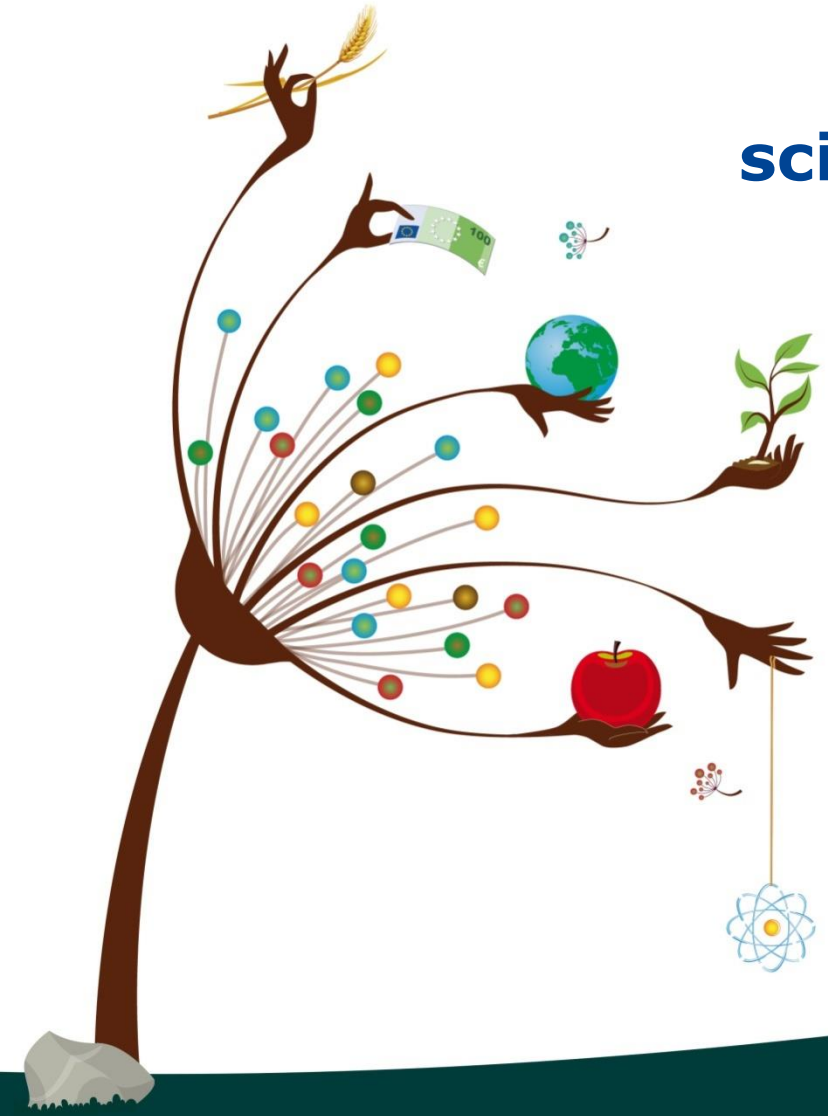

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EU Regional Benchmarking to Assess Territorial Patterns under Energy Technologies Selected in the Framework of Smart Specialisation

Analysis of Territorial Systems
Juan Pablo Jiménez Navarro

Seville, 29th September 2016

Presentation structure

- Introduction & background
- Objective
- Methodology
- Case study
- Future work

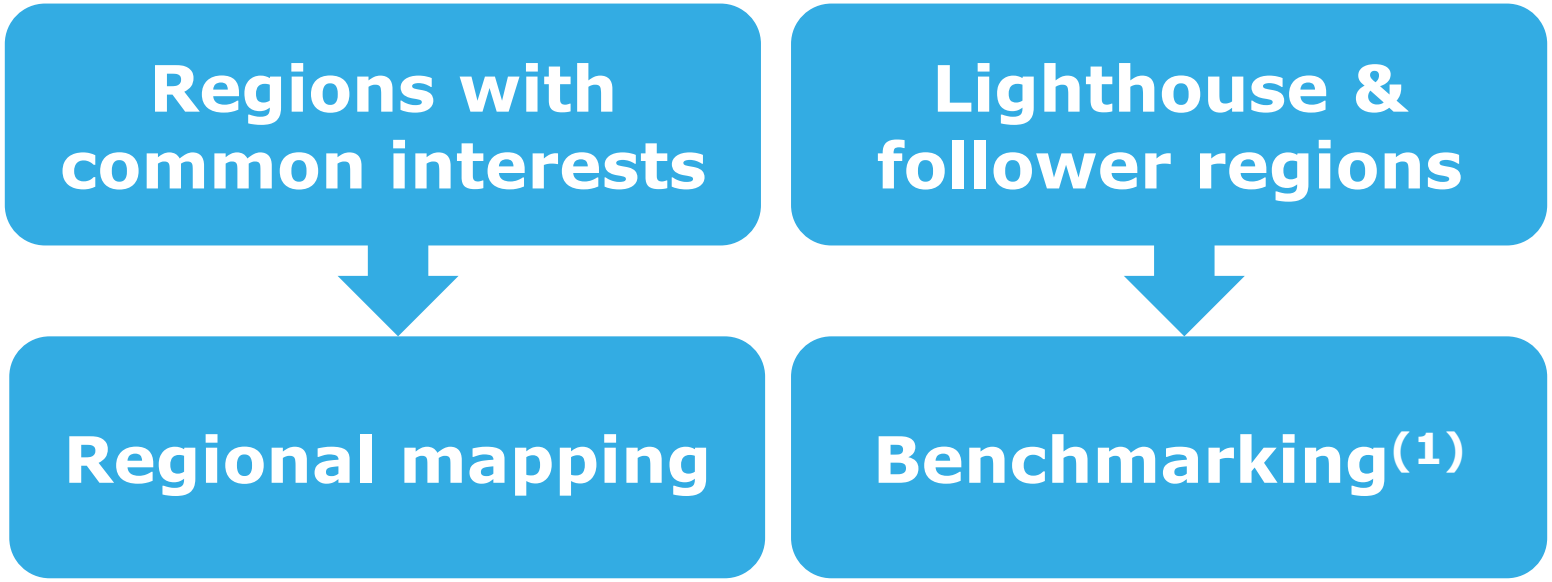
Introduction & background

"One of the most important aspects under the concept of the Smart Specialisation Strategy is **territorial cooperation**"

Building bridges between people
European Commission, 2011

Introduction & background

How do we ensure the effectiveness of **territorial cooperation**?



(1) http://s3platform.jrc.ec.europa.eu/regional-benchmarking

Objective

Provide a methodology to foster the creation of regional working groups within energy themes by:

i. facilitating the identification of groups of regions with a common **energy** interest – *Regional mapping*
ii. measuring level of similarity amongst them - *Benchmarking*
iii. identifying lighthouse regions in certain energy aspects (*dimensions*)

Objective – Why energy?

i. Amongst different areas, energy plays a main role as a cross-cutting issue that affects many other sectors as well as their productivity.

ii. Wide energy interest

More than **250 territorial units** have demonstrated energy interest in their smart specialisation strategies

Juan Pablo Jiménez Navarro, Andreas Uihlein: Mapping regional energy interests for S3P-Energy. JRC Science for Policy

Methodology

4-steps methodology:

- **Classification of regions** per energy technology interest
- Definition of a **list of energy indicators** used to carry out the comparison. Collection of information & calculation of indicators
- Analysis of **energy similarities** amongst regions
- Weighted-parameter analysis

Methodology

1st step: Classification of regions per energy technology interest

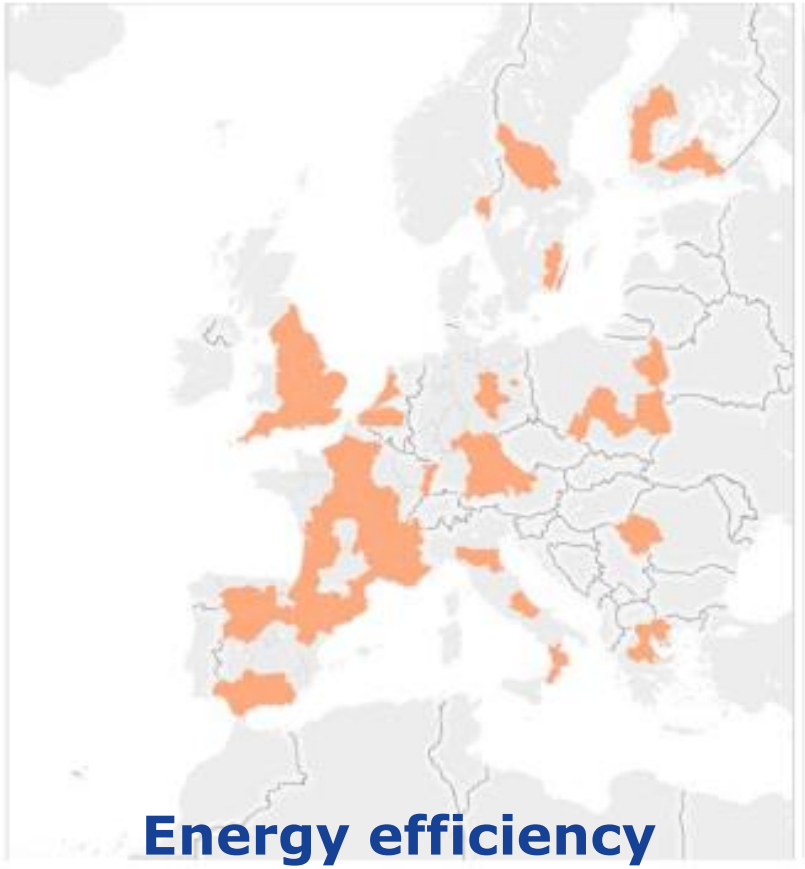
i. Eye@RIS3 tool

ii. Only summarised information provided by the tool was assessed in order to simplify the classification

iii. List of energy technologies based on Strategic Energy Technology Information System (SETIS)

European Commission

Methodology



Energy efficiency

Smart grids

Joint Research Centre

Methodology

2nd step: Definition of a **list of energy indicators.**
Collection of information & calculation of indicators

- No consensus from literature review
- Lack of information available at regional level

Proposed list of indicators organised in seven dimensions

New proposals are welcomed!

Socio-economic
Energy price
Energy use
Energy technology deployment
Academia
Sectorial structure
Innovation capacities

Dimension	Elements	Parameter	Geographical coverage	Year	Unit
Socio-economic	Population	Total population	Regional	2013	N of inhabitants
	Urban	Population in urban areas	Regional	2013	N of inhabitants
	Region wealth	Gross Domestic Product	Regional	2013	EUR
		Gross Domestic Product	Regional	2013	GDP/inhabitants
Energy Price	End use energy price before taxes	Gas Price for Domestic	National	2014	EUR/kWh
		Gas Price for Industrial	National	2014	EUR/kWh
		Electricity Price for Domestic	National	2014	EUR/kWh
		Electricity Price for Industrial	National	2014	EUR/kWh
	End use energy price after taxes	Gas Price for Domestic	National	2014	EUR/kWh
		Gas Price for Industrial	National	2014	EUR/kWh
		Electricity Price for Domestic	National	2014	EUR/kWh
		Electricity Price for Industrial	National	2014	EUR/kWh
Energy Use	Energy consumption	Final energy consumption - total	Regional	2009	Ktoe/year
		Final energy consumption – by households	Regional	2009	Ktoe/year
	Relative energy consumption	Energy Use per GDP	Regional	2009	MWh/EUR
		Energy Use per inhabitant	Regional	2009	MWh/inhabitant
	Energy Demand	Heating Degree Days	Regional	2009	HDD
Wind	Wind capacity	Installed capacity	Regional	2014	$MW_{operation}$
	Wind production	Energy produced		2014	$GWh_{produced}$

Dimension	Elements	Parameter	Geographical coverage	Year	Unit	Included in the analysis	Source
Energy deployment	Wind deployment	Number of plants	Regional	2014	-	YES	GlobalData/Renewable UK
Academia	Universities	Number of universities	Regional	2016	-	YES	Scopus
	Regional in-house Knowledge	Number of publications	Regional	2016	N of wind publication	YES	Scopus
			Regional	2016	Share of wind publication in the energy area	YES	Scopus
			Regional	2016	Share of wind publications	YES	Scopus
Sectorial structure	Energy sector size	Number of companies with innovative activities	Regional	2015	N of companies in the region.	YES	BNEF
		Representativeness of the regional sector at the national level	Regional	2015	%	YES	BNEF
Innovation capacities	Total intramural R&D expenditure (GERD) by sectors of performance and NUTS 2 regions	All sectors	Regional	2013	EUR/inhabitant	YES	[Eurostat 2016a]
		Business enterprise sector	Regional	2013		YES	
		Government sector	Regional	2013		YES	
		Higher education sector	Regional	2013		YES	
		Private non-profit sector	Regional	2013		YES	
	Total R&D personnel and researchers by sectors of performance, sex and NUTS 2 regions	Number of researchers	Regional	2013	Number	YES	[Eurostat 2016b]

Methodology

3rd step: Analysis of energy similarities amongst regions

i. Calculation of dissimilarity or distance matrix

$$D=\begin{bmatrix} \mathbf{0} & \mathbf{d(1,2)} & \cdots & \mathbf{d(1,n)} \\ \vdots & \mathbf{0} & & \vdots \\ \mathbf{sym} & \cdots & & \mathbf{0} \end{bmatrix}$$

ii. Euclidean distance (r = 2)

$$d(i,j) = \left(\sum_{k=1}^{n} |p_{i,k} - p_{j,k}|^r\right)^{1/r}, r \geq 1 \quad (1)$$

iii. Normalization of variables

$$p'_{i,k} = \frac{p_{i,k} - \overline{p_k}}{\sigma_k}$$

4th step: Weighted-parameter analysis

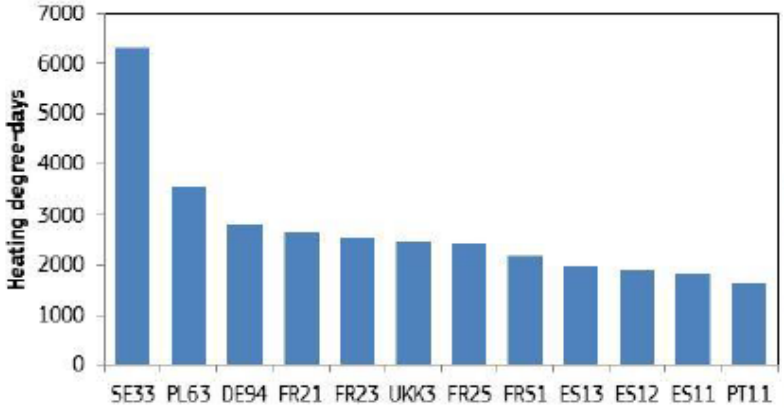
$$Weight\ param_i = \frac{1}{Number\ of\ dimensions} \cdot \frac{1}{\sum_j^N param_j}$$

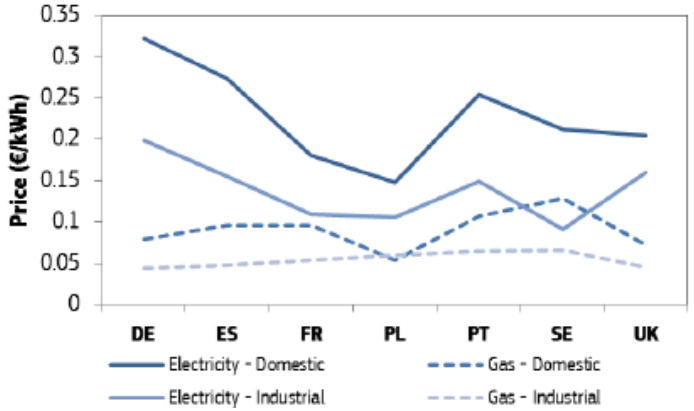
Case study – Wind energy

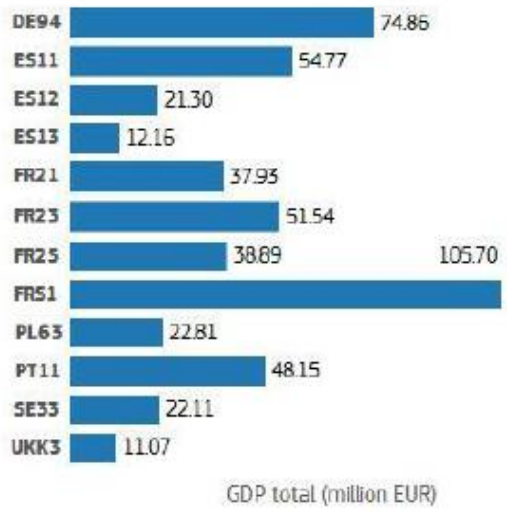
NUTS ID	COUNTRY CODE	NUTS NUTS Level	Region/Country Name
DE94	DE	2	Weser-Ems
ES11	ES	2	Galicia
ES12	ES	2	Principado de Asturias
ES13	ES	2	Cantabria
FR21	FR	2	Champagne-Ardenne
FR23	FR	2	Haute-Normandie
FR25	FR	2	Basse-Normandie
FR51	FR	2	Pays de la Loire
FR94	FR	2	Réunion
PL63	PL	2	Pomorskie
PT11	PT	2	Norte
SE33	SE	2	Övre Norrland
UKK3	UK	2	Cornwall and Isles of Scilly

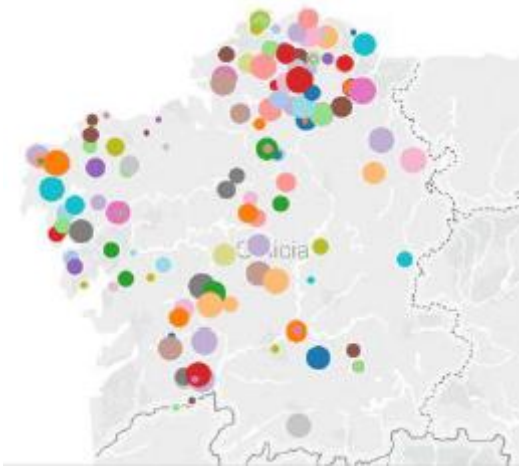
Case study – Wind energy

Results from data collection









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Case study – Wind energy

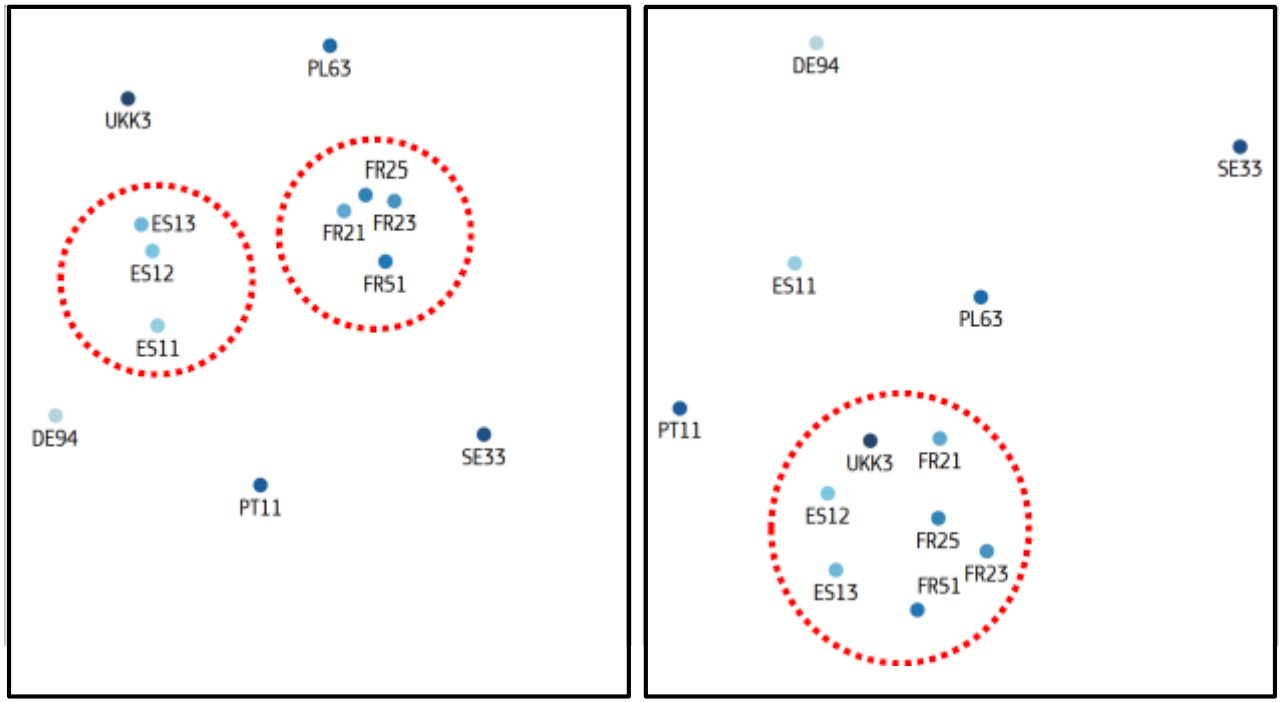
Distance matrices

Regions	DE94	ES11	ES12	ES13	FR21	FR23	FR25	FR51	PL63	PT11	SE33	UKK3
DE94	0.00	9.33	10.60	11.24	12.13	12.83	12.72	12.17	13.42	13.14	15.90	11.57
ES11	9.33	0.00	4.57	5.55	9.65	10.53	10.22	10.11	11.70	9.59	13.53	8.77
ES12	10.60	4.57	0.00	2.24	9.37	9.67	9.52	10.09	11.14	9.63	13.34	7.64
ES13	11.24	5.55	2.24	0.00	9.57	10.00	9.36	10.32	11.35	9.92	13.08	7.59
FR21	12.13	9.65	9.37	9.57	0.00	2.99	2.51	4.28	7.82	11.47	10.77	10.05
FR23	12.83	10.53	9.67	10.00	2.99	0.00	2.75	3.80	8.18	11.73	11.00	10.63
FR25	12.72	10.22	9.52	9.36	2.51	2.75	0.00	3.87	7.85	11.29	10.39	10.15
FR51	12.17	10.11	10.09	10.32	4.28	3.80	3.87	0.00	8.13	10.91	11.17	11.05
PL63	13.42	11.70	11.14	11.35	7.82	8.18	7.85	8.13	0.00	13.01	13.84	10.86
PT11	13.14	9.59	9.63	9.92	11.47	11.73	11.29	10.91	13.01	0.00	13.41	12.59
SE33	15.90	13.53	13.34	13.08	10.77	11.00	10.39	11.17	13.84	13.41	0.00	15.76
UKK3	11.57	8.77	7.64	7.59	10.05	10.63	10.15	11.05	10.86	12.59	15.76	0.00
Average Distance	12.28	9.41	8.89	9.11	8.24	8.55	8.24	8.72	10.66	11.52	12.93	10.61

Regions	DE94	ES11	ES12	ES13	FR21	FR23	FR25	FR51	PL63	PT11	SE33	UKK3
DE94	0.00	24.33	36.29	41.78	36.83	42.03	40.72	38.10	40.79	39.29	56.35	38.42
ES11	24.33	0.00	21.69	27.69	23.42	30.67	27.34	25.42	31.94	28.98	59.72	25.80
ES12	36.29	21.69	0.00	9.92	17.05	20.03	16.55	19.69	25.41	28.91	57.74	12.73
ES13	41.78	27.69	9.92	0.00	18.47	21.87	15.17	21.34	26.99	32.60	56.50	12.24
FR21	36.83	23.42	17.05	18.47	0.00	13.88	11.31	17.48	22.44	34.04	49.83	13.99
FR23	42.03	30.67	20.03	21.87	13.88	0.00	10.99	15.28	25.54	35.62	51.04	20.75
FR25	40.72	27.34	16.55	15.17	11.31	10.99	0.00	14.32	23.04	32.15	50.11	15.33
FR51	38.10	25.42	19.69	21.34	17.48	15.28	14.32	0.00	25.89	29.42	54.26	22.50
PL63	40.79	31.94	25.41	26.99	22.44	25.54	23.04	25.89	0.00	30.04	46.27	22.09
PT11	39.29	28.98	28.91	32.60	34.04	35.62	32.15	29.42	30.04	0.00	65.43	31.83
SE33	56.35	59.72	57.74	56.50	49.83	51.04	50.11	54.26	46.27	65.43	0.00	54.17
UKK3	38.42	25.80	12.73	12.24	13.99	20.75	15.33	22.50	22.09	31.83	54.17	0.00
Average Distance	39.54	29.73	24.18	25.87	23.52	26.15	23.37	25.79	29.13	35.30	54.67	24.53

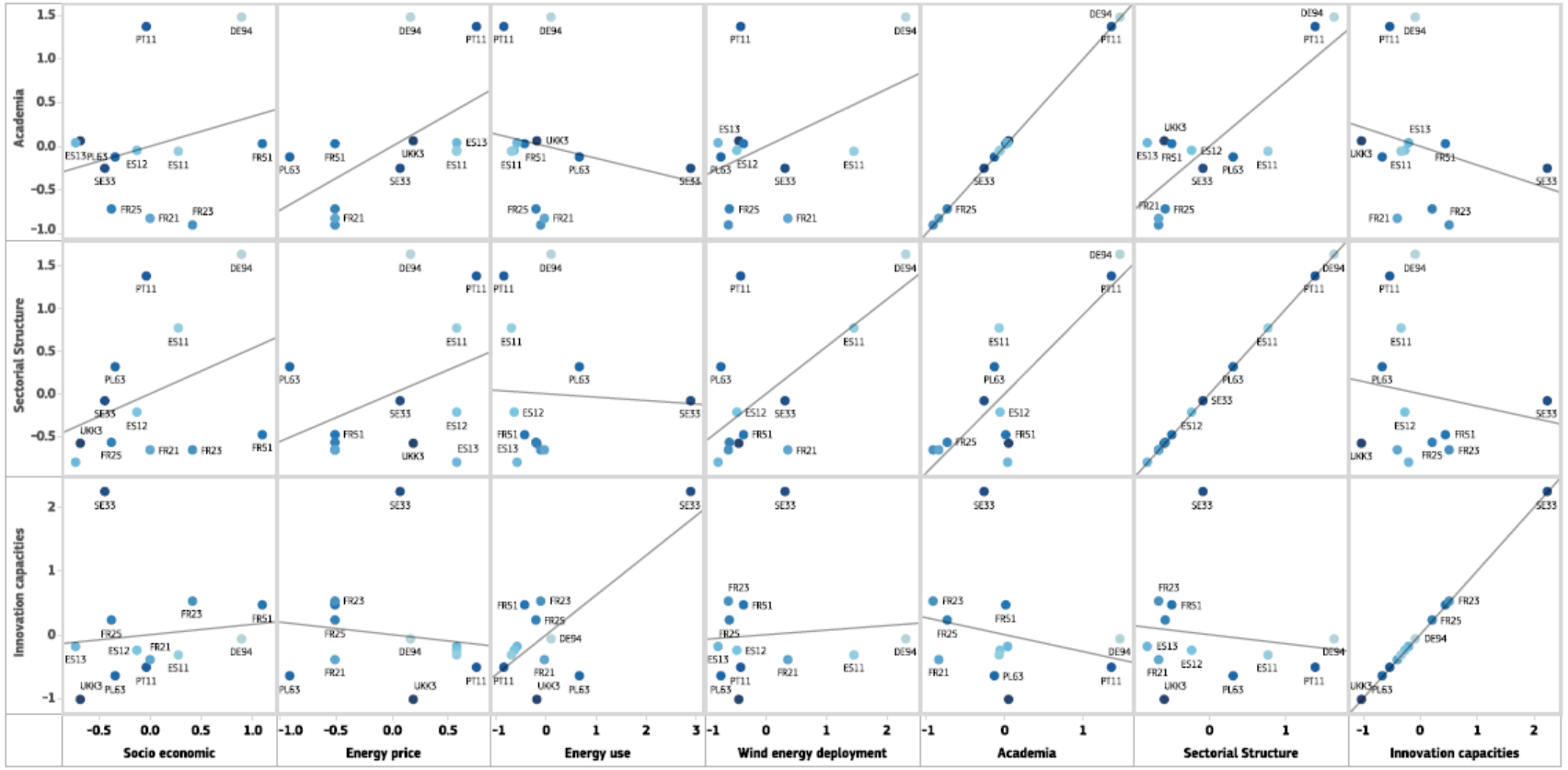
Case study – Wind energy

2D - Distance matrix



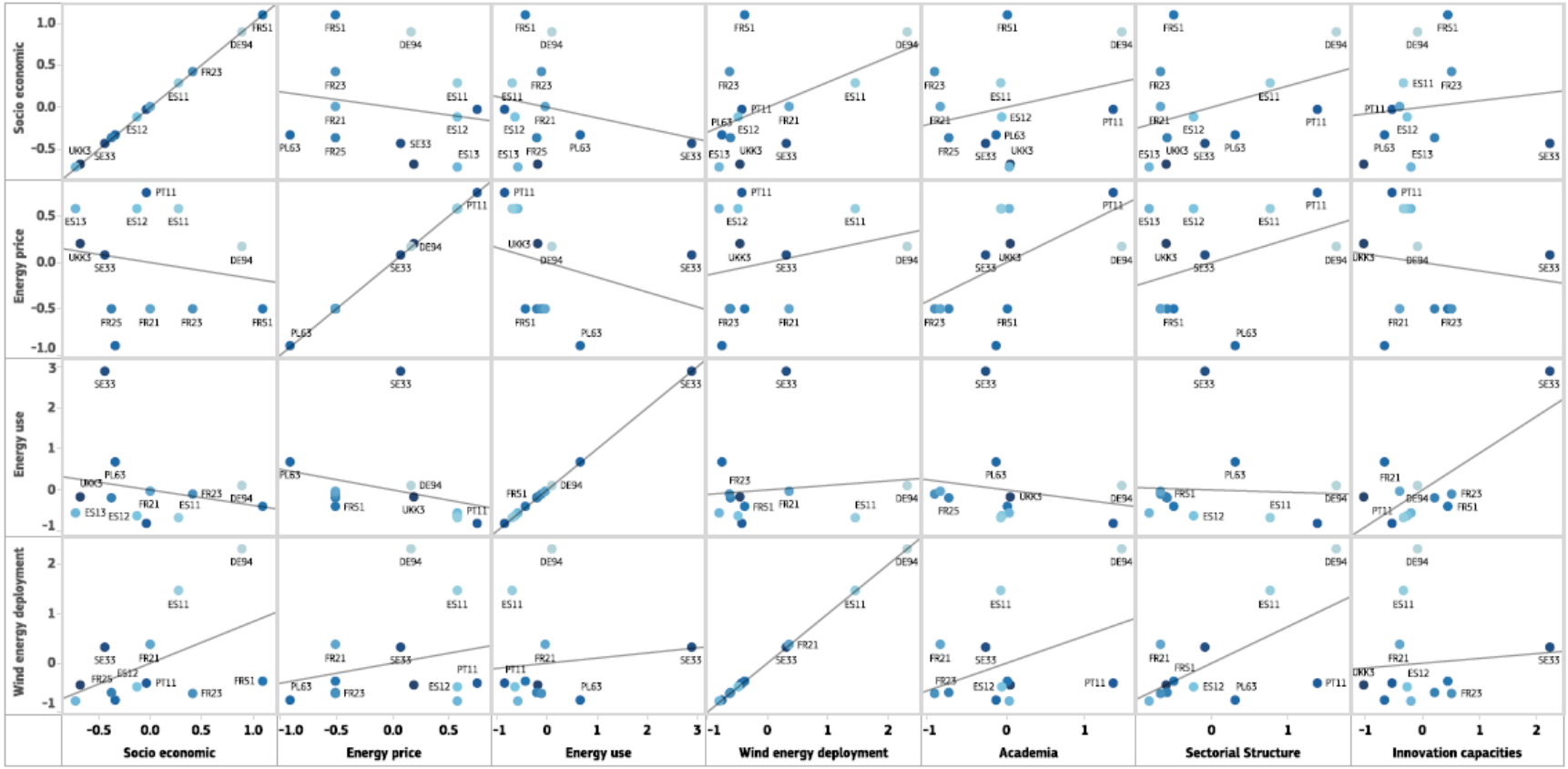
Case study – Wind energy

Correlation between dimensions



Case study – Wind energy

Correlation between dimensions



Case study – Wind energy

Correlation between dimensions – r coefficient

	Socio economic	Energy Price	Energy use	Wind energy deployment	Academia	Sectorial structure	Innovation capacities
Socio economic	1.000						
Energy Price	0.032	1.000					
Energy Use	0.047	0.080	1.000				
Wind energy deployment	0.250	0.055	0.011	1.000			
Academia	0.070	0.305	0.034	0.182	1.000		
Sectorial structure	0.136	0.142	0.002	**0.412**	**0.686**	1.000	
Innovation capacities	0.013	0.018	**0.559**	0.007	0.057	0.020	1.000

Case study – Wind energy

Conclusions

- Regions in the same countries present a higher level of similarities according to the overall similarity matrix, regardless parameters are weighted or not. No national/regional policies have been assessed
- No correlation between energy price and wind energy deployment
- Lack of relation between energy prices &energy use
- No clear conclusions are obtained from the analysis of potential correlation.

Future work

Resource availability seems to be the reason of high levels of deployment.

Particular **analysis on regional/national policies** will also offer additional information for a better understanding in each region.

These indicators will allow establishing stronger correlations and evaluating the impact of policies on each regional dimension.

Thanks for the attention

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