Incentive schemes in theory and practice: *a complicated policy versus a complete one*

Matteo Leonardi 21 May 2013

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Classifying renewable incentive schemes

Generation based (kWh)

	Production side	Demand side
Generation based (kWh)	Feed-in tariffs Tendering systems Quota obligation	Quota obligations Green pricing Fiscal measure Net metering
Capacity based (kW)	Investment subsidies Fiscal measures Quota obligation	Quota obligation Fiscal measures

Capacity based (kW)

Why do we want an incentive scheme for renewables?

- Environmental reasons
- Security of supply/diversification of energy mix
- The country is exposed to oil price fluctuation I want to secure a portion of my energy mix on renewable to contrast oil price cycles.
- Exploit national natural resources instead of importing energy products
- Renewable are more labor intensive then other generating options.
- It might be the opportunity for development of new industrial and commercial activities.
- Promote renewables may be a first step for new players in the electricity market
- Renewable may be the opportunity to attract new medium sized investors in the country
- Renewable may offer a reliable source of electricity in remote areas.

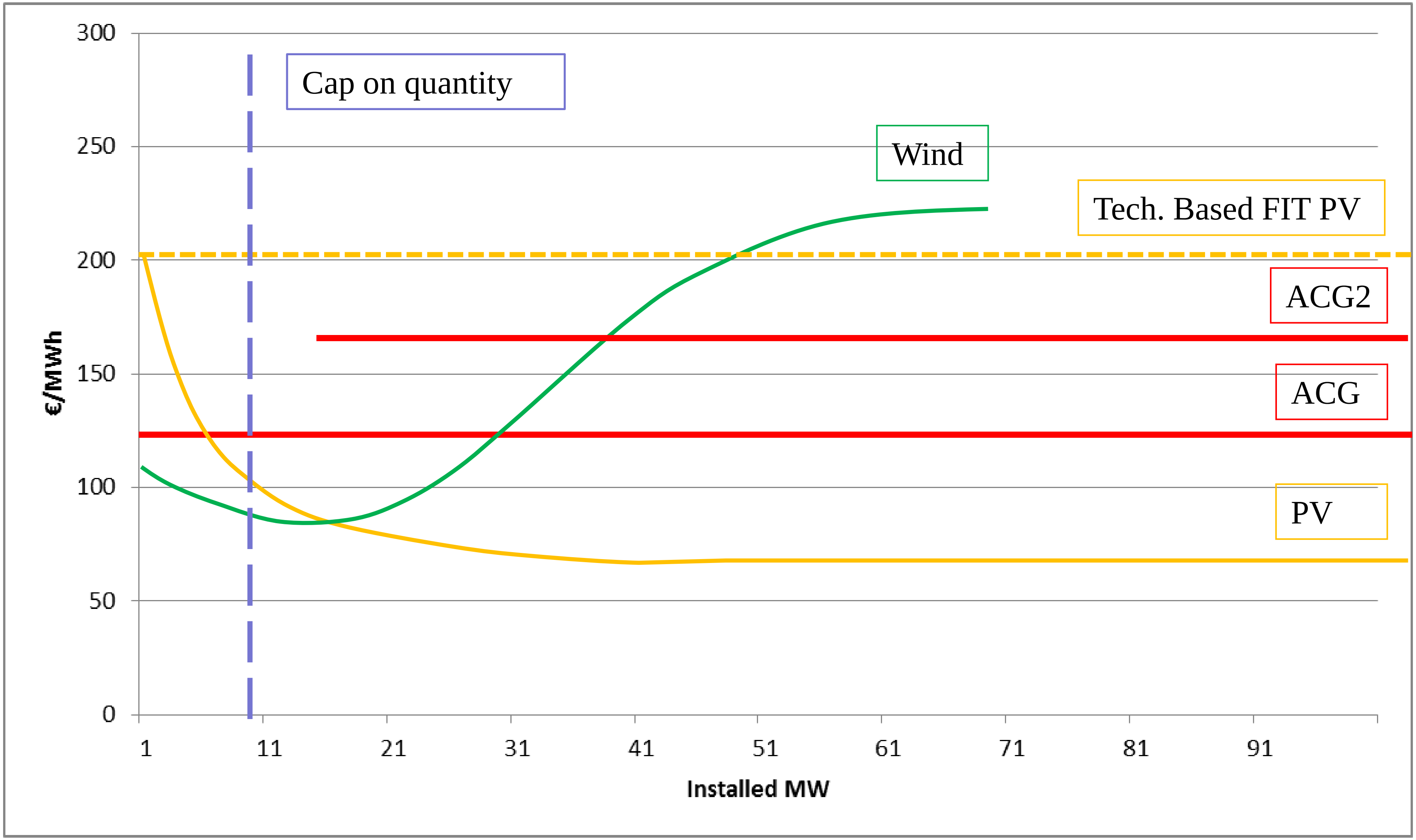
Feed in tariff

- FITs need a regulator/legislator to set prices, to define incentive mechanism characteristics, to follow the incentive implementation and to constantly update it.
- There are many differences in existing and potential FITs.
- The two main consist in the methodology used to set renewable power plant remuneration per kWh fed into the grid:
  1. Avoided cost of generation (ACG) of alternative technology
  2. Estimation of renewable technologies cost
- There is no “best methodology”. A good incentive scheme should try to make the different variables as much coherent as possible with policy targets.
- ACG is often the fastest way to open up the electricity generation market to new participants, but it is not necessarily the cheapest option
- Estimation of renewable costs needs a higher and constant market monitoring by the policy makers.

Avoided cost of alternative technology

Steam turbine/CCGT	120MW
Fuel	NG, HFO, LFO, Coal/Mix
Efficiency	55%-38%
Life span	20 years
CAPEX €/kW	1400€
Fuel cost €/kWh	65€/kWh
O&M €/kWh	5€/kWh
WACC/IRR	15%

1. Avoided cost of alternative technology
   1. Average market cost
   2. Marginal market cost
   3. Retail cost
2. Identification of benchmark technology (capacity, efficiency)
3. Identification of fuel used (NG, coal, HFO, LFO, mix)
4. Estimation of CAPEX for benchmark technology
5. Estimation of OPEX (including fuel cost) of benchmark technology
6. Estimation of cost of capital/rate of return



300
250
200
150
100
50
0
€/MWh
1
11
21
31
41
51
61
71
81
91
Installed MW
Cap on quantity
Wind
Tech. Based FIT PV
ACG2
ACG
PV

Renewable technology cost methodology

	CAPEX	OPEX	Load Factor	WACC	FIT €/MWh	Premium €/MWh	Elect. Price €/MWh
Small hydro ROR	3000	3%	4000	8%	120	60	60
Large Hydro basin	3500	2%	3200	8%	108	48	60
PV	1500	1%	1600	8%	135	65	70
Small wind	2200	5%	2500	10%	150	80	70
Large wind	1400	3%	2500	8%	120	60	60
Biogas	1800	5%	4000	12%	100	20	80

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Updating FIT tariffs

- FIT is normally constant for each generation of plants (ie plants commissioned in 2013-2015)
- For future ones FIT need to be updated
- If the system is based on ACG the methodology to update FIT according to fuel cost needs to be clear
- It is necessary to define if Inflation rate will be included or not included in tariff update
- Exchange rate risk
- Define sales of electricity once the FIT period is expired

Eligibility criteria

- Which Technologies are eligible for FIT according to
  - Size of single plant
  - Overall technology capacity
  - Overall system cost

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I reduce cost of inflation by allowing an yearly correction of 50%

I introduce market price risk for late comers

I set the incentive at the estimated LCOE with adequate WACC

I transfer some risk linking the FIT to avoided cost of production

	FIT €/MWh			Yearly update		Plants commissioned 3 years later		Curtailments	Balancing
	Premium	Electricity	Total	Premium	Electricity	Premium	Electricity		
Hydro ROR <1MW	70	70	140	Corrected by inflation 50%	Avoided cost	Corrected by inflation 100% ced by a g curve on per	Market price	FIT prolonged accordingly	No
Hydro Reservoir >1MW	50	50 base load; 90 peak load	100/140	Corrected by inflation 50%	Avoided cost	Corrected by inflation 100% and reduced by a 5% learing curve estimation per year	Market price	FIT prolonged accordingly	Yes

Tariff Differentiation

- There is no differentiation based on technology, size, fuel type, or application. Tariff is differentiated depending on whether the SPP is grid-connected or mini-grid.
- For 2012 Grid-Connected: Dry Season 183.05 TZS/kWh; Wet Season 137.29 TZS/kWh; Average 152.54 TZS/kWh
- For 2012 Mini-Grid: 480.50 TZS/kWh

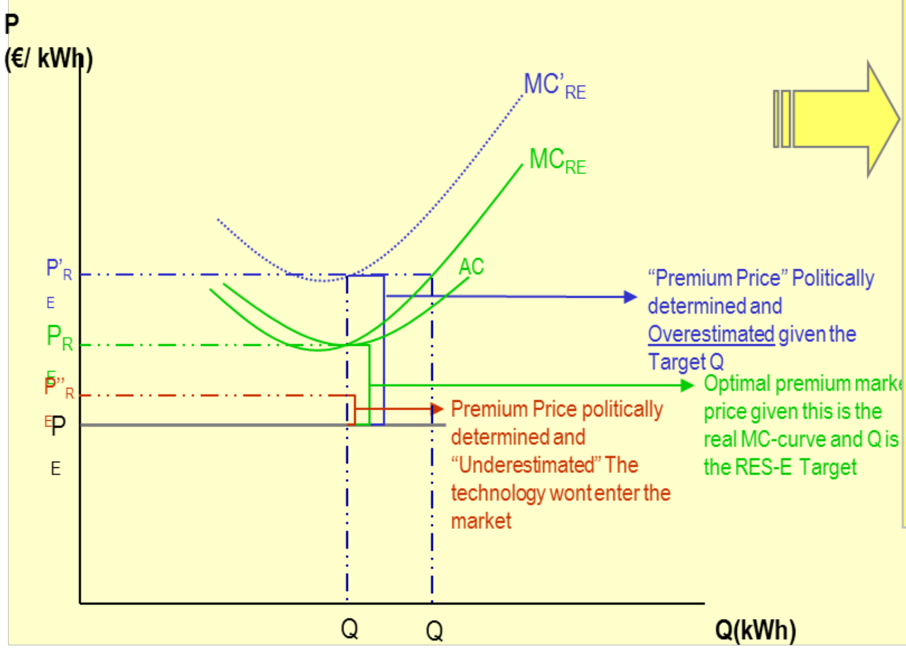
I partially reduce curtailment risk (inflation is 50% included)

I introduce price difference between base load and peak load to incentive production in peak hours

For late comers TIF are corrected by inflation and cut by 5% on supposed learning curve performance

I exclude balancing cost for non programmable sources but I include for programmable ones.

FIT in theory



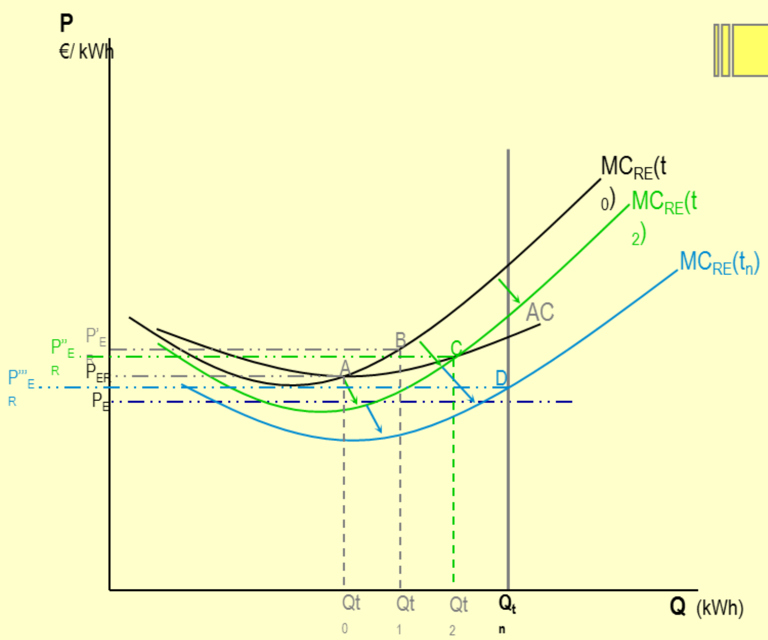
When the Feed-in price is overestimated, some economic inefficiencies take place since consumers pay an extra benefit in the short and medium run to producers

Remember on FIT

- Remember to set a maximum quota for eligibility
  - MW installed
  - Total cost
- Remember developers need to know well in advance when the budget of the incentive scheme will be saturated. From site identification to plant commissioning count easily 2 years. You risk to pay too much/disincentive correct planning.
- Remember to open a consultation document and to produce a regulatory/legislative impact assessment. Sometimes solutions are simpler than they look like.
- Remember also renewables have an environmental impact.

Quota obligation mechanisms

- Obligations can be placed over consumers/producers/utilities
- The obligation corresponds to the target the legislator wants to achieve
- The legislator/regulator sets the obligation quota and let market forces to find the right price
- All renewable electricity is certified and certificates may be traded among companies. This is supposed to reduce overall policy cost.
- Cap and floor may be introduced to reduce investment risks or to avoid excessive GC prices due to dominant market position.
- More mature renewable technologies are developed first, more expensive ones are set aside as long as they don't become competitive
- To function you need to have a number of competitors that can compete.
- Enforcement problems. There is a strong asymmetry between electricity companies (especially large ones) and the regulator. It is very difficult to introduce an obligation and make it respected when the asymmetry is strong.
- If the market is not fully liberalized, it is difficult for the company to transfer the obligation costs to consumers. The risk is that the authority has to introduce a tariff component to make companies recover their costs.
- The risk is that the legislation keeps modifying the law to compensate market failures. Most EU green certificate markets have been abandoned and substituted by auctions/FIT
- Regulation of existing renewable may become complex



·Final Quota Obligation is (Qtn)
·Price is the result and thus always determined by the market when moving from Qt0 to Qtn. This ensures greater efficiency than Feed-in schemes.
·Price is then dependent on supply and demand factors (not only on the height of the quota), and therefore less certain to investors.

Summary of action	Impact on consumer
Grid access and dispatching priority	No cost for final consumers.
Connection and grid extension costs	Cost of connection and timing well defined. Grid extension rules given Cost paid by producer or partially socialized.
Licensing	Simple and clear licensing procedures. No cost for final consumers
Avoided cost	Average national generating cost (inclusive/not inclusive of capital cost) Marginal cost of generation at time of day. No present cost for final consumers (future?)
Incentive (feed-in)	Based on avoided cost + premium Based on estimated production cost of technologies Cost transferred to final costumers but may be cheaper than AGC
Incentive (green certificate)	Based on quota obligation, one market for green certificate and one market for electricity Cost included into final electricity price
Curtailment	Curtailment rules defined. Can add additional costs or postpone cost in time