

Green Energy Act Alliance

*Design Elements of Feed-in Tariffs:
Spain, Germany, France and Ontario*

France's Advanced Renewable Tariffs

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The European Context

Europe energy and climate policy: « 3 * 20 % in 2020 »

❑ **20 % reduction of greenhouse gases emissions in 2020**

⇒ Compared to 1990 emissions

❑ **20 % more energy efficiency**

⇒ Beyond effects of already decided policies and measures

❑ **20 % renewable energy in final energy consumption**

⇒ Compared to 6.9 % in 2006

⇒ Binding target at the European Union level

⇒ Binding target of 10 % of fuels for transportation from RES

⇒ A related European Directive (= European Law) in preparation

¶ Under the French Presidency (June to december 2008)

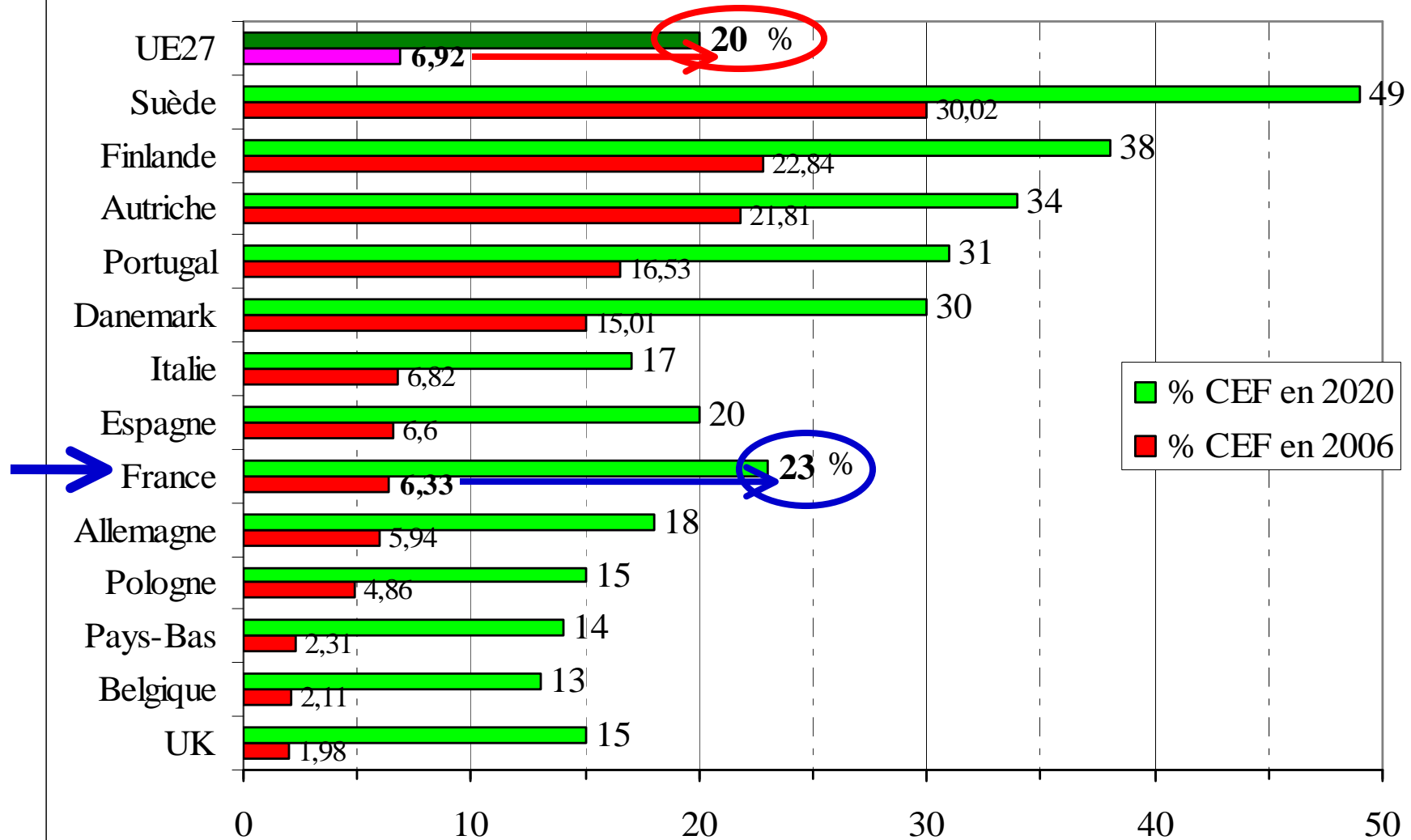
¶ To be adopted before June 2009

⇒ All the 27 member states will have to present a National Action Plan to the European Commission

⇒ Interim targets will be defined from 2012 to 2018

The coming European Directive « 20% RE in 2020 » (Heat, electricity, fuel)

Projet directive ER 2020: % ER dans CEF en 2006 et objectifs 2020



Renewable Electricity Roadmap for the « 3 * 20 % » Plan

Source: European Renewable energy Council, November 2008

Source: EREC, Nov 2008, "RE Technology Roadmap"	TWh from RE in EU27				GW RE in EU27	
	2006	2010	2020	% in 2020	GW 2020	% in 2020
Wind	82	176	477	35%	180	35%
Hydro	357,2	360	384	28%	120	23%
Bioenergy	89,9	135	250	18%	50	10%
Photovoltaic	2,5	20	180	13%	150	29%
Solar Thermal	0	2	43	3%	15	2,9%
Geothermal	5,6	10	31	2%	4	0,8%
Ocean Energy	0	1	5	0,4%	2,5	0,5%
TOTAL	537	704	1 370	100%	522	100%
% of EU Electricity	16%	19,7%	33 to 40 %			

The French Context

The « Grenelle de l'Environnement » outcome

- ❑ **A 2007-2008 national debate on environment, energy and sustainable development between government and « civil society »**
 - ❑ **Complements the July 2005 law on energy (« F4 in 2050 »)**
 - ❑ **The « Grenelle 1 » law adopted in November 2008**
 - ❑ **The « Grenelle 2 » law (detailed measures) to be passed in spring 2009**
- ❑ **Will serve as a basis for French action plan for renewables**
 - ⇒ Confirms the **23 % target from renewables** in France's final energy consumption in 2020 compared to 6.3 % in 2006
 - ⇒ From -35 Mtoe by supplementary Energy Efficiency measures
 - ⇒ And by + **20 Mtoe of Renewables**, of which + **7 Mtoe power**
 - ¶ Of which + **5.3 Mtoe from wind power: 60 TWh from 25 GW in 2020**
 - ¶ And around + **0.5 Mtoe from Photovoltaics: 5.8 TWh from 5,6 GW**

**French Renewable Tariffs
as an example of
Advanced Renewable Tariffs
(ARTs)**

ARTs (1): French renewable tariffs are differentiated

□ By renewable energy technologies

- ⇒ Wind
- ⇒ Solar photovoltaic
- ⇒ Hydropower
- ⇒ Bioenergy: biogas, solid biomass, biomass part of MSW
- ⇒ Geothermal energy

□ By Applications

- ⇒ Wind: onshore or offshore
- ⇒ PV: Building integrated, non BI, PV plants on land
- ⇒ According to rated power range: biomass, biogas, Hydropower
- ⇒ High efficiency CHP
- ⇒ Options for time and seasons of delivering: hydropower

□ By regional application: Mainland, Overseas department ₉

ARTs (2): French renewable tariffs are Cost + Profit based

❑ Officially based on a real project IRR before tax on profit

⇒ 8% real project IRR from the 2006 review imposed by the July 2005 law on energy (« Loi POPE »)

❑ Fined-tuned by profitability levels adapted to targets

⇒ Wind: profitability increase with wind speed at hub height

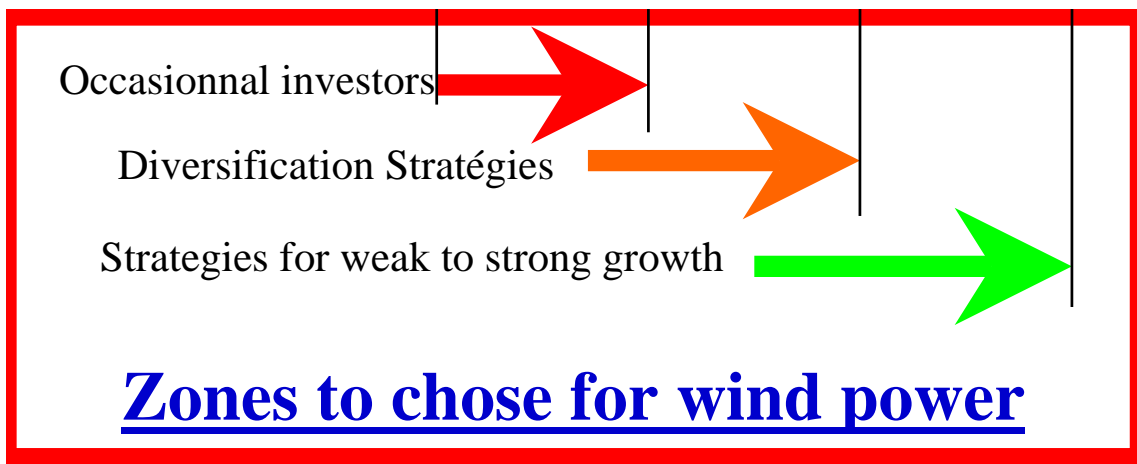
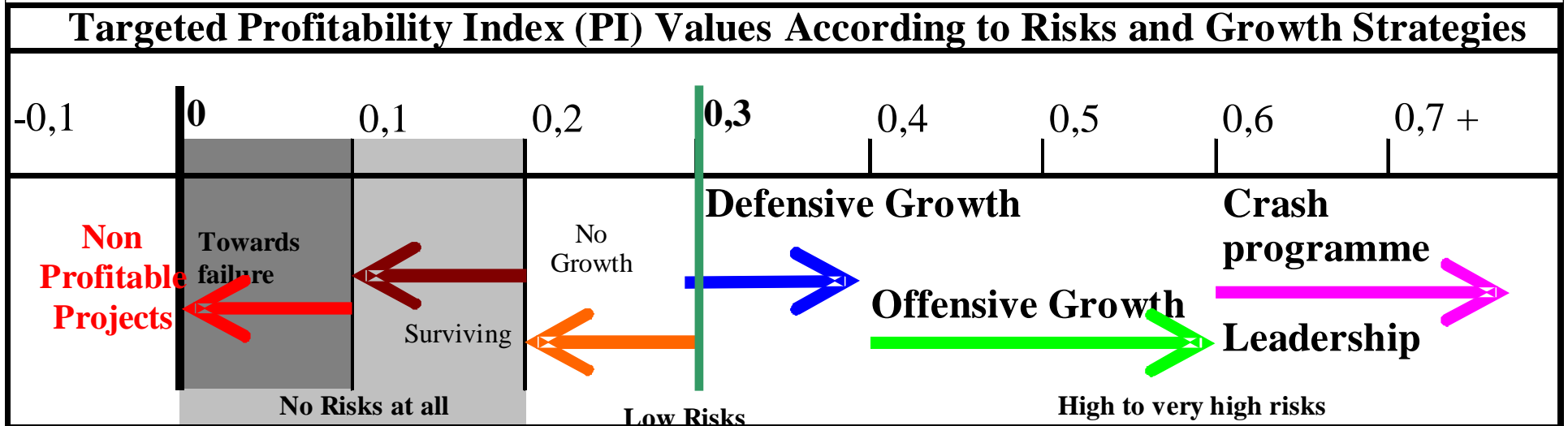
⇒ BIPV: increased profitability to help innovation and market deployment of new BIPV modules and systems

⇒ CHP from biogas: at least same profitability level than the one from CHP based on fossil fuels

❑ Fine-tuning easier from the Profitability Index than from IRR

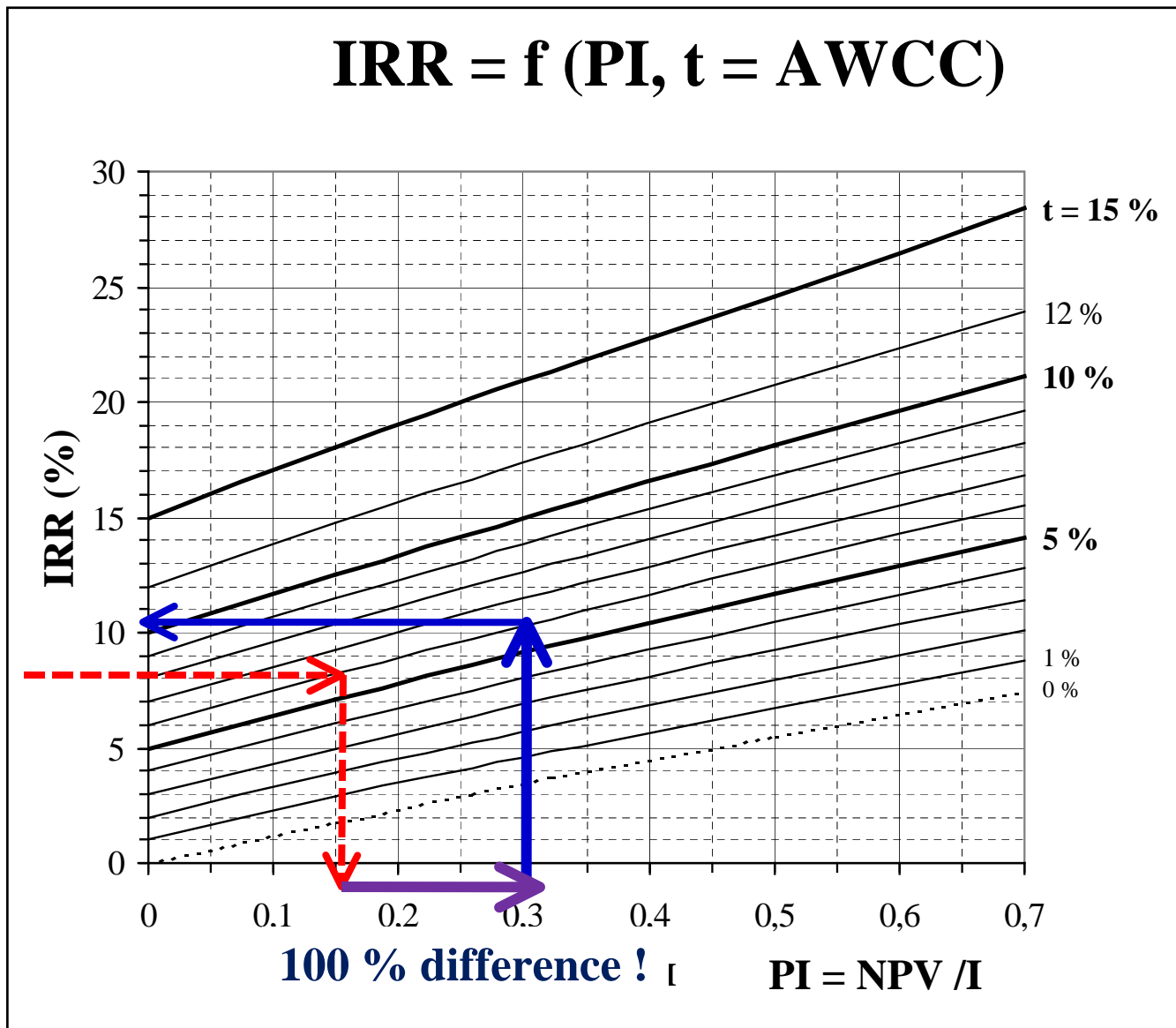
Example of profitability target choice

- Using the Universal Profitability Scale based on the Profitability Index $PI=NPV/I$

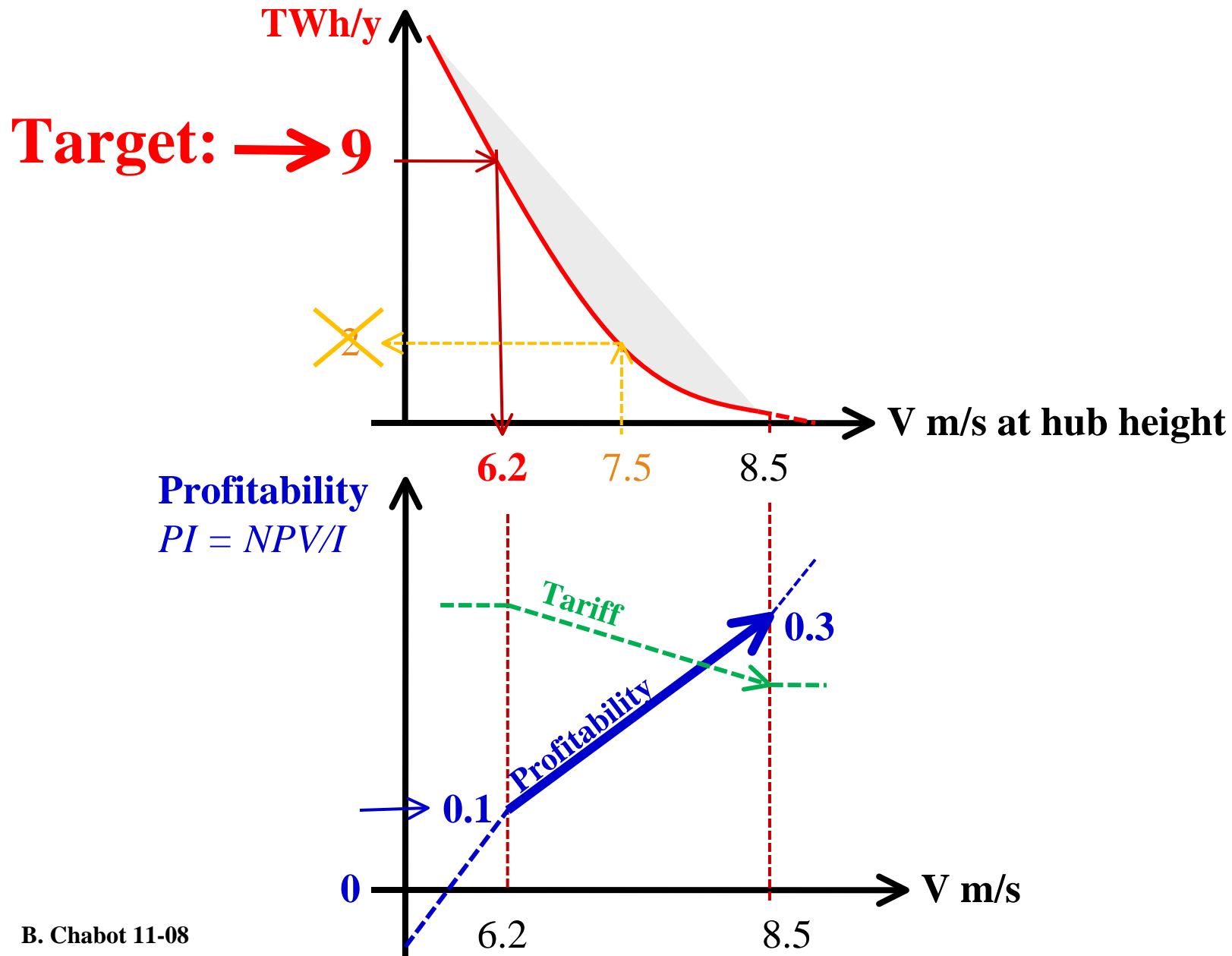


Links PI / IRR for n = 15 years

Ex: $t = AWCC = 6\%$: 100 % PI variation from 0.15 to 0.3 : IRR vary only from 8 to 10.3%



ARTs (3): Tiered Wind Tariffs Principle



ARTs (3): French Tiered on shore wind tariffs

□ Two successive tariffs levels :

⇒ T1 fixed for all projects from years 1 to 10

⇒ T2 variable for projects from years 11 to 15

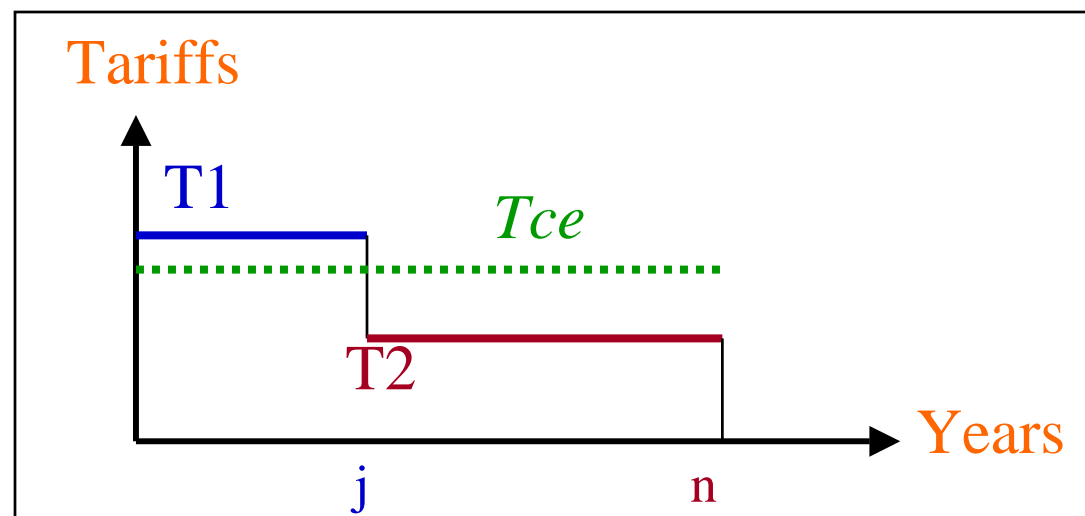
⇒ T1 and T2 define a virtual constant “equivalent tariff”, Tce

□ For a specific project :

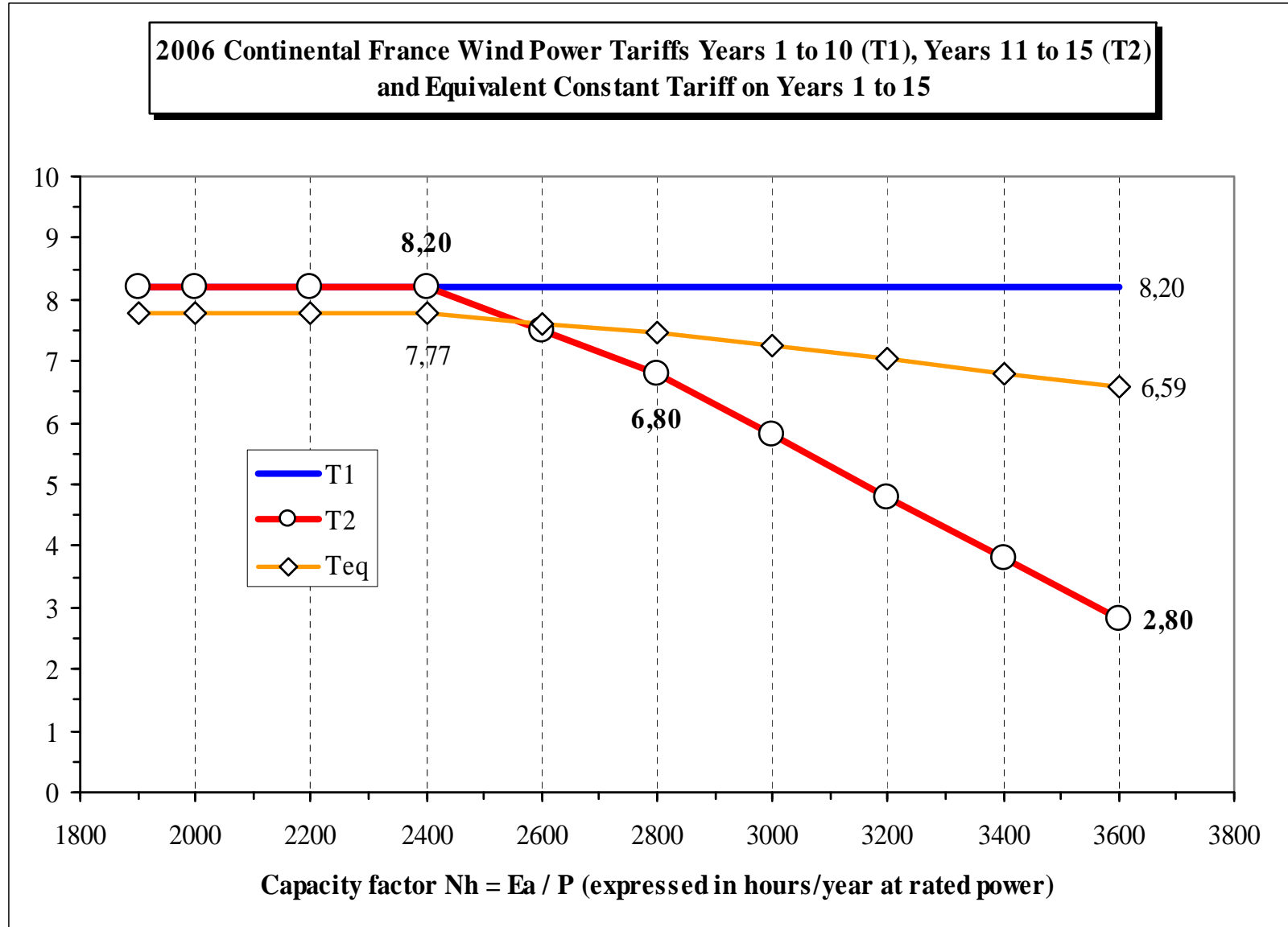
⇒ N_h = averaged E_y / P from values years 1 to 10

⇒ T2: linear calculation from reference values of $N_h = E_y / P$

⇒ { Tce from (T1, T2, t = real discount rate = AWCC before tax) }



ARTs (3): French onshore wind tiered tariffs



Equivalent constant tariff T_{Veq} are calculated here with a 6 % real discount rate and a 2 % future inflation rate

ARTs (4): protection against inflation

- ❑ **A tariff system must be designed without forgetting to take into account tariff protection against inflation**
 - ⇒ **Either by protecting completely tariffs against inflation, which is legitimate as wind power projects are participating to the fight against imported inflation**
 - ⇒ Either by defining a tariff system with an imperfect protection against inflation but by “correcting” by an increase the initial value of tariffs to compensate the effects of anticipated level of future inflation
 - ⇒ The first option is legitimate, simpler, **more reliable, more visible by investors and bankers, it gives lower initial tariffs values** and within a project contract a constant tariff expressed in constant € of year (0)?
- ❑ **If a “100 % protection against inflation”, is not possible, a minimum protection level should be 60 to 90 %**
- ❑ **French tariffs are 60 % protected against inflation within a PPA**

Sensitivity of project profitability to the protection of tariff

❑ **Example on a wind project :**

❑ **Perfect protection (green):**

⇒ $v = 0 \%$, $PI = 0.3$

⇒ Profitable project, built

❑ **Imperfect protection (blue)?**

⇒ $v' = -1,5 \%/y$, $PI' = 0.08$

⇒ Project insufficiently profitable

⇒ Project not selected, not built

⇒ Or if built, risk of stranded cost or bankruptcy

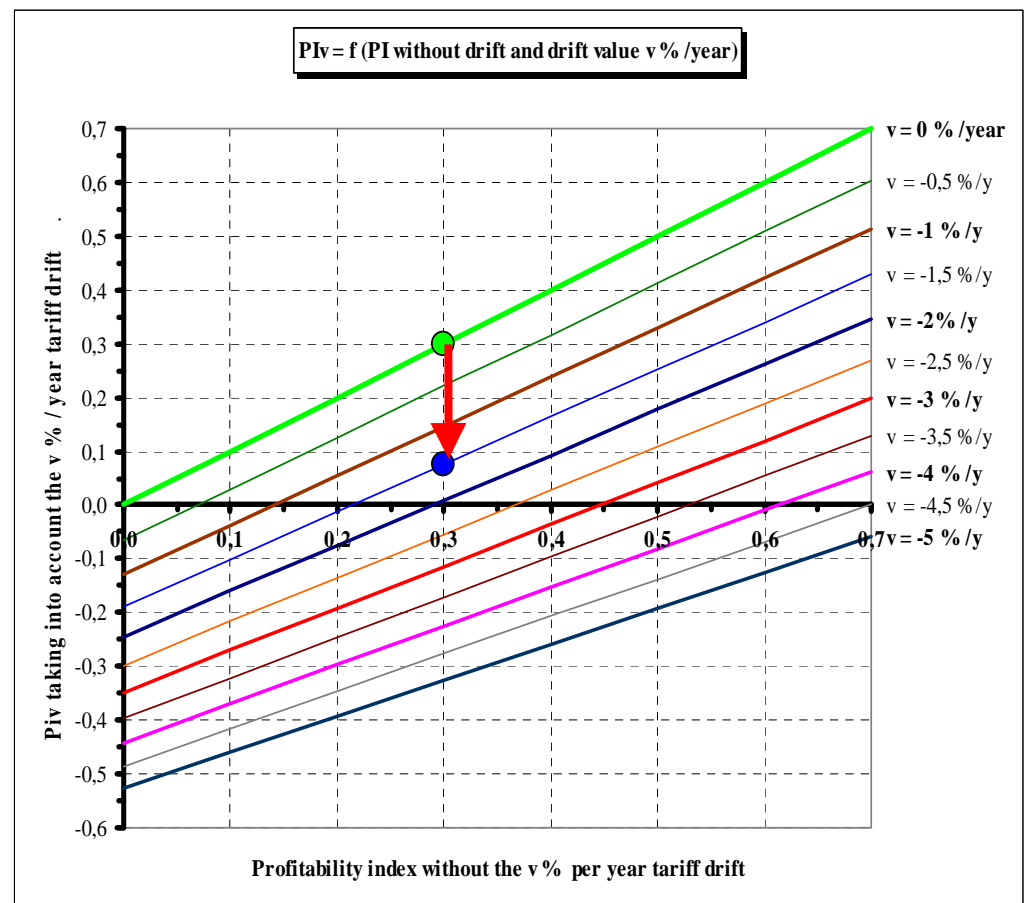
❑ **Very strong sensitivity of project profitability to the protection level of the tariff**

❑ **Advantage of using PI**

⇒ Explicit formula

⇒ Reliable profitability scale

Onshore Wind Power					
n	20,00	years	Ka(t,n)	0,08718	
t	6,00	% real	Com	2,17	c€/kWh
Iu	1 300	€/kW	Ci	4,72	c€/kWh
Nh	2 400	h/year	ODC	2,80	c€/kWh
Kom	4,00	%	Ci/ODC	0,630	



ARTs (5) Indexation of new contracts tariffs at year (n+1)?

□ Define if one must apply a decreasing rate of the tariff for new projects, e. g. in France (2006 tariffs):

⇒ Wind power tariffs : « - 2 % per year from 1/1/2008 »

⇒ Photovoltaic tariffs: « no decrease » → “- 0 % per year”

□ And above all define if this possible decreasing rate :

⇒ Must be applied on the initial value of the initial tariff, example of Ontario tariffs : no decrease in tariff expressed in current \$ → the real power purchase of the tariff is in fact decreasing in constant \$: $v = - i \% / \text{year}$ → around minus 2 % to minus 3 % / year

⇒ Or on this value corrected from inflation

⇒ Or on this value corrected by a specific index, e.g. wind power in France: 50 % variation of index ICHTTS (wages) + 50 % variation « PPEI » (products and services for industry)

⇒ Or by an index **specific to the technology** : case to consider for wind power due to large specific variation of wind turbine costs

□ Apply the corresponding definition

ARTs (6) : What next for French FITs = 100 % ARTs ??

❑ **General**

⇒ Shift inflation protection within a PPA from 60 % to 80 // 90 %

❑ **Wind**

⇒ Shift from capacity factor Nh (h/year) to **Energy Yield Eas (kWh/m².year)**: cf **OSEA 2005 adoption and proposal**.

⇒ For onshore shift from n = 15 years to n = 20 years

⇒ Adapt levels of tariffs versus the 25 GW target in 2020 and versus increasing wind turbines costs.

⇒ ...

❑ **Photovoltaic:**

⇒ Create tiered PV tariffs: North: 1000 kWh/m².y, vs 1800 south

❑ **Solid biomass: increase tariff level**

❑ **...**

❑ **Nobody is perfect, but everyone can learn from others to make progress !**

Results of French ARTs

French Wind Tariffs are Efficient (2)

❑ France was in 2007:

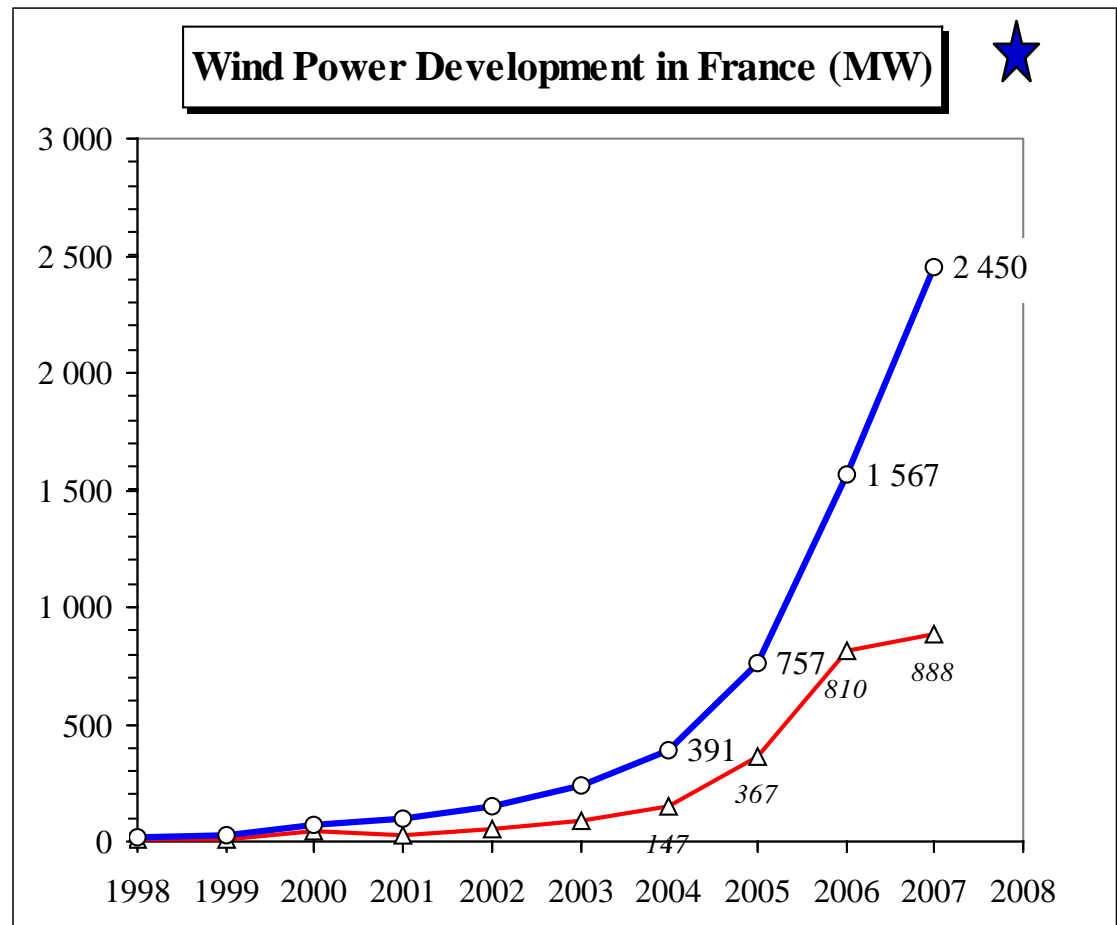
- ⇒ N° 8 wind capacity
- ⇒ N° 5 wind market (**third in EU**)

❑ Jobs created:

- ⇒ < 100 in 1993
- ⇒ Around 1000 in 2000
- ⇒ Around 5000 in 2007
- ⇒ **Towards 18 100 in 2012**

❑ FITs overcost passed on electricity consumers

- ⇒ Based on the difference between FIT and electricity market price
- ⇒ < 5 % of public service charges
- ⇒ **Less than 0.6 €family in 2007**



Conclusions

- ❑ **Market regulation in favour of RE electricity is logical and is simple and effective if based on fair and efficient tariffs (ARTs) as demonstrated in Europe and in France**
- ❑ **Benefits from this regulation are rapidly outweighing its cost**
- ❑ **2001 and 2006 French Feed-In Tariffs confirmed as the main wind development driver in France to get 25 GW in 2020**
- ❑ **Same dynamic growth created now for PV and Biogas with 2006 relevant tariffs**
- ❑ **Future French wind and other renewable policy from the new 20 % European target for renewables in 2020 will be based on continuity in success from fair and efficient tariffs**
- ❑ **An extension of FITs for renewable heat is on the way in France to get the 23 % French target for renewables in 2020**
- ❑ **Sharing experience, methods and tools can avoid delays and unnecessary or risky tests or trials for FITs systems designs**