

The role of RES in the energy landscape of the future

A critical analysis

María Eugenia SANIN
maria-eugenia.sanin@polytechnique.edu

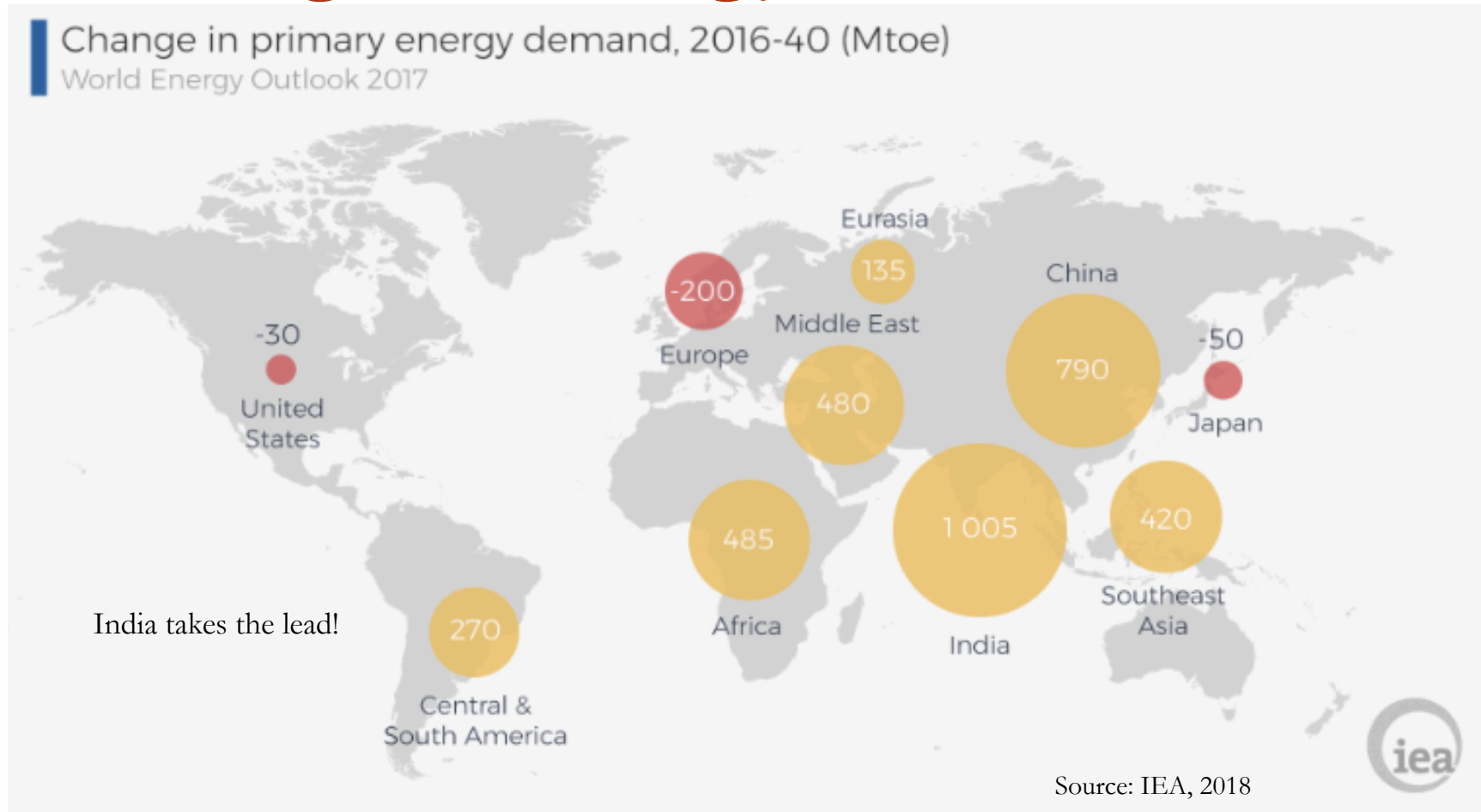


1. Global landscape

María Eugenia SANIN
maria-eugenia.sanin@polytechnique.edu



Change in Energy Demand for 2040

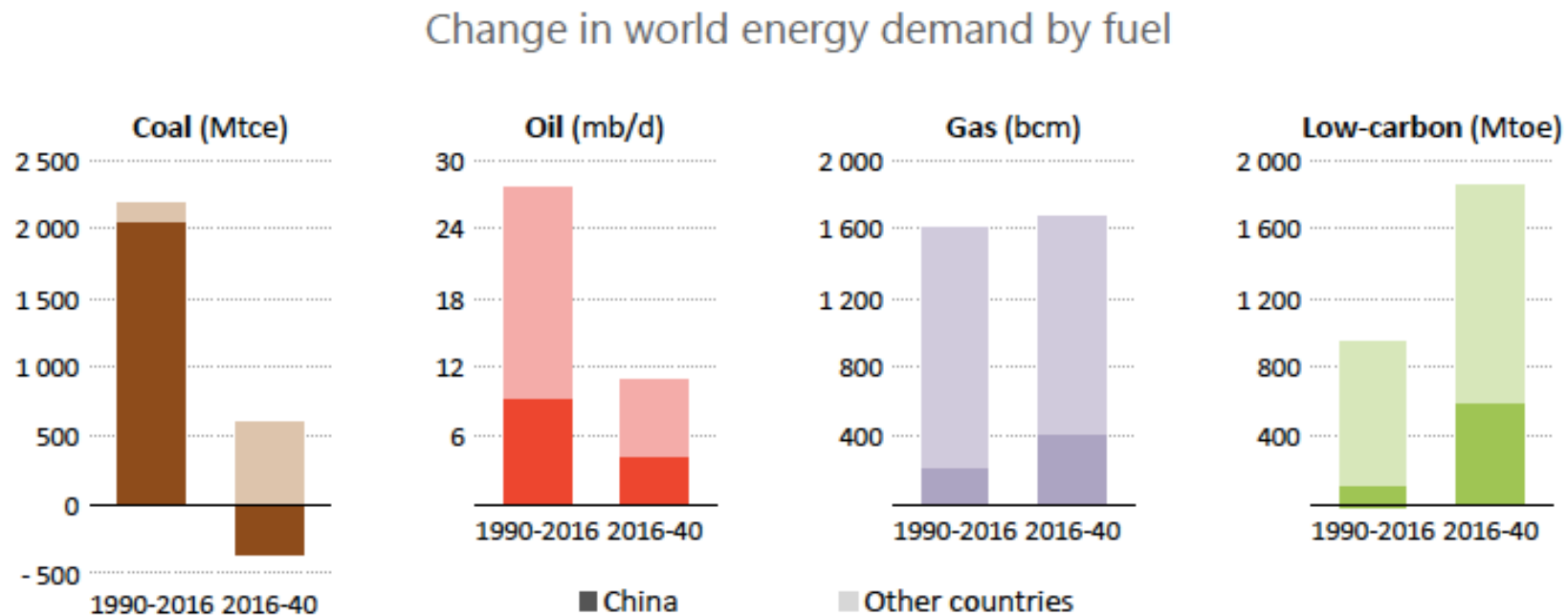


Maria-Eugenia SANIN

In the IEA's New Policies Scenario, global energy needs rise more slowly than in the past but still expand by 30% between today and 2040: equivalent to add another China and India to today's demand.

Change Energy Demand in 2040

Compared with the past 25 years, the way that the world meets its growing energy needs changes dramatically in the New Policies Scenario, with the lead now taken by **natural gas**, by the rapid rise of **renewables** and by **energy efficiency**.



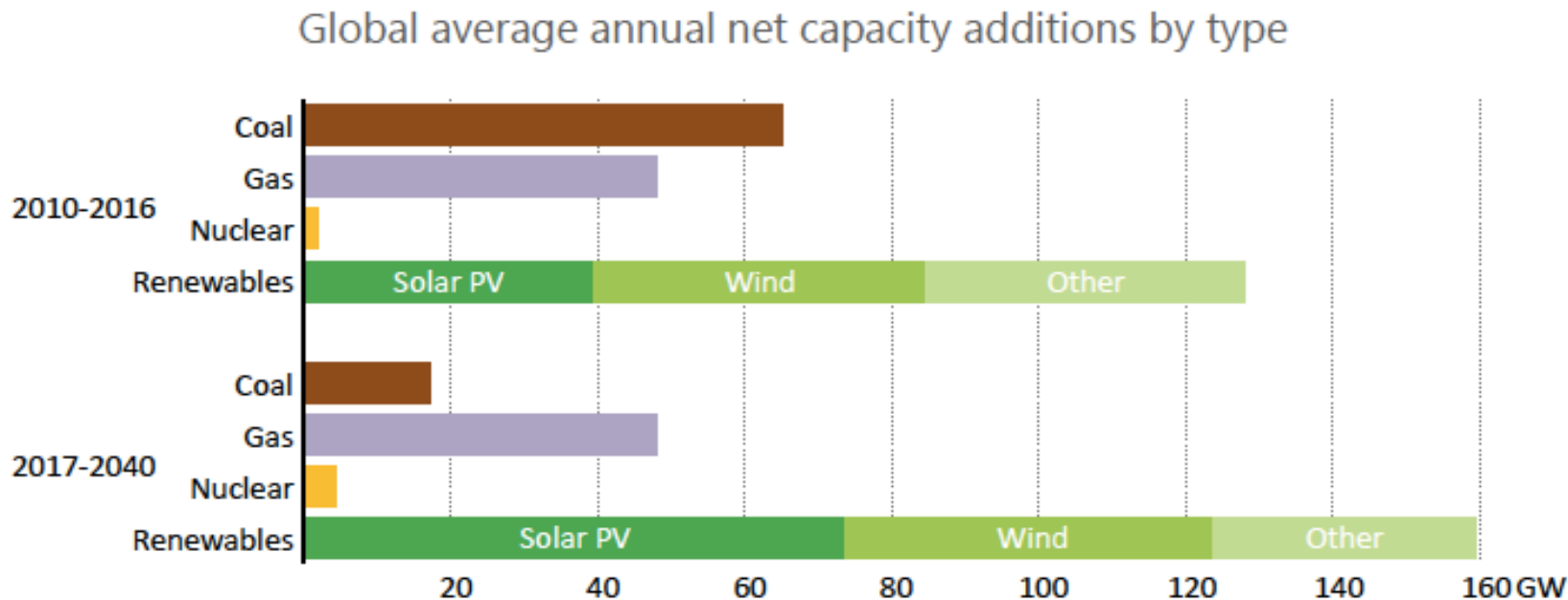
Tons of coal eq, million barrels per day, billion cubic meters, Tons oil eq.

Low-carbon sources & natural gas meet 85% of the increase in global demand (40 and 45%, respectively).

Renewable Public policy: competitive auctions versus feed-in-tariffs.

Electricity: PV leading tech.

Renewables capture 2/3 of global investment in power plants to 2040 (reaching 40% of elec capacity) as they become, for many countries, the least-cost source of new generation.



Maria-Eugenia SANIN

China, India & the US lead the charge for solar **PV**, while **Europe** is a frontrunner for onshore & offshore **wind**: rising shares of solar & wind require more **flexibility** to match power demand & supply

In **Europe** renewables will account for **80% of new capacity** in 2040.

Source: IEA, 2018

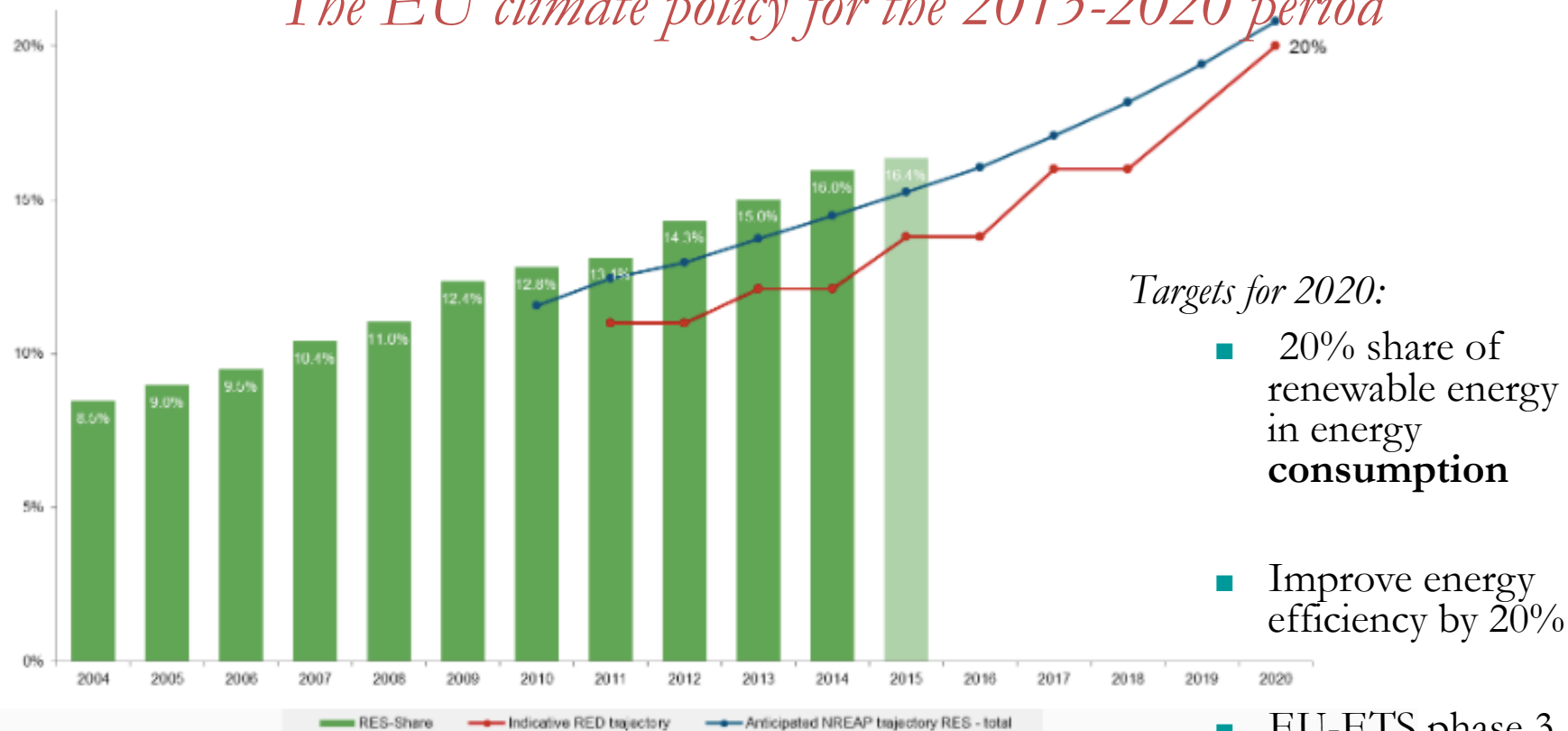
2. European context

María Eugenia SANIN
maria-eugenia.sanin@polytechnique.edu



European Energy and Climate Policy

The EU climate policy for the 2013-2020 period

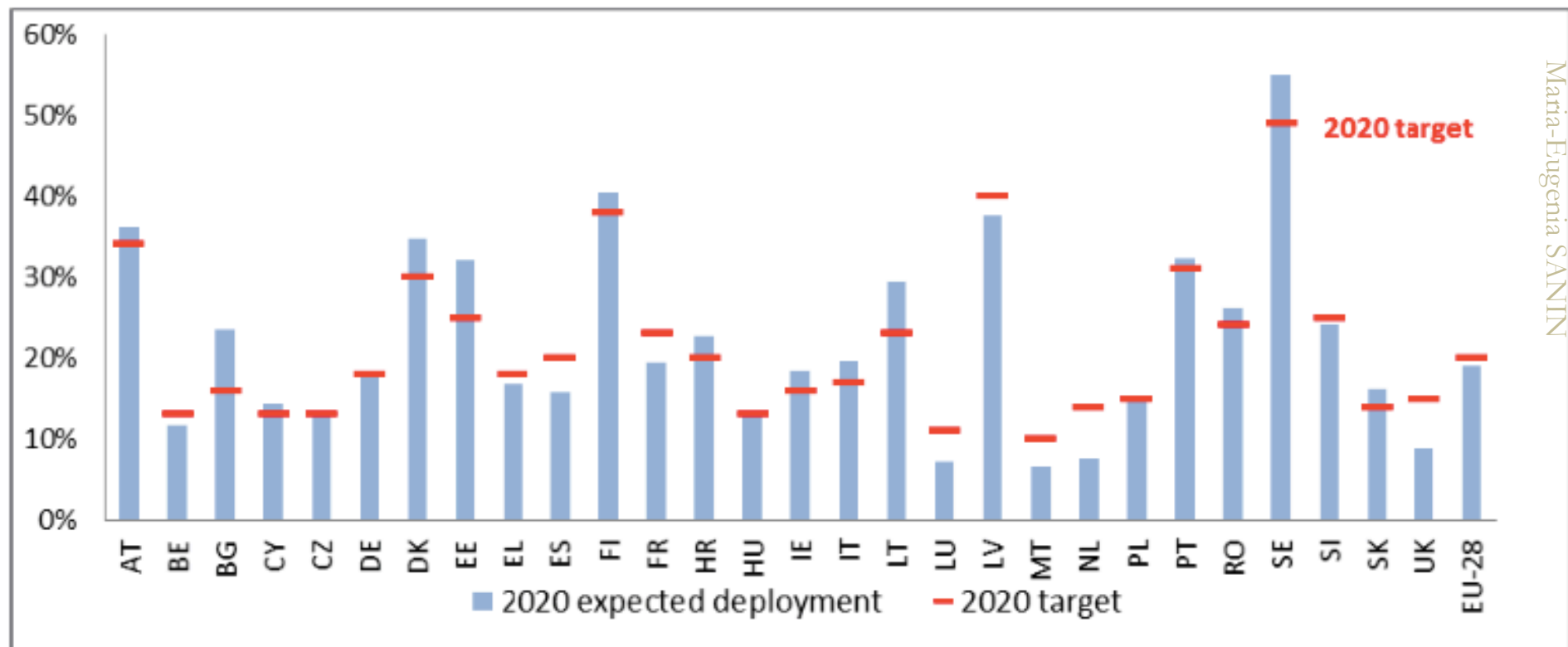


Maria-Eugenia SANIN

In 2014, the share of renewable energy sources (RES share) reached 16% of gross final energy consumption, higher than the intended trajectory for all countries together.

Progress by Country

Figure 2. Expected RES deployment in Member States and 2020 RES targets²⁰



Maria-Eugenia SANIN

Source: European Commission, based on TU Wien (Green-X) projections (2014)

European progress: main usages

Final Energy Consumption in the EU28 in 2015

based on Öko-Institute proxies, statistical transfers and mult. counting excluded in Mtoe

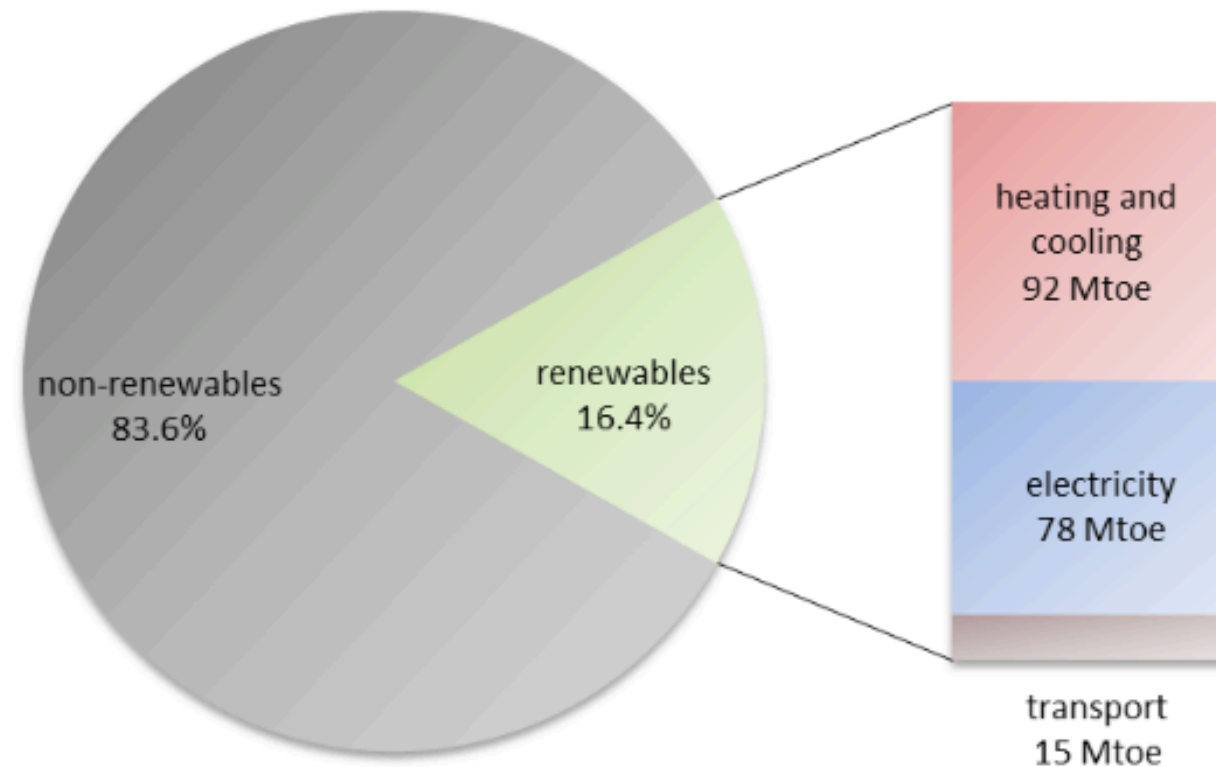


Figure 2: final energy consumption in the EU28 in 2015 (source: Öko-Institut)

European progress: sources (1)

i. Heating and cooling

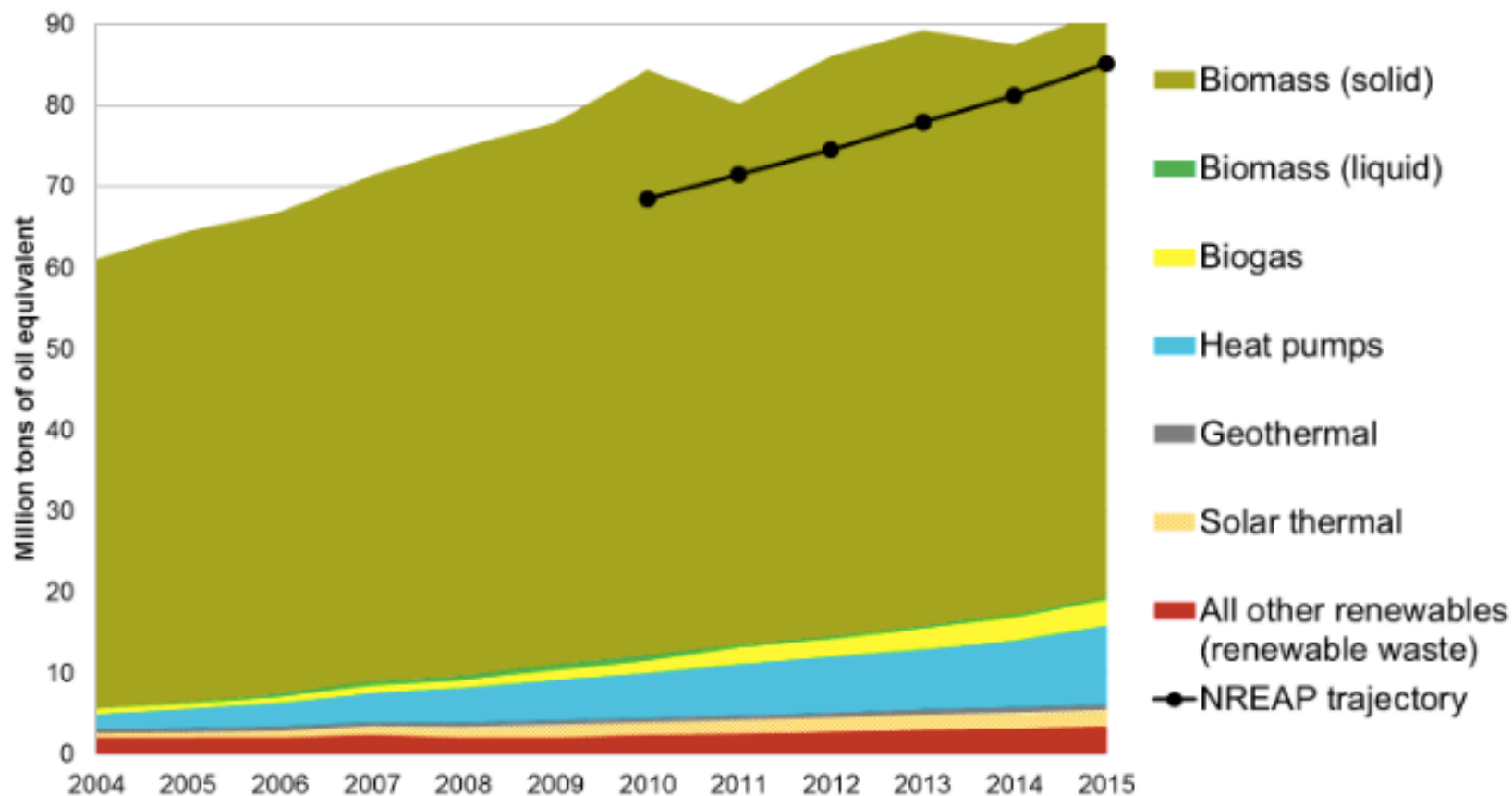


Figure 3 : EU-28 renewable heating and cooling production by source (source: EUROSTAT, Öko-Institut)

European progress: sources (2)

ii. Electricity

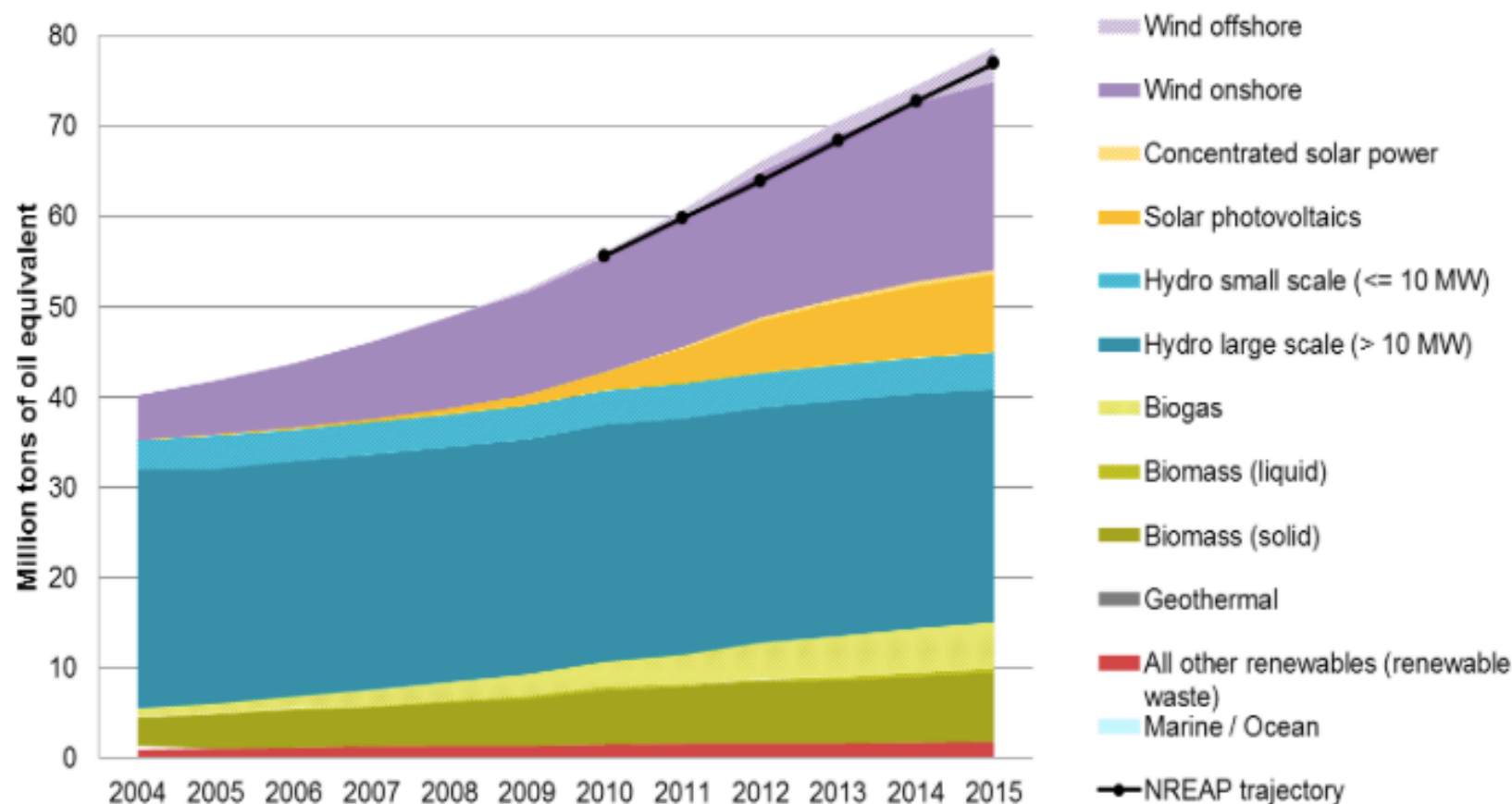


Figure 4 : EU-28 renewable electricity production by source (source: EUROSTAT, Öko-Institut)

European Energy and Climate Policy

The EU climate policy for the 2020-2030 period

Targets:

- at least a **27% share of renewable energy** consumption
- 40% reduction GHG compared to 1990
- at least 27% energy savings compared with BAU

Policies to meet them:

- A reformed EU emissions trading scheme (ETS): market stability reserve (MSR) as for 2021
- **Competitive, affordable and secure energy**: the Commission proposes a set of key indicators to assess progress over time and to provide a factual base for potential policy response: they relate to
 - energy price differentials with major trading partners
 - supply diversification
 - interconnection capacity
- New governance system to enhance security of investment, coordination and transparency

3. French context

María Eugenia SANIN
maria-eugenia.sanin@polytechnique.edu



Loi de Transition Énergétique

- Law adopted the 22nd of July and published on the 18th of August 2015.
- Main objectives:
 1. 40% reduction in GHG by 2030 and to 1/4 by 2050 (as compared to 1990). It also considers carbon budgets established by periods of 5 years having emission level caps. (Carbon price increase to 22 euros in 2016, 56 in 2022 and 100 in 2030).
 2. 30% reduction of fossil fuel consumption in 2030 as compared to 2012.
 3. Nuclear production capped to 63,2 GW and at 50% in 2025 (today is 75%).
 4. Demand: 2050's final energy consumption must be 1/2 of 2012 s.
 5. **Renewable's share must be 32% in 2030** (it was 13.7% in 2012 with 68% coming from hydro and biomass).

Programmation pluriannuelle de l'énergie

Approuvée par le décret n° 2016-1442 du 27 octobre 2016

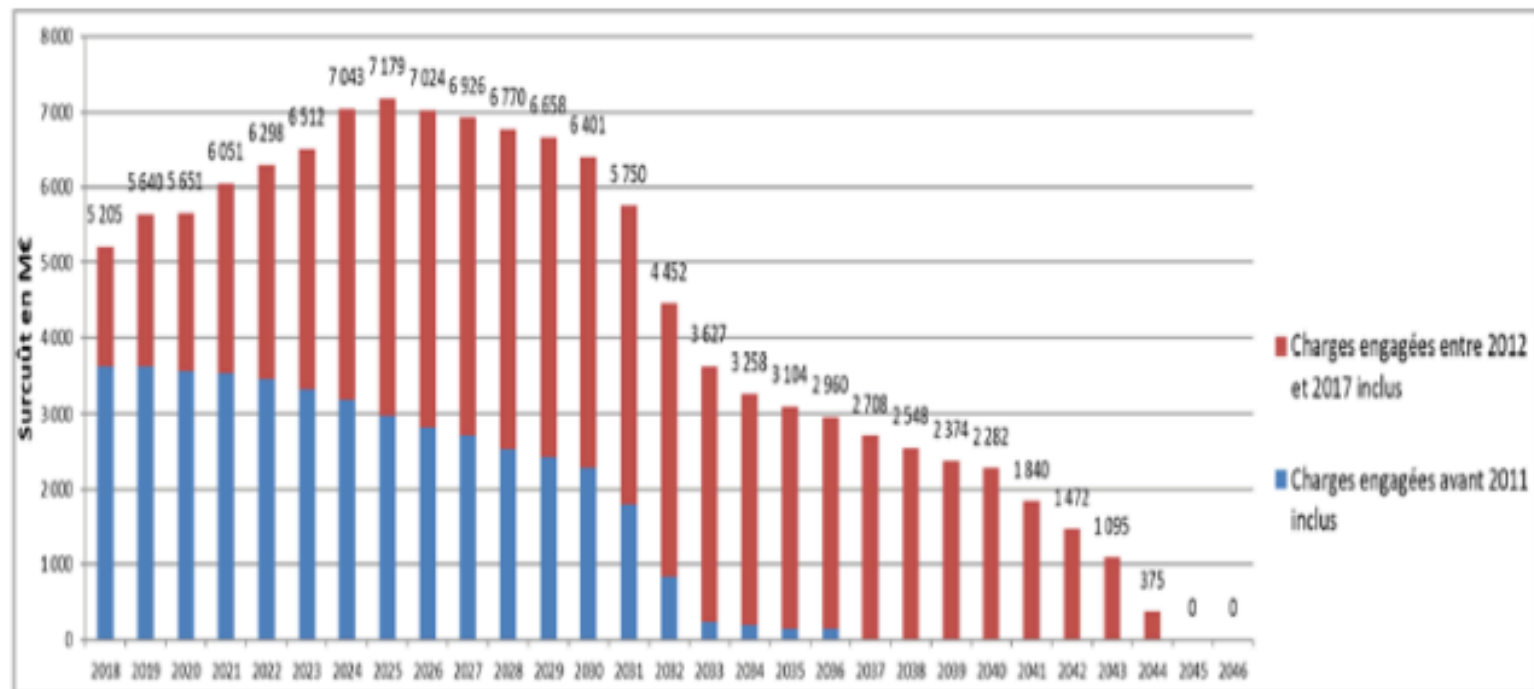
For the part concerning renewables, the objectives for 2023 (to be revised at the end of 2018):
augmenter de plus de **50% la capacité d'énergies renouvelables électriques** et augmenter de **50% la production de chaleur renouvelable** en 2023

	2014	2018	2023 bas	2023 haut
Eolien terrestre	9 300 MW	15 000 MW	21 800 MW	26 000 MW
Solaire photovoltaïque	5 300 MW	10 200 MW	18 200 MW	20 200 MW
Hydroélectricité	25 300 MW (62 TWh)	25 300 MW (61 TWh)	25 800 MW (63 TWh)	26 050 MW (64 TWh)
Eolien en mer posé		500 MW	3 000 MW (entre 500 et 6000 MW de plus de projets engagés, en fonction des concertations sur les zones propices, du retour d'expérience de la mise en oeuvre des premiers projets et sous condition de prix)	
Energies marines (éolien flottant, hydroliennes, etc.)			100 MW (entre 200 et 2 000 MW de plus de projets engagés, en fonction du retour d'expérience des fermes pilotes et sous condition de prix)	
Bois-énergie	357	540 MW	790 MW	1 040 MW
Méthanisation	85 MW	137 MW	237 MW	300 MW
Géothermie électrique		8 MW	53 MW	
Déchets, biogaz de décharge et de STEP	~1200 MW	~1350 MW	~1500 MW	
TOTAL	41 GW	52 GW	71 GW	78 GW

Maria-Eugenia SANIN

Recent debate on ENR costs in France

Graphique n° 9 : prévision d'évolution des dépenses à venir au titre des engagements pris jusqu'à fin 2017 (soutien aux EnR électriques, et au biométhane injecté)



Source : CRE¹⁰³

Les dépenses publiques inéluctables de soutien aux EnR dues aux contrats signés avant 2017 : 121 milliards d'euros (valeur 2018).

In perspective

**Tableau n° 37 : les provisions nucléaires du parc actuel d'EDF
à fin 2013 et les charges comptabilisées en 2013**

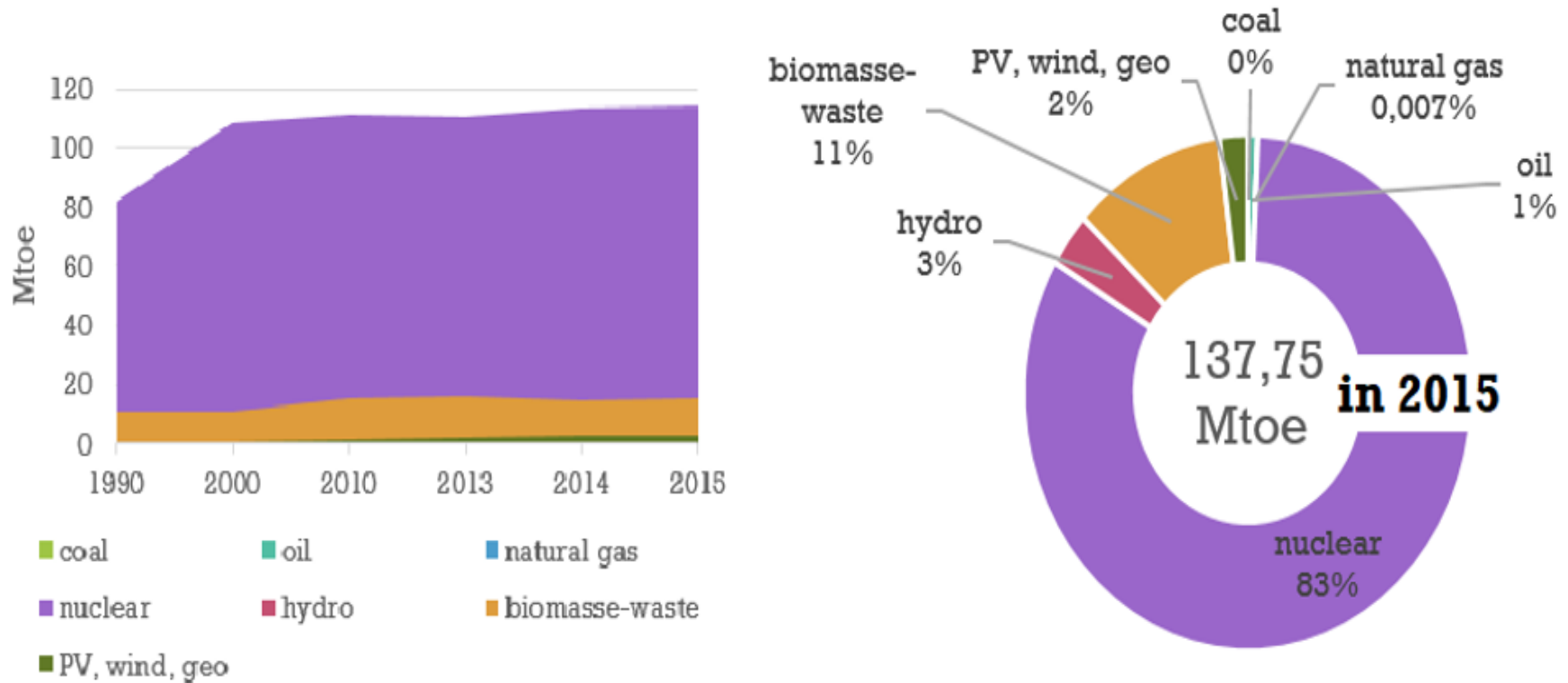
M€₂₀₁₃	Provisions	Charge annuelle	Charge annuelle en 2010 (M€₂₀₁₀)
Gestion future combustible usé et déchets	16 574	1 195 (1)	1 042 (2)
Derniers cœurs	2 313	106	91
Démantèlement des centrales en exploitation	10 907	520	461
Total	29 794	1 821	1 594

Source : Cour des comptes à partir de la comptabilité d'EDF

(1) Hors provision non récurrente de 208 M€ pour l'ANDRA

(2) L'écart de 34 M€ par rapport au chiffre du rapport 2012 est due aux charges de désactualisation pour le parc arrêté incluses à tort dans le précédent rapport.

In perspective (2)



Maria-Eugenia SANIN

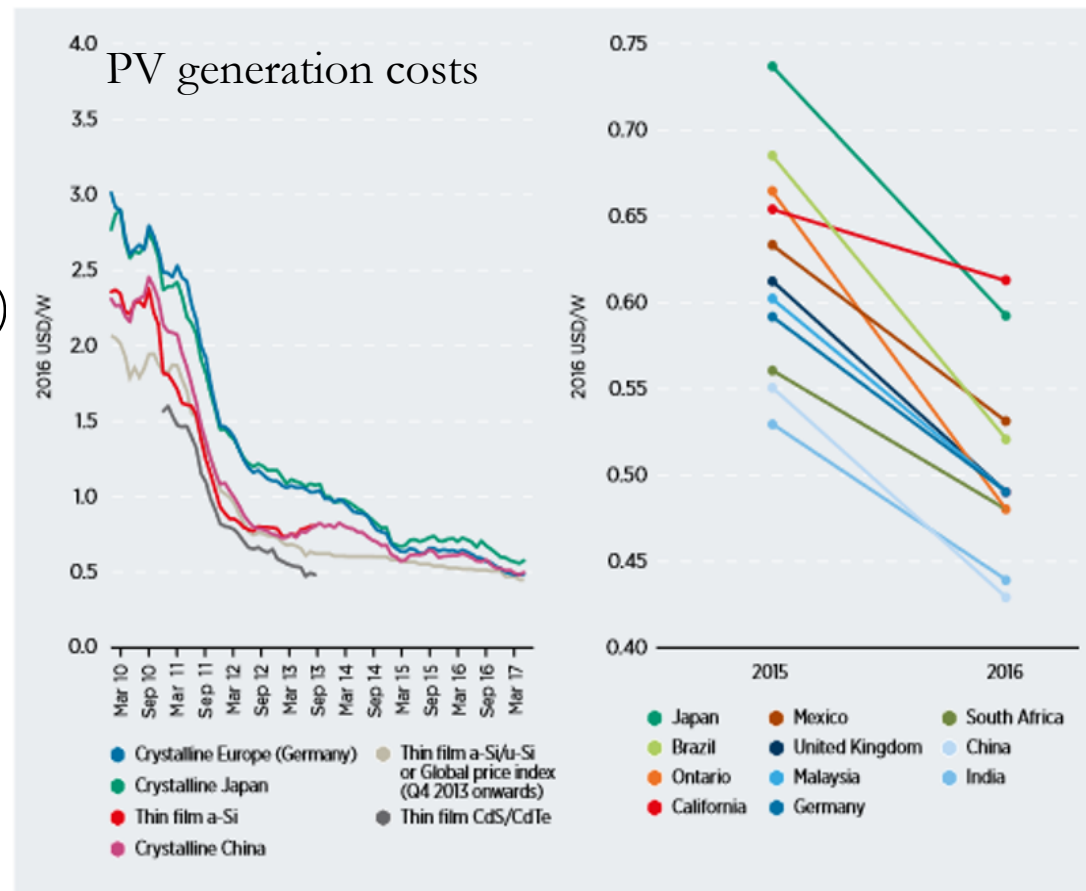
4. Focus on PV

María Eugenia SANIN
maria-eugenia.sanin@polytechnique.edu

World trends

2016's cumulative ranking of cumulative PV capacity installed:

1. China (77.7 GW)
2. Japan (41.6 GW)
3. Germany (40.9 GW)
4. USA (32.9 GW)
5. Italy (19.2 GW)
6. UK (11.2 GW)
7. India (9.6 GW)
8. **France (6.7 GW)**
9. Australia (5.2 GW)
10. Korea rep (5 GW)



Maria-Eugenia SANIN

Policy for residential PV in EU

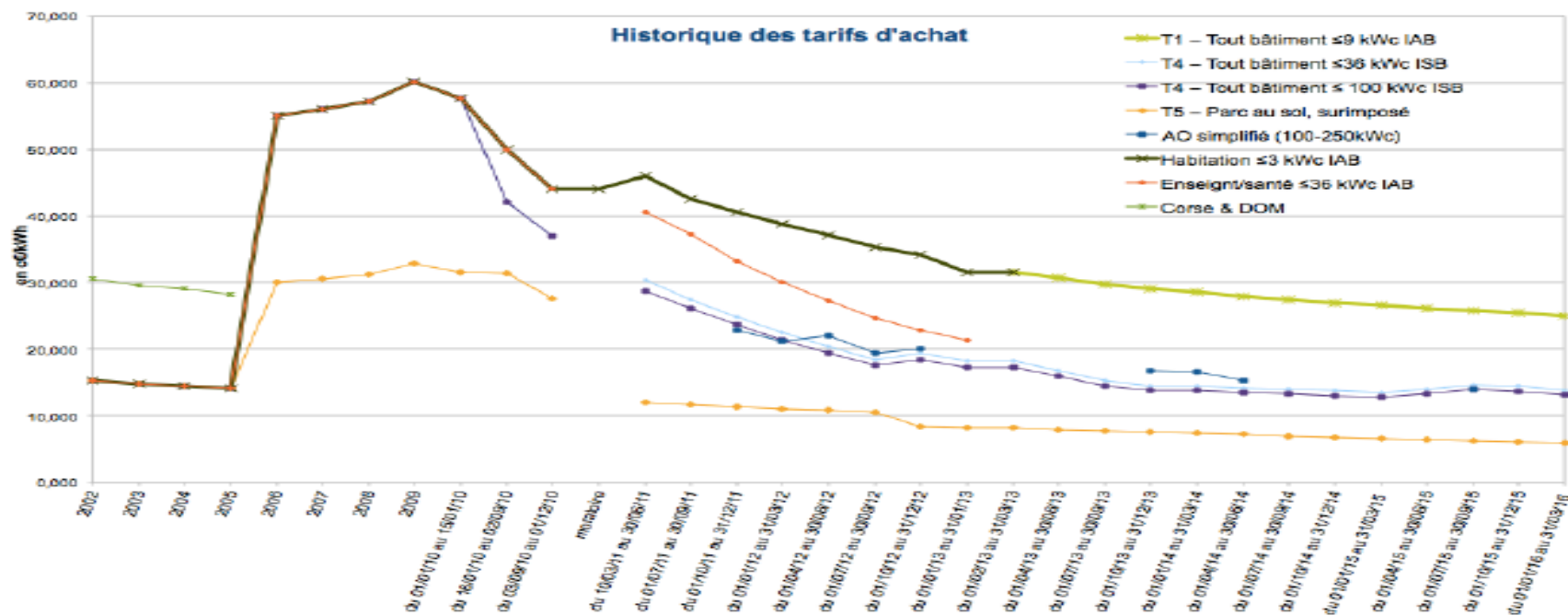
		2009	2010	2011	2012	2013	2014
Flanders	GC: (€/1000 kWh)	450	350	330	250	21	NA
	Period of eligibility	20 yrs ^a	20 yrs.	20 yrs.	20 yrs.	20 yrs.	
	Net metering ^a	MEP	MEP	MEP	MEP	MEP	MEP
	Tax credit (on gross investment)	40%	40%	40%	NA	NA	NA
Germany	FTT (€/kWh)	0.4301	0.3914	0.2874	0.2443	0.1702	0.1368
	Self-consumption premium (€/kWh)	0.2501	0.2276	0.1236	0.0805	NA	NA
	Period of eligibility	20 yrs.	20 yrs.	20 yrs.	20 yrs.	20 yrs.	20 yrs.
Italy	FTT ^a (€/kWh)	0.412 ^b	0.403 ^b	0.377 ^b	0.247 ^b	0.196	NA
	Self-consumption premium (€/kWh)	NA	NA	NA	NA	0.114	NA
	Period of eligibility	20 yrs.	20 yrs.	20 yrs.	20 yrs.	20 yrs.	NA
	Net metering ^a	PR	PR	PR	PR	NA	PR
	Tax credit (on net investment)	NA	NA	NA	NA	NA	50%
Spain	FTT (€/kWh)	0.34	0.34	0.3135	0.2738	NA	NA
	Period of eligibility	25 yrs.	25 yrs.	25 yrs.	25 yrs.	NA	NA
France	FTT (€/kWh)	0.328	0.42	0.3035	0.2249	0.1817	0.1454
	Period of eligibility	20 yrs.	20 yrs.	20 yrs.	20 yrs.	20 yrs.	20 yrs.
	Tax credit (on gross investment)	50%	50%	22%	11%	11%	NA

^a NA stands for 'not applicable', yrs. stands for 'years', MEP stands for 'at market electricity prices' and PR stands for 'partial reimbursement'.

^b In Italy, up to 2012 the FTT is available for all electricity produced rather than for the share of electricity fed into the grid, which is the case in all other countries offering FITs.

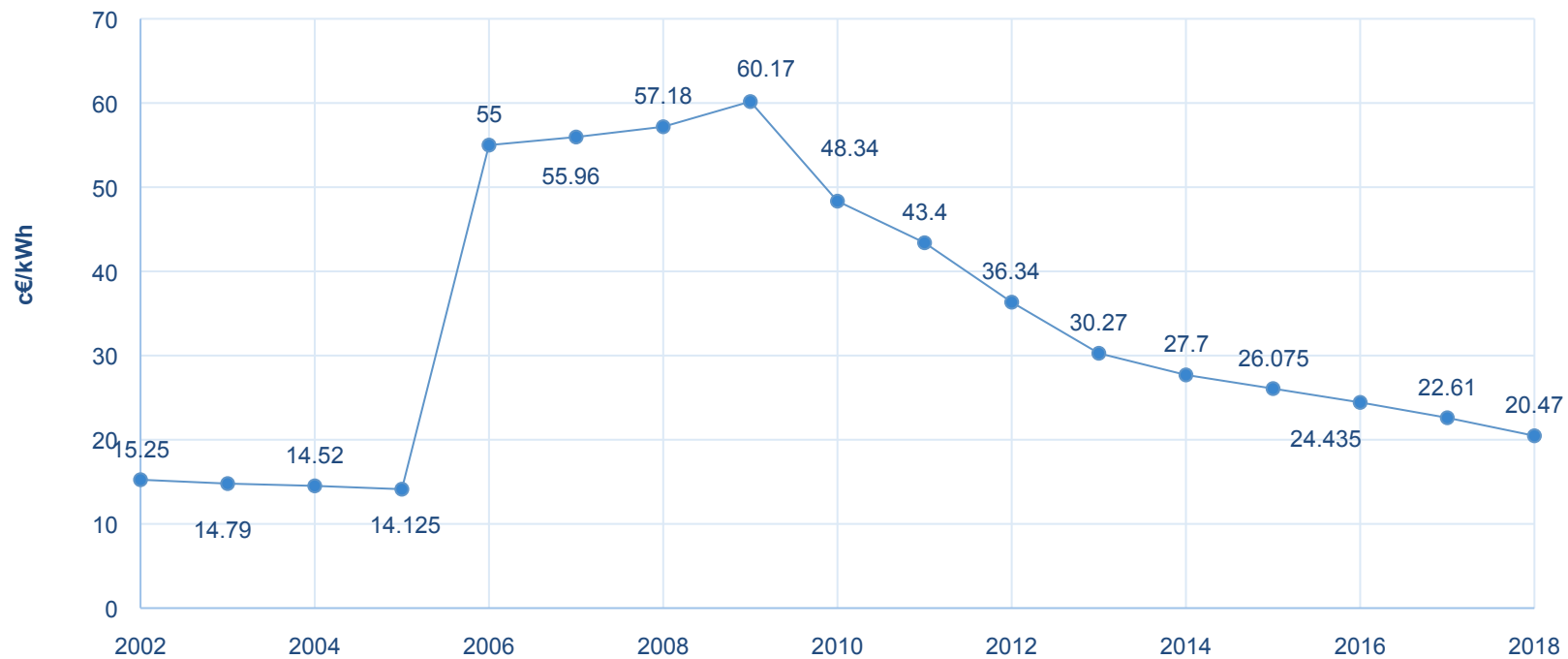
Maria-Eugenia SANIN

French Feed In Tariff



Maria-Eugenia SANIN

Feed In Tariff: Residential Consumers



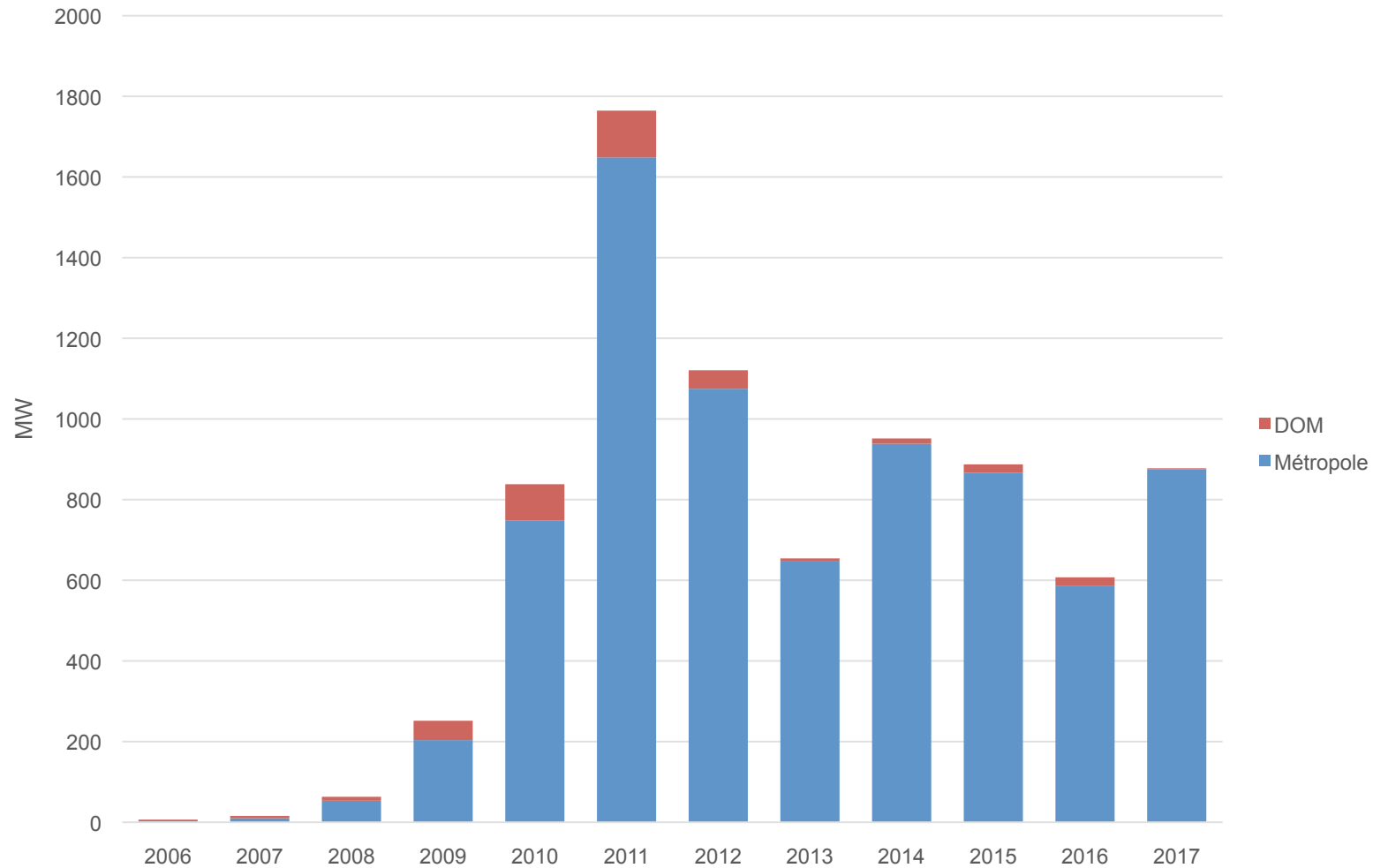
Maria-Eugenia SANIN

Other support

<i>Income Tax Credit</i>		<i>VAT</i>		
	%	Cap (EUR)	for PV	Standard
2006	50%	8000	-	-
2007	50%	8000	-	-
2008	50%	8000	-	-
2009	50%	8000	-	-
2010	50% (25% from 29/09)	8000	-	-
2011	11%	3200	7%	19.60%
2012	11%	1056	7%	19.60%
2013	11%	1056	7%	19.60%
2014	-	-	10%	20%
2015	-	-	10%	20%
2016	-	-	10%	20%
2017	-	-	10%	20%

Maria-Eugenia SANIN

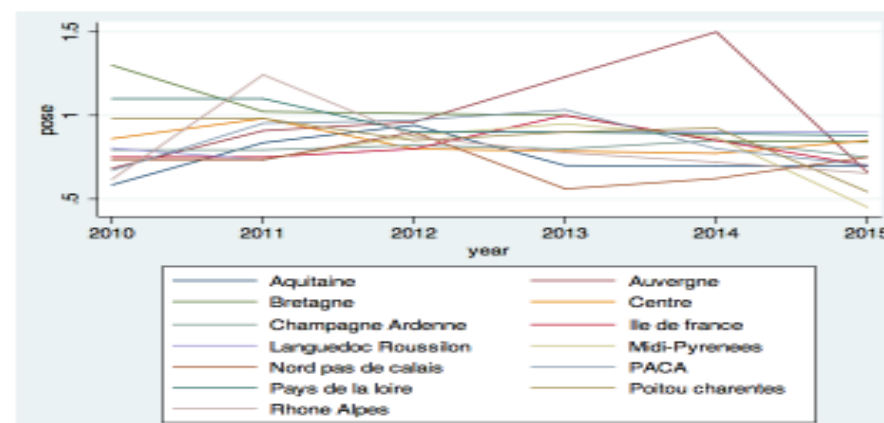
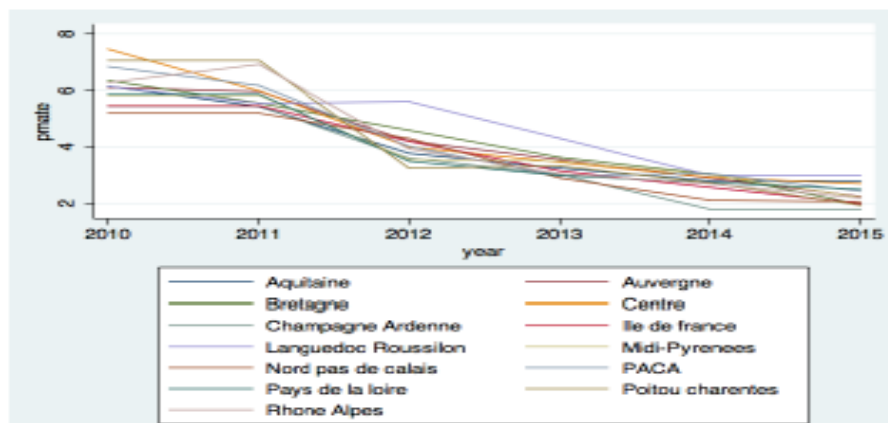
PV installed capacity in France



Maria-Eugenia SANIN

Source: IRENA (2017)

In France: Decreasing but heterogeneous by region

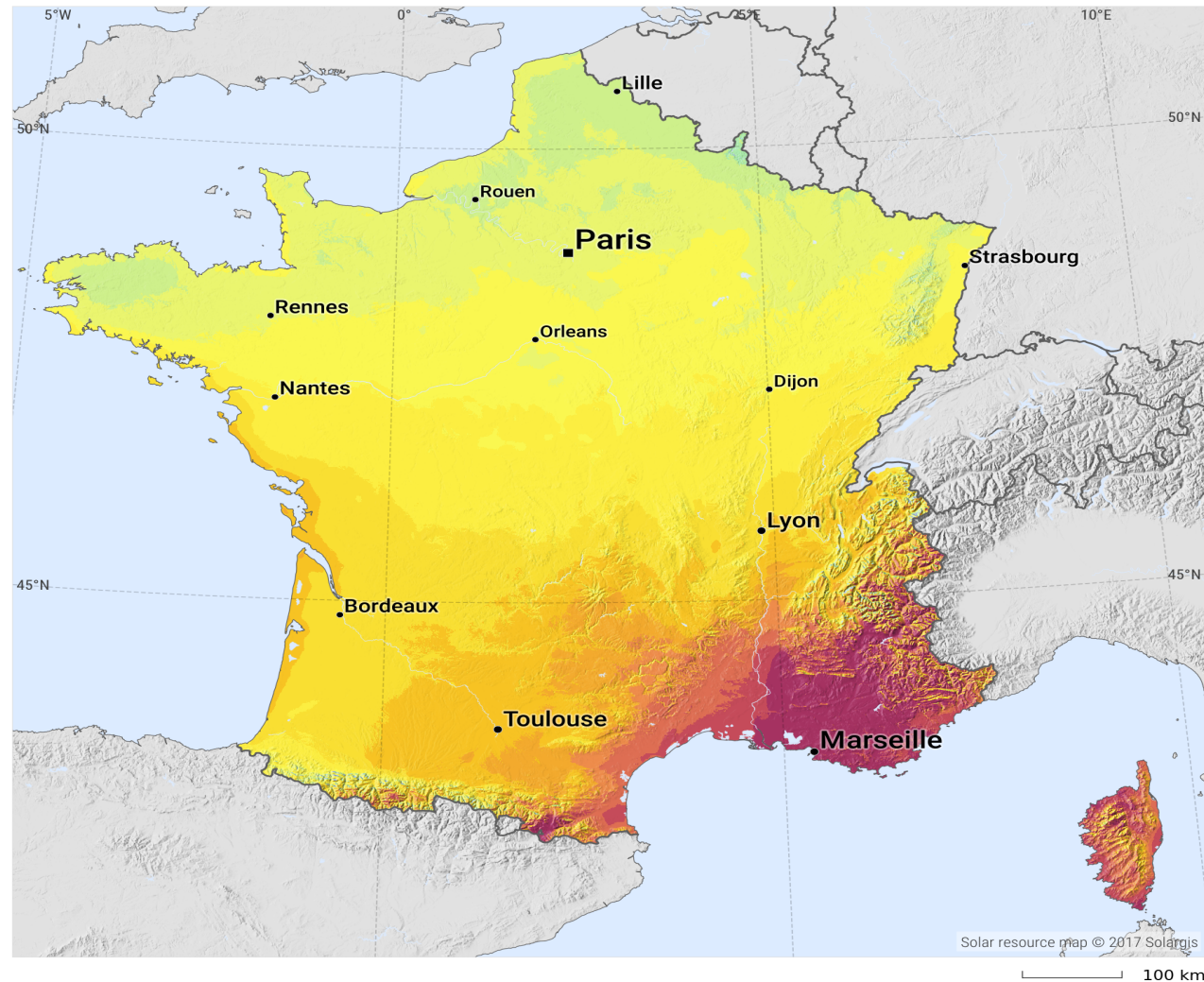


Maria-Eugenia SANIN

Results

PHOTOVOLTAIC POWER POTENTIAL FRANCE

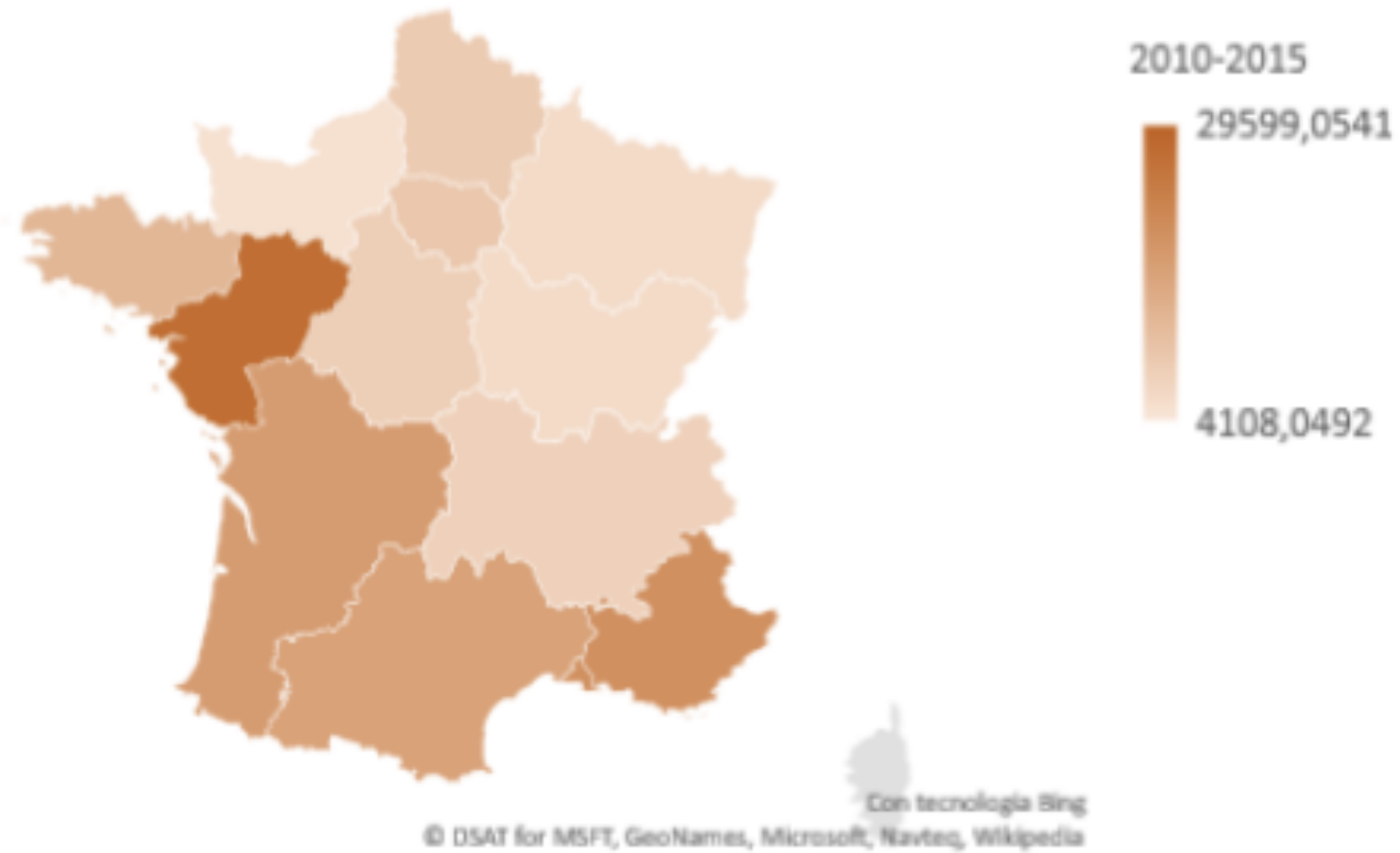
SOLARGIS



This map is licensed by Solargis under the Creative Commons Attribution license (CC BY-SA 4.0). You are encouraged to use content of the map to benefit yourself and others in creative ways. For more information, please visit <http://solargis.com/download>.

Results

Number of installations 2010-2015



Maria-Eugenia SANIN

4. Concluding remarks

A critical analysis

María Eugenia SANIN
maria-eugenia.sanin@polytechnique.edu

Several points still present themselves as an open debate

- A whole set of policies in place but...
 - Security of Supply: diversify at least cost and with efficient functioning
 - CO₂ emissions: overlapping policies are suboptimal
 - A systemic analysis of the energy matrix must be conducted to choose the best strategy considering all the policy objectives as well as different technologies expected evolution in terms of costs (ADEME usually carries on this type of analysis).