



# A market for green patents? Analysis of ownership changes in environmental technologies from Spain.

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# 1. Introduction

## Aim

Analyze the current situation of environmental innovation and the market for environmental technologies in Spain.

# 1. Introduction

## Definition of technological eco-innovation

Alternative product or process innovations with a lower environmental impact than available technology (Carrillo-Hermosilla et al, 2009)

# 1. Introduction

## Definition of transfer of technology

Formal and informal transmission of knowledge, skills and technology between organizations that allows the local context to get adapted to the demands of the environment by absorbing and spreading that knowledge, both within and between countries (Roessner, 2000; Chung, 2001; Kanyak 1985).

# 1. Introduction

## Indicators to measure eco-innovation processes

Several indicators

Focus on patents

“Green patents” to designate patents in environmental-related technologies

# 1. Introduction

## Contribution of the study

1. Use of patent registers to assess to what extent environmental technologies have experienced changes of ownership
2. Focus on green technology transfer within a developed country
3. Preliminary analysis of the behaviour of green patent owners in Spain
4. Providing a first statistical light on the market for green patents of Spanish origin

# 2. Spanish context

## In Spain...

Renewable energy technology segment increased considerably from 2000 to 2009 because of regulation (REN21, 2013)

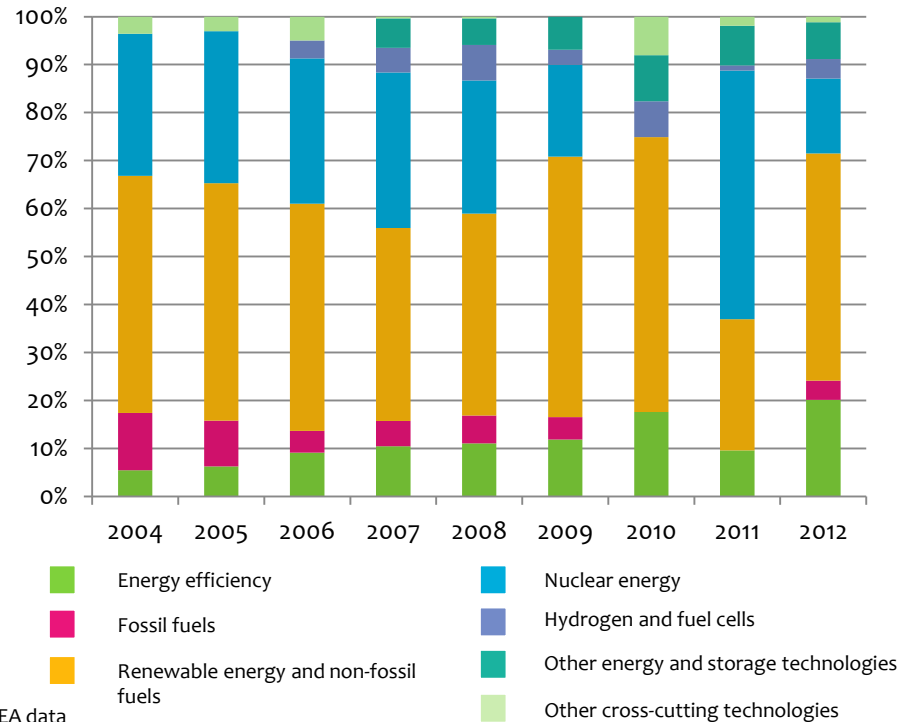
Patents applications of Spanish residents in this field represented 0,9 % in 2000 and 3,9 % in 2009 (OEPM, 2010)

Spain ranks fifth in the world ranking of countries with renewable energy technology patents applications (OEPM, 2013)

Spain situation is good mainly in solar-thermal and wind energy technologies

In the last decade companies have exceed individual inventors as main generators of innovation in green technologies in Spain (Casado and Calles, 2010)

Share of total R & D budget in the Spanish energy sector.

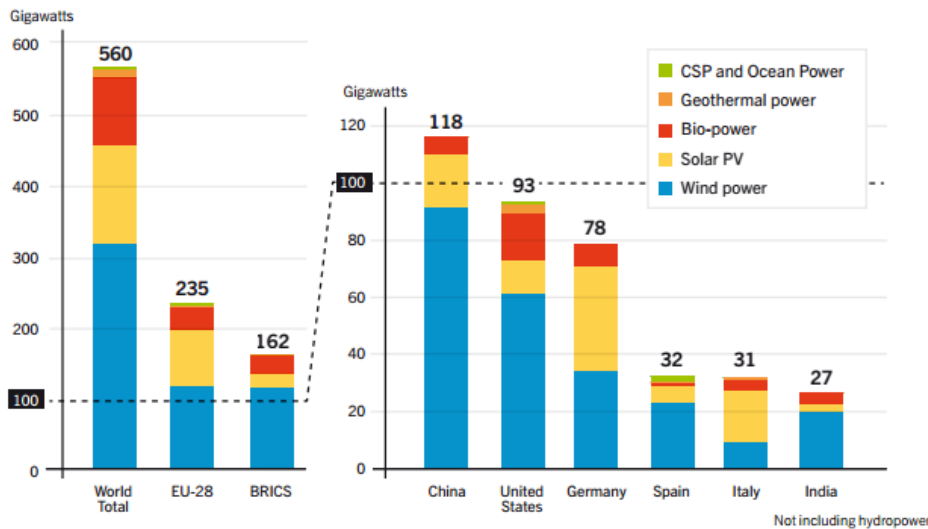


Source: Own elaboration using IEA data



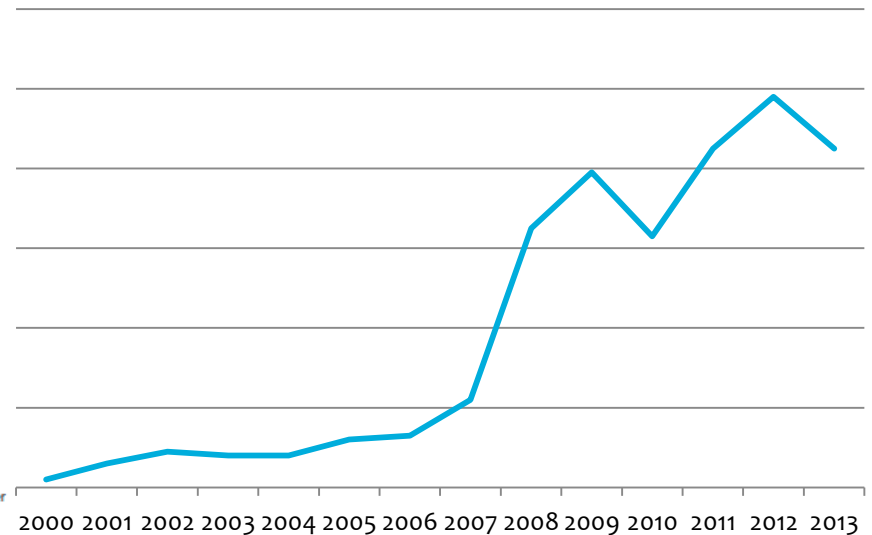
# 2. Spanish context

Renewable Power Capacities in World, EU-28, BRICS, and Top Six countries, 2013



Source: REN21, 2014

European renewable energy patent applications of Spanish origin published in the period 2000-2013



Source: Own elaboration using OEPM data

## 2. Links to the existing literature

Technology plays a relevant role in the reduction of environmental impacts and costs derived from mitigation and adaptation actions (Albino et al, 2014)

Ensuring the efficient allocation of environmental technology ownership is important to society in order to get the maximum diffusion to fight against environmental problems

The concept of "technology markets" is receiving increasing attention among researchers in economics and management of innovation (Meniere et al., 2012)

Transfer of green technology is influenced not only by IPR but also by regulation, human assets, networks and knowledge institutions among others (Johnson and Libecker, 2009)

# 2. Links to the existing literature

## Serrano (2006,2008,2010)

- Analysis, from an economic and econometric perspective, of technology transfer using national registries for US patents.
- Individual inventors and SMEs sell patents to a greater extent than big companies.
- Reallocation of technology from innovative small companies to big ones with complementary assets
- Pr (patent trade) depending on several factors like the age and citations of the patent among others.
- Patent transfer varies with the technology field and the type of ownership

## Meniere et al. (2012)

- Analysis of patent market in France. French origin patents in INPI and EPO. Transfer of patents represent relatively low volumes, but with a strong increase 1997-2009. They show a higher quality than the average.
- Prevalence of patent portfolios transfers between companies and intra-group transactions

## Dechezlepretre et al. (2011)

- Patented inventions in Climate Change Mitigation (CCM) technologies and their transfer from 1978-2005
- Quantitative description of geographic distribution and temporal trend of invention and diffusion of CCM technologies at global level
- Technology transfer- high in the political agenda. Up to date , green tech. transfer mostly between developed countries

Patents

Green patents

# 2. Links to the existing literature

## Environment-related technology transfer

Legal links between companies

Technological field

Applicant typology

Reallocation of property rights

Market of property rights/Real transfer

### Administrative transfer

- Administrative changes or changes of name
- Transfer between companies with parent-subsidary relationships
- Transactions between applicants of the same patent

Commercial transfer

# 3. Data and methodology

## a) The data

PATSTAT- April  
2014

Patent applications  
filed from Spain  
related to the  
environment  
(Green patents)

Resulting dataset:  
1276 environmental  
EPO patent  
applications

52% are green  
patents in energy  
generation from  
renewable and  
non-fossil sources

Period: 1979-2013

# 3. Data and methodology

## a) The data

31 environmental technologies after grouping some categories of OECD's classification

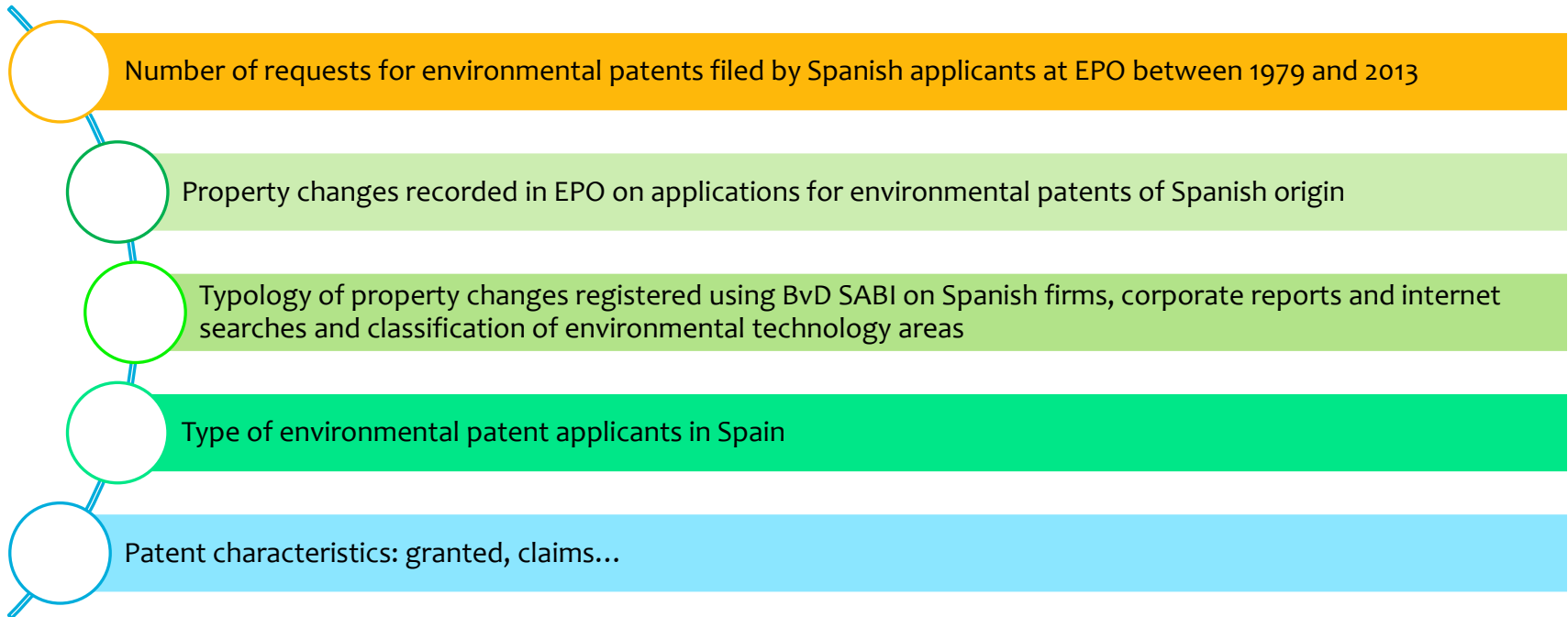
### Environmental related technologies classification



- General environmental management (5)
- Energy generation from renewable and non fossil sources (10)
- Combustion technologies with mitigation potential (4)
- Technologies specific to climate change mitigation (2)
- Technologies with potential or indirect contribution to emissions mitigation (3)
- Emissions abatement and fuel efficiency in transportation (4)
- Energy efficiency in buildings and lighting (3)

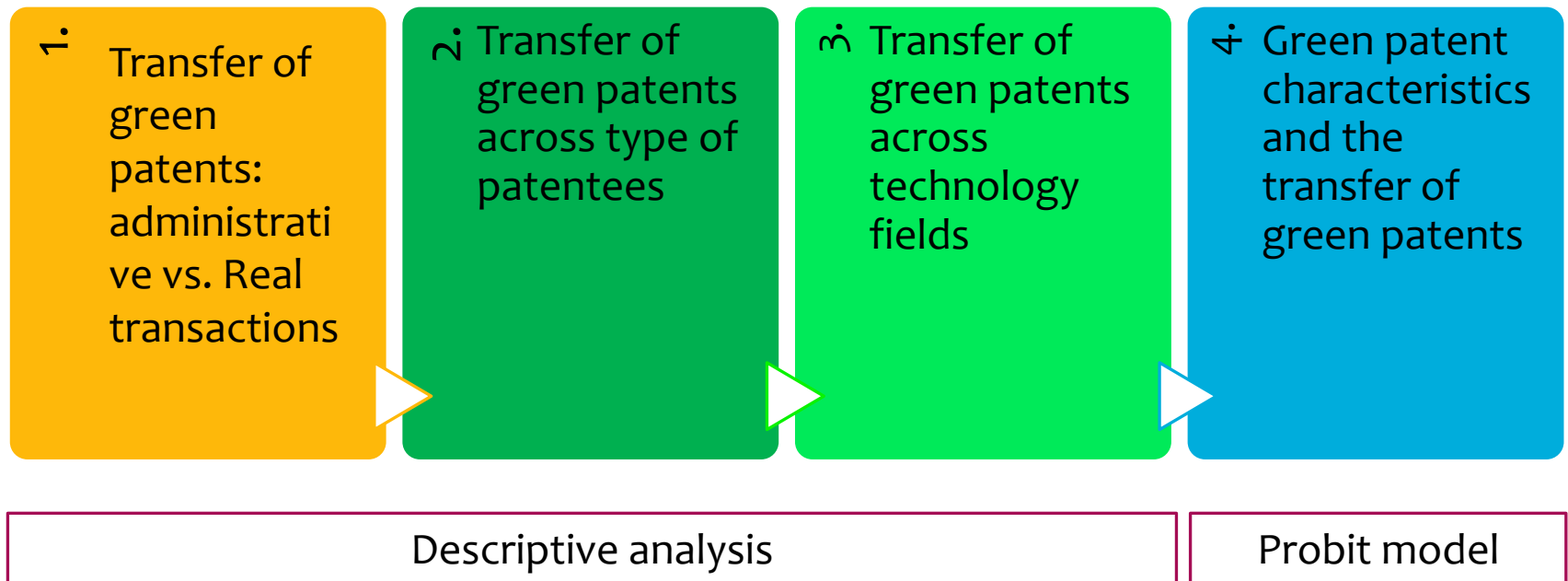
# 3. Data and methodology

## b) The Methodology



# 3. Data and methodology

## b) The Methodology





# 4. Main results

The patent registry documents provide insight into the types of applicants. Of the 1276 green patent applications, 22.81% have been granted to date

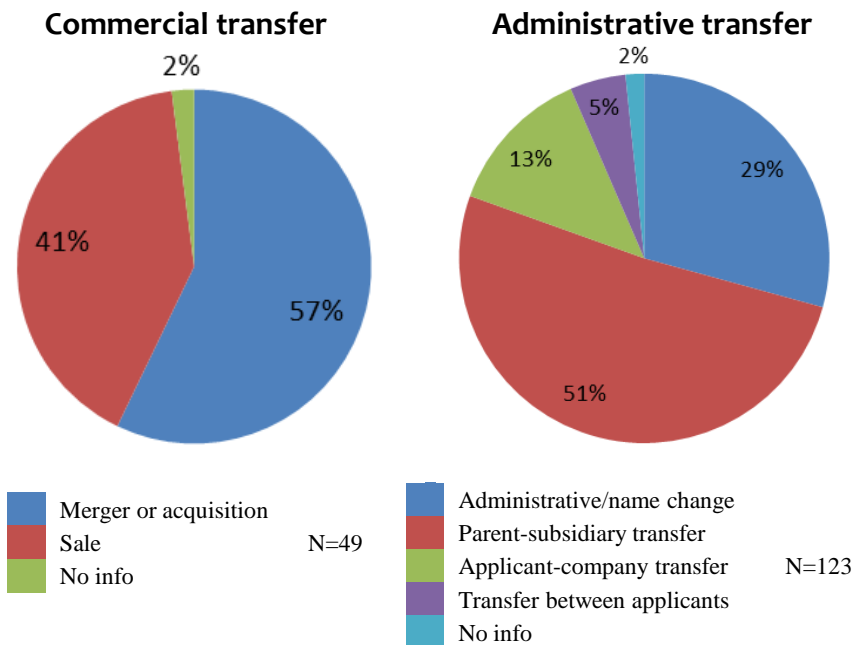
Only 13% of patented environmental technologies have registered changes in ownership. 46.5% have been granted to date

Just over a quarter of these changes can be considered truly business transactions (commercial transfer)

# 4. Main results

## Transfer of green patents: Administrative vs. Commercial transactions

Green technology transfer distribution by typologies  
(Commercial vs. Administrative)



Truly transactions are mainly due to mergers and acquisitions

Administrative transfers are mainly due to transactions between parent and subsidiary companies

Source: Own elaboration using PATSTAT information

# 4. Main results

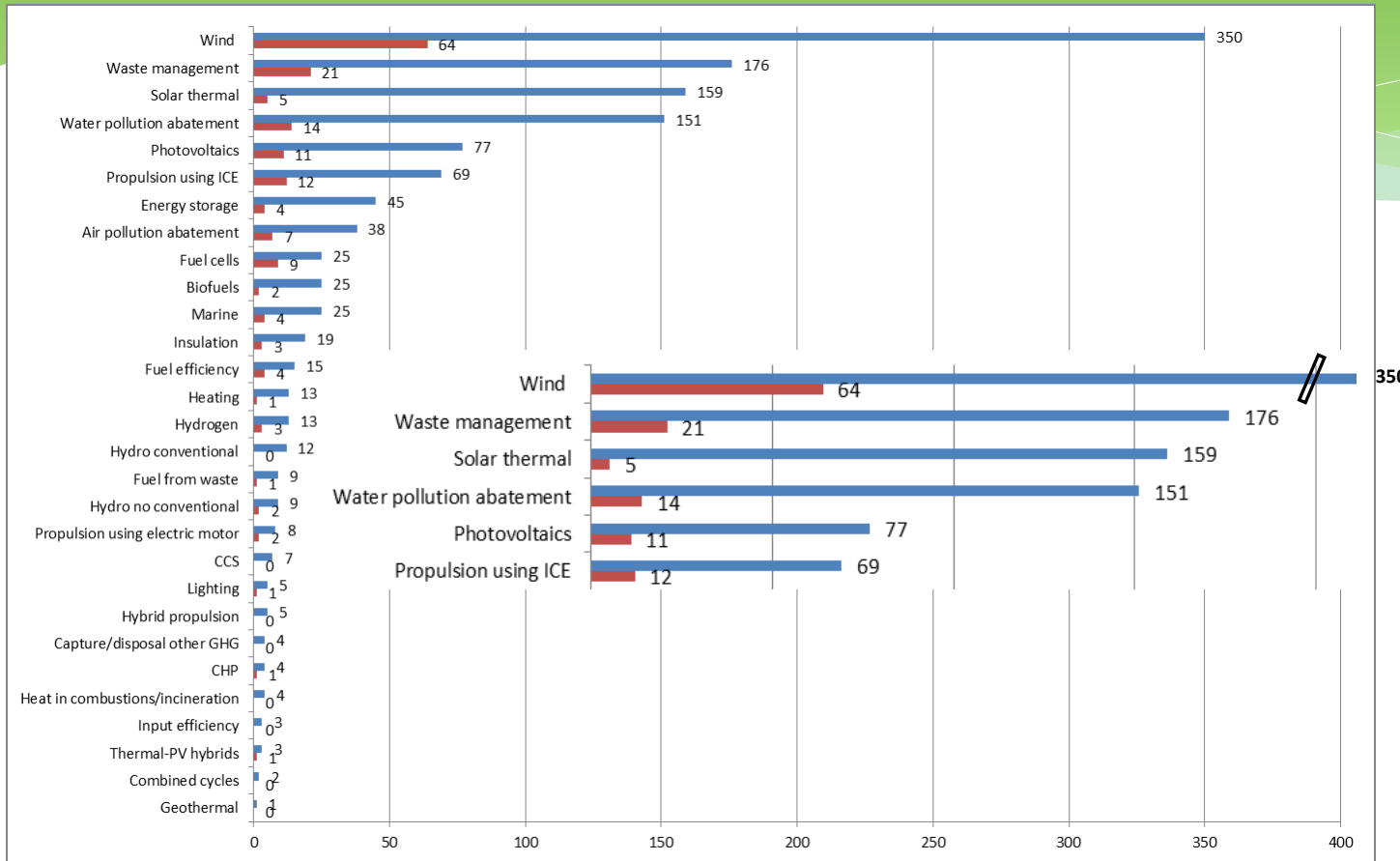
	Green patents with commercial transfer	Green patents with administrative transfer	Green patents without registered transfer	Total
1. Administrative change/Name change	0	36	0	36
2. Parent-Subsidiary transfer	0	63	0	63
3. Applicant-company transfer	0	16	0	16
4. Transfer between applicants	0	6	0	6
5. Merger or acquisition	28	0	0	28
6. Sale	20	0	0	20
Without specific info	1	2	0	3
Without registered changes	0	0	1104	1104
<b>Total</b>	<b>49</b>	<b>123</b>	<b>1104</b>	<b>1276</b>

Source: Own elaboration using PATSTAT information

- Although they are not commercial transfers, changes of ownership between companies in the same group represent 37% of registered changes.
- Conclusions of some studies demonstrate the importance of the subsidiaries as a driver of innovation (Tsai and Wen, 2009), but regarding intra-country transfers, we must consider the high probability that these intra-group transfers occur because of either institutional, economic or fiscal strategic reasons that have nothing to do with an intended acquisition of knowledge flows (De Vicente et al., 2010)

# 4. Main results

## Transfer of green patents across technology fields

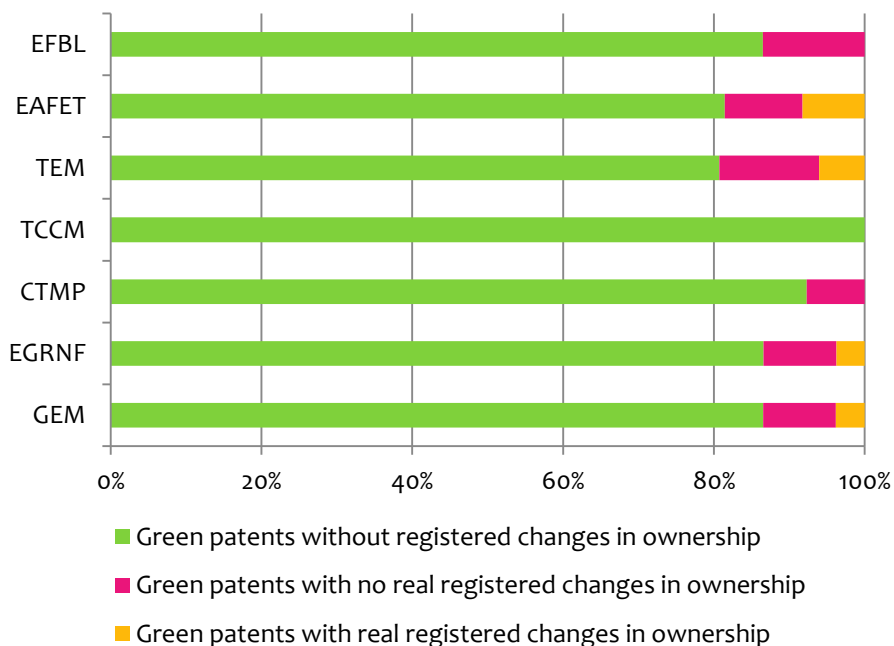


Environmental patent applications in Spain included in the sample and registered changes of ownership by technology

Source: Own elaboration using PATSTAT information

# 4. Main results

Analysing in which green technologies transfer is more dynamic...

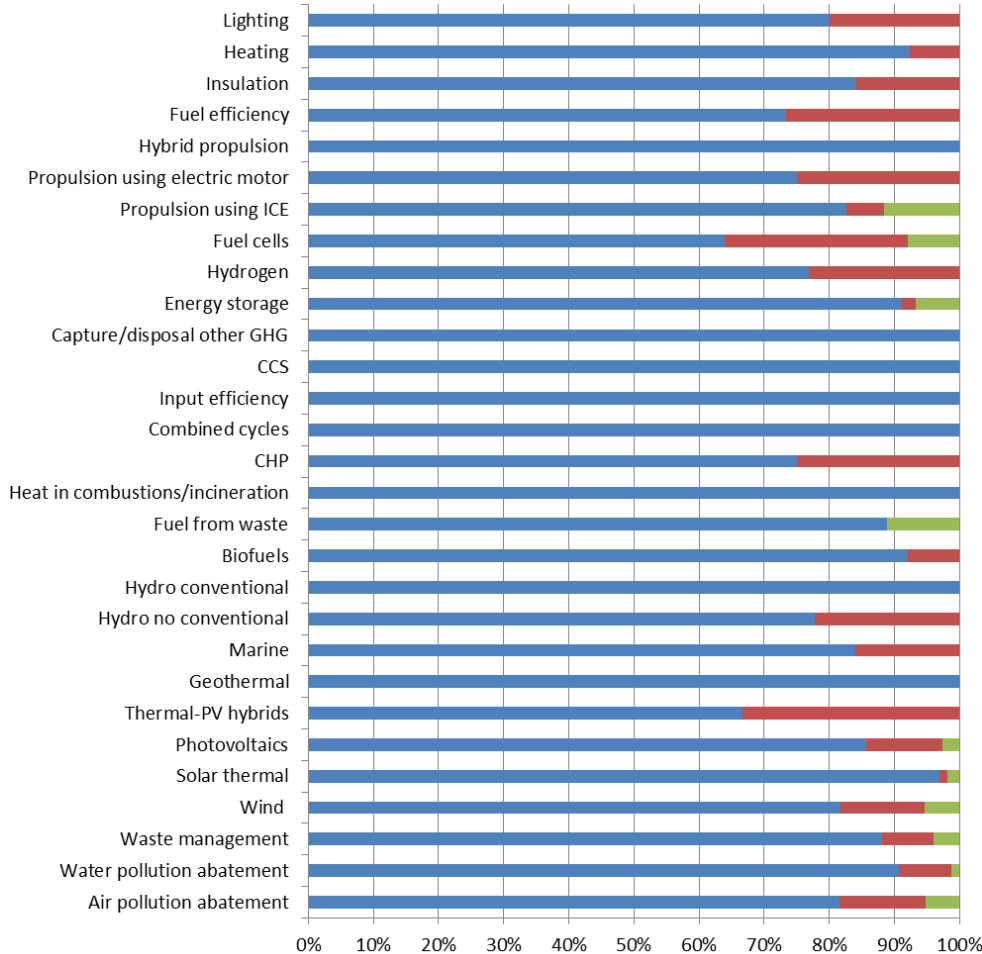


GREEN TECHNOLOGIES								
	Env. Managem	Renewable / non-fossil	Comb. Miti.	Clim.Chang Miti	Emis. Miti	Transport	Buildings	TOTAL
Green patents with commercial transfer	22.91%	52.08%	0%	0%	10.42%	16.67%	0%	49 (100%)
Green patents with administrative transfer	25%	52.42%	0.81%	0%	8.87%	8.06%	4.03%	123 (100%)
Green patents without registered transfer	29.26%	52.54%	1.09%	1%	6.07%	7.16%	2.90%	1104 (100%)

Renewable energy and non-fossil generation technologies: the most dynamic/ Also IPR in these techs have been the most easily transferred in terms of total changes of ownership.

Source: Own elaboration using PATSTAT information

# 4. Main results



Source: Own elaboration using PATSTAT information

- Green patents without ownership changes
- Green patents with administrative ownership changes
- Green patents with commercial ownership changes

In relative terms compared to the total number of green patents in each field, specific technologies for propulsion using internal combustion engines (11,5%) and those for generating fuels from waste (11,1%) are both the categories which have registered more real ownership changes.

Although by groups in absolute terms renewable energy technologies are the ones with a higher number of commercial transfers, category by category, the largest transfer of technology can be seen in the group for reducing emissions and fuel efficiency for transport.

# 4. Main results

## Transfer of green patents across type of patentees

26% individual applicants among Spanish green patents applicants

74% others →  
85% companies/15% universities or research centers

Green innovation in Spain is quite atomized. There is no a main agent

Gamesa with a 8,94% of the total green patent applications is the leader

Applicant	Typology of applicant	%	Typology of green patents
<b>Gamesa</b>	Business group	8.94%	Wind/ Hybrid propulsion
<b>Alstom</b>	Business group	6.17%	Wind/ Solar PV
<b>Abengoa</b>	Business group	3.41%	Waste management/ Solar Thermal/ PV/ Hybrid/ Hydrogen/ Fuel cells
<b>Consejo Superior de Investigaciones Científicas (CSIC)</b>	Research Center	2.56%	Air pollution abatement/ water pollution abatement/ Waste management/Solar Thermal/ PV/ Biofuels/ CCS/ Hydrogen/ Fuel cells/ Propulsion using ICE/ Isolation
<b>Acciona</b>	Business group	2.41%	Air pollution abatement/ Wind/ PV/ Hydrogen/ Propulsion using ICE
<b>Ingeteam</b>	Business group	1.92%	Wind/ PV/ Hydrogen/ Hybrid propulsion
<b>Exide Technologies</b>	Business group	1.63%	Energy storage
<b>Universidad Politécnica de Madrid (UPM)</b>	University	1.28%	Water pollution abatement/ Wind/ Solar Thermal/ PV/ Non-conv. Hydro/ Energy storage/ Isolation

# 4. Main results

	Company	Univ/RC	Individual	Total
Commercial transaction	45	1	3	49
	3,53%	0,08%	0,24%	3,84%
Administrative transaction	95	10	18	123
	7,45%	0,78%	1,41%	9,64%
No transaction	724	113	267	1104
	56,74%	8,86%	20,92%	86,52%
Total	864	124	288	1276
	67,71%	9,72%	22,57%	100%
Pearson $\chi^2(4) = 20,776$		Pr = 0,000		
Cramér's V = 0,091				

There is a substantial difference in the rates of transfer across types of patentees.

Universities and Research Centers are the ones who show the lowest rate of transfer



## Results of the probit model (Marginal effects)

	1	
	Change	Real Change
Grant	0,1385*** (0,025)	-0,0245 (0,090)
Claims	0,0046 (0,016)	0,1054 (0,066)
Family_size	0,0053 (0,021)	0,1476* (0,082)
Bwd_citations	-0,0001 (0,017)	0,0760 (0,057)
<b>Applicant (ref: Firms)</b>		
Univ/PRO	-0,0881*** (0,028)	-0,2615** (0,113)
Individuals	-0,0913*** (0,022)	-0,1931* (0,106)
<b>Green technology field (ref: Renew/non-foss)</b>		
Env. Management	-0,0536** (0,024)	0,0247 (0,097)
Combustion mitigation potential	-0,1066* (0,060)	---
Climate change mitigation	---	---
Emission mitigation	0,0176 (0,047)	0,0698 (0,147)
Efficiency transport	-0,0342 (0,037)	0,3463*** (0,129)
Efficiency Buildings	0,0759 (0,084)	---
Fyear	Yes	Yes
Obs	1151	142
Wald Test (X <sub>2</sub> ) (Sig.)	129,58 (0,000)	28,98 (0,088)

(\*\*\*) Significant at 1% level (\*\*) significant at 5% level and (\*) significant at 10% level.

# 5. Conclusions



From the descriptive analysis...

- Market for environmental technology transfer in Spain is still small.
- Most of technologies that have experienced changes in ownership, have been through relationships between companies in the same group (37% of changes) → Administrative transactions.
- The patent sale or transfer by merger or acquisition is much smaller, representing only 27% of registered changes → Commercial transactions.
- Technologies related to energy generation with renewable energy and non-fossil fuels → most patented in Spain.
- Although, in absolute terms, the patents in wind energy have been the largest in number of registered changes, technologies for the improvement of internal combustion engines are the most dynamic in relative terms.
- Although innovation is highly fragmented in terms of the types of applicants, in Spain the private company profile dominates, being Gamesa Business Group who shows the higher percentage of total environmental patent applications (8.94%).
- Finally, from an econometric preliminary analysis the, likelihood of reallocation or trade may be influenced by the quality of green patents.



# Thank you very much

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