1 435	1 250	1 438	1 758
France	121	338	496	556	1 511	2 270
Others	1 561	1 830	2 511	2 993	3 922	4 872
EU27	**9 001**	**11 408**	**16 867**	**19 090**	**25 181**	**37 698**

* CEER estimate includes only 19 countrie

FIGURE 2.1 INSTALLED POWER GENERATING CAPACITY PER YEAR IN MW AND RES SHARE (%)

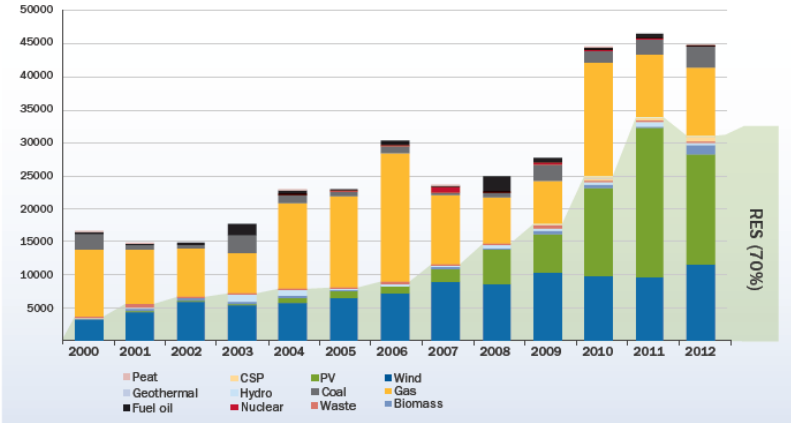
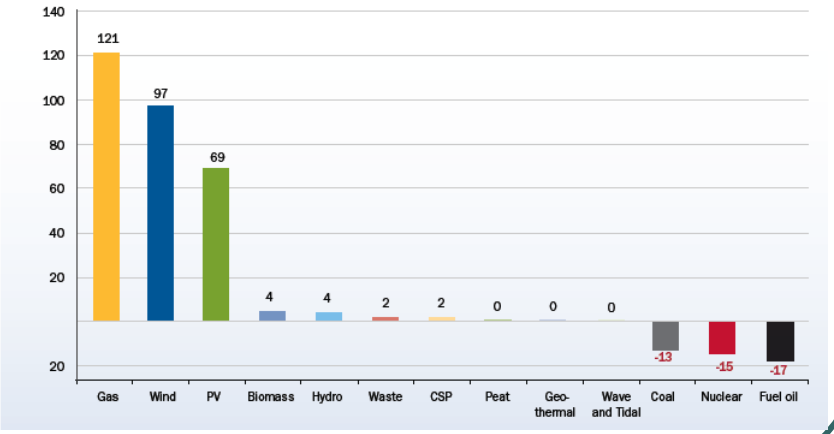


FIGURE 2.2 NET ELECTRICITY GENERATING INSTALLATIONS IN THE EU 2000-2012 (GW)



Source: EWEA, 2013

Power generation in the protected markets: the Italian experience

- Since 1992 Italy adopted all support schemes: FIT, FIP, TGC, tendering …
- The results have been very positive in terms of investments and capacity and generation increase (see table)
- The most effective instrument was the "Conto Energia" that promotes solar energy: 17 GW of PV capacity has been installed and 40 to 50 billion € invested (mainly between 2009 and 2012).

	2002	2004	2006	2008	2010	2012
	Installed capacity (MW)					
Hydro	16 820	17 056	17 412	17 623	17 876	18 200
Wind	780	1 131	1 908	3 538	5 814	8 144
Solar	6	7	7	432	3 470	16 350
Geothermal	707	681	711	711	772	772
Bio-energies	892	1 192	1 256	1 555	2 352	3 800
Total	**19 206**	**20 067**	**21 294**	**23 859**	**30 284**	**47 266**
	Gross production (GWh)					
Hydro	39 519	42 338	36 994	41 623	51 117	41 940
Wind	1 404	1 847	2 971	4 861	9 126	13 900
Solar	4	4	2	193	1 906	18 800
Geothermal	4 662	5 437	5 527	5 520	5 376	5 570
Bio-energies	3 423	4 499	5 286	5 966	9 440	12 250
Total	**49 013**	**54 125**	**50 781**	**58 164**	**76 964**	**92 460**

➢ *Financing has not been a problem* neither for companies nor for families: considering the very profitable premia lasting for 20 years and assuming that the payment obligation would be maintained, the banks were ready to finance up to 100% (a situation similar to the housing bubble elsewhere in recent years. Similar risks for lenders?)

➢ *The impact on the Italian industry was modest*, although the implications for employment were not negligible, but concentrated in jobs such as installation, design and sites searching

2.3 Energy transition and networks operators

- There are two simultaneous transitions for networks:
  - An organizational transformation driven by the unbundling obligation between TSOs and generators
  - A paradigm shift in networks operation and development because of the growth of the distributed generation
- The paradigm shift is caused by ET. It increases the need for investments to allow access to the grid of centralized and decentralized and intermittent generation
- The unbundling is more justified by the risk of limiting investments by integrated companies more than that of access discrimination
- A negative consequence of unbundling is the loss of overall optimization of generation and network investments: the network now must necessarily follow the generation.
- A positive consequence of unbundling is that financing of networks is no longer a problem if the regulator is “benevolent” and reliable.

Network transition and network operators: The Italian experience

- ENEL was forced to divest TERNA in 2005 (and a small share of its distribution grid). Instead, ownership unbundling of the distribution networks has never been seriously considered
- TERNA's investments have greatly increased after the independence from ENEL. Nevertheless sometimes there are still congestions (Italy has zonal prices that indicate congestions) and the grid is not always ready to accept all the RES generation
- Costs and revenues are regulated in a different way for Capex and Opex. The basic RoR has always been satisfactory and in addition new investments can enjoy a premium
- At present basic WACC is 8,40% for transmission and 8,60% for distribution and the possible premium is between 1,5 and 2%
- Companies are therefore urged to invest and the difficulty is not the funding, but to reach social acceptance of the new lines

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Italy and energy transition

- During the 2000s, with center-right governments, Italy has never been at the forefront in promoting the ET « European style ». However, Italy has always tried to comply obediently with Community obligations and has pioneered the use of instruments such as green and white certificates that few countries have adopted.
- In 2012 the Government headed by Mario Monti has taken some decisions and has launched a consultation on a new **National Energy Strategy** whose final document was approved in March 2013.
- The new guidelines are fully in line with the development of the green economy, but also rely on some of the lessons that may prove beneficial in the definition of how to proceed in the energy transition to 2030, as required by the Commission in the recent Green Paper “A 2030 framework for climate and energy policies”

Environmental sustainability vs economic sustainability

- The first objective of NES is: “to significantly reduce the gap in energy costs for consumers and businesses, aligning prices and energy costs to those of rest of Europe by 2020, and ensuring that the energy transition in the longer term does not undermine the competitiveness of the Italian and European industry”
- For Italy, closing the gap of costs with Europe in the power sector, will depend first of all on the gas price evolution
- The second element is the cost of RES-E support
- In July 2012 the Government was forced to set an annual cap for total subsidies: 6,7 G€ for PV and 5.8 G€ for the rest of RES This means **a commitment to a total debt of 250 G€** (87% already subscribed. At present annual commitment is 6,64 G€/y for PV and 4.22 G€ for other RES)

Environmental sustainability vs social sustainability

- The way in which energy transition is promoted has a double redistributive effect to pay for it: *between countries and within countries.*
- Burden sharing criteria in Europe are contestable: we need a more transparent and revised criteria if new targets are set
- Italy has agreed to pay a high cost in Europe and this cost is passed on to the domestic consumers and SMEs.
- For domestic consumers the « general charges » (which consist mainly of RES support), increased from 14 €/MWh in the 2nd quarter 2008 to 36 €/MWh in the 2nd quarter 2013
- The problem of allocation of costs among domestic consumers (and its link with energy poverty) is starting to be discussed

Environmental benefits vs industrial benefits

- Investments (and incentives) in RES (and energy efficiency) are supported in the NES also because of their employment impact
- In case of Italy a large share of incentives went to solar PV, with limited industrial impact (jobs created mainly concerned panels installation). (In light of the failure of many German solar companies perhaps this problem does not concern just Italy)
- Early RES deployment before they are competitive can contribute to their cost reduction, but it means financing the "learning curve" for the benefits of "late comers". Consequently it is urgent that Europe acts to harmonize RES support policies and thinks about the pace of development of RES

A need for new rules to integrate markets

- New RES production is no longer marginal.The NES indicates that RES market share will attain 36-38% in 2020 (27% in 2012) with a total electricity demand almost flat
- According to the NES, this perspec-tive raises three problems (not only in Italy):
  - How to fix new market rules to let protected and non-protected generation compete and cohexist?
  - How to develop local and national grids to cope with RES production expansion?
  - How to ensure the back-up capacity needed for intermittent RES production?