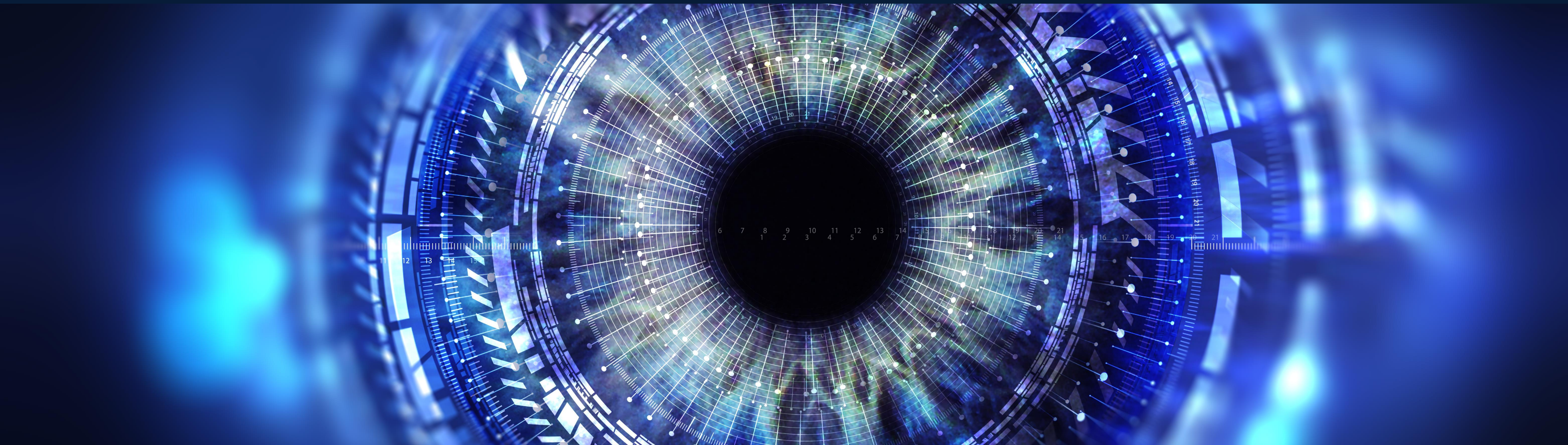


EconSight

Identifying Green Patents for Green Impact



Why Patents?

Patents are one of the rare involuntary data sources available, which allow for measurement of technical progress of companies (or other entities, such as regions,..).

Why Green Patents?

Patents are one of the rare involuntary data sources available, which can measure the green activity and finally the green transition of a company.

Identifying Green Patents for Identifying Green Opportunities

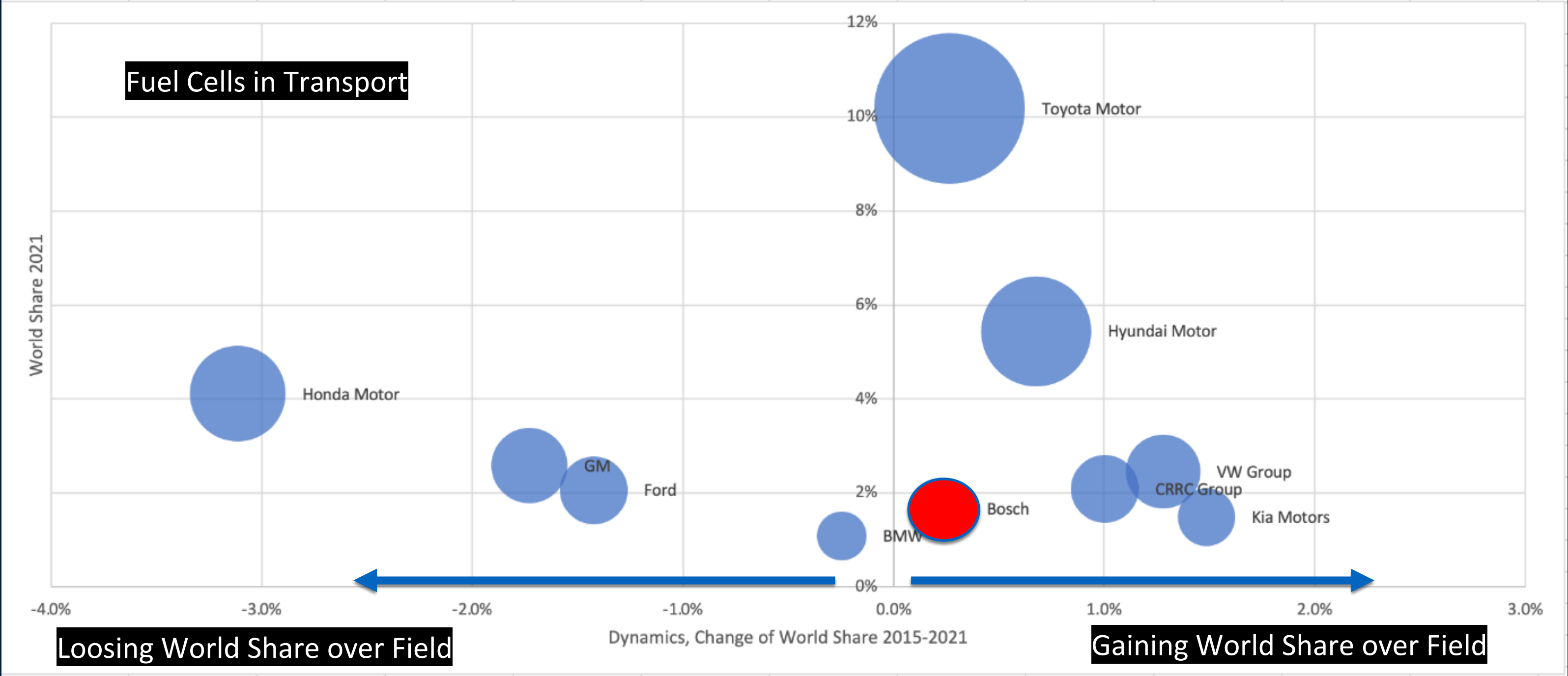
We could measure: How many Green Patents a given Company has today?

Result Bosch:
9'105/53'439 or 30.5% Patents in Y02/CPC = Green

What we measure instead: What is the impact of Investments of a given company in Green Technologies which enables the transition of that company to a successful Green Player/Leader/Disruptor in a given/changing market environment

Proclamation: „Bosch is developing both stationary and mobile fuel-cell solutions. From 2021 to 2024, Bosch plans to invest one billion euros in fuel cell technology «

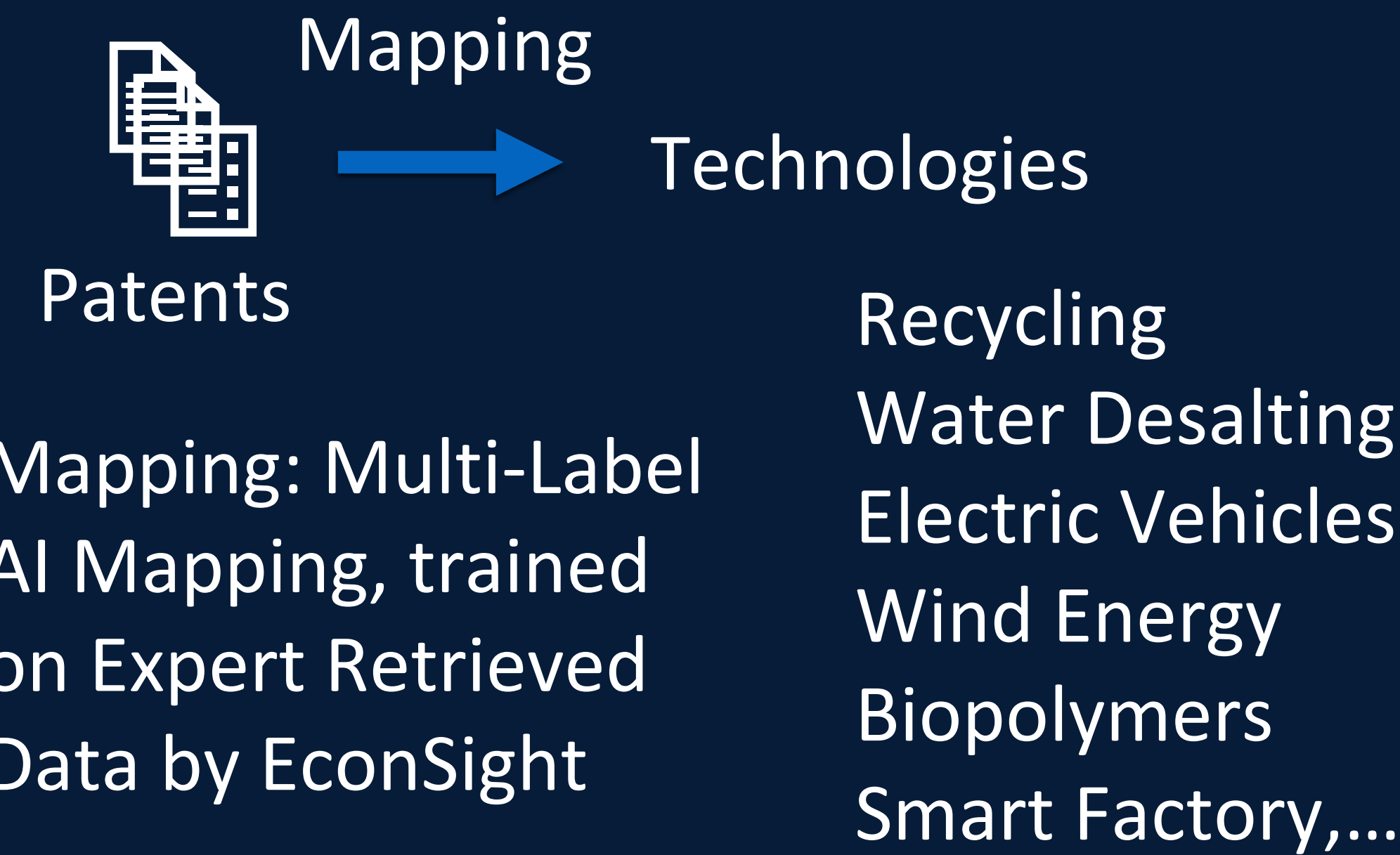
Reality Check in Patents 2021: Bosch is under the Top10 Patent Leading Companies in Fuel Cells in Transport already and has a postive change in world share of patents = Growing stronger than others in the field.



World Leader in Patents concerning Fuel Cells in Transport Applications
Patents look into the future of the next 2-5 years

EconSight Identifying Green Patents

Step1



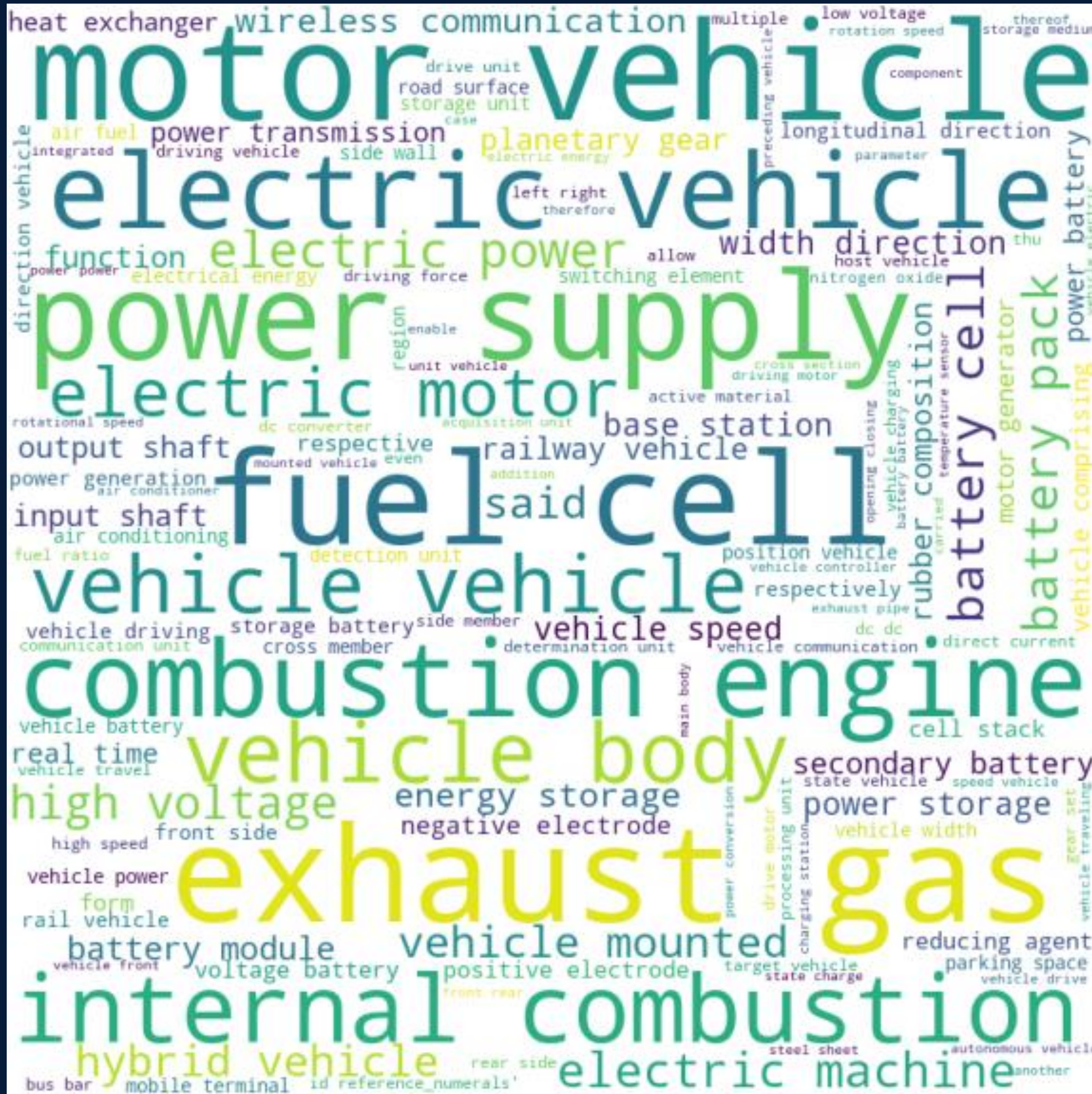
Mapping: Multi-Label
AI Mapping, trained
on Expert Retrieved
Data by EconSight

EconSight Green Technologies - 100 technologies in five broad categories

Renewable Energy & Storage <ul style="list-style-type: none">- Algae- Battery Handling and Other Battery Tech- Battery Technology- Biomass_Biofuel_Biogas- Double Layer Capacitor, Supercapacitor- Energy Storage Devices- Floating Wind Energy Systems- Fuel Cell- Fuel Cell Manufacturing- Green Hydrogen Production- Heat Pumps- Hydrogen Generation and Storage- Lithium Batteries- Maritme & Hydro Power- Nuclear Fusion Reactors- Organic PV & Perovskit- PEM Fuel Cell- Photovoltaic AC/DC Conversion- Photovoltaic Others- Silicon Photovoltaic- Solar Thermal Energy- Solid State Battery- Wind Energy	Climate Change Mitigation <ul style="list-style-type: none">- Advanced Insulation Materials- Biochar, Torrefaction, Biomass Pyrolysis- CarbonCapture & Carbon Sequestration- Climate Adaption Agriculture- Climate Adaption Health- Climate Adaption in Infrastructure_Extreme Weather- Climate Relevant Agriculture Production/Adaption/Forrestation- Drinking Water Purification and Biological Water Treatment- Earthquake_Tsunami_Protection- Forest Fire Warning- GHG Cement Reduction- GHG Management System- GHG Reduced Rice Production- GHG Reducing Animal Fodder- Meat Analoge- NOx Removal- Water Desalting
Energy & Material Efficiency <ul style="list-style-type: none">- 3D Printed & Robotic Automated Building- Additive Manufacturing- Chips of Reduced Power Consumption- Digital Agriculture, Precision Farming- Dynamic Glass- Efficient Building- Efficient Glas, Ceramic, Sand Production- Efficient Metal Processing- Efficient Production, Chemical, Petrochem, Textile- Energy Efficient Computing- Energy Efficient Lighting, Building, Office- HVDC High Voltage Direct Current- MLED, Micro-LED- OLED- Power & Energy Saving- Power Saving Wireless/Connected- Smart City- Smart Factory- Smart Grid & Smart Meter- Smart Home- Superconductor- Urban Logistics & Automated Warehousing	Mobility <ul style="list-style-type: none">- Active Traffic Control- Battery Charger For Vehicle- Climate Efficient Ship Propulsion- Connected Cars & Road Traffic Interaction- Efficient Car Design, Weight Reduction, Aerodynamics, Tires, Rolling Resistance etc.- Efficient Car Management- Efficient Traffic/Car Management/Platooning- Electric Vehicles- Electrical, Solar, Fuel Cell Aircraft- Exhaust Catalyst- Hybrid Vehicles- Low Sulfur Marine Diesel- Maglev & Hyperloop- Platooning- Railroad & Tramway- Synthetic Fuels
	Sustainable Consumption <ul style="list-style-type: none">- Agricultural Waste Handling & Reuse- Aquaculture- Biopolymers- Cement Substitution, Recycling and Waste Reuse- Marine Recycling & Waste Management- Plastic, Glass, Paper, Electronics & Consumer Waste Recycling- Recycling- Sustainable Packaging- Waste & Refuse Management- Waste Gas, Garbage Handling, Waste Combustion

ESG3 Green Mobility by EconSight

AI BASED CALCULATION



EconSight Green Technologies - 100 technologies in five broad categories

Renewable Energy & Storage

- Algae
- Battery Handling and Other Battery Tech
- Battery Technology
- Biomass_Biofuel_Biogas
- Double Layer Capacitor, Supercapacitor
- Energy Storage Devices
- Floating Wind Energy Systems
- Fuel Cell
- Fuel Cell Manufacturing
- Green Hydrogen Production
- Heat Pumps
- Hydrogen Generation and Storage
- Lithium Batteries
- Maritime & Hydro Power
- Nuclear Fusion Reactors
- Organic PV & Perovskit
- PEM Fuel Cell
- Photovoltaic AC/DC Conversion
- Photovoltaic Others
- Silicon Photovoltaic
- Solar Thermal Energy
- Solid State Battery
- Wind Energy

Climate Change Mitigation

- Advanced Insulation Materials
- Biochar, Torrefaction, Biomass Pyrolysis
- CarbonCapture & Carbon Sequestration
- Climate Adaption Agriculture
- Climate Adaption Health
- Climate Adaption in Infrastructure_Extreme Weather
- Climate Relevant Agriculture Production/Adaption/Forrestation
- Drinking Water Purification and Biological Water Treatment
- Earthquake_Tsunami_Protection
- Forest Fire Warning
- GHG Cement Reduction
- GHG Management System
- GHG Reduced Rice Production
- GHG Reducing Animal Fodder
- Meat Analoge
- NOx Removal
- Water Desalting

Mobility

- Active Traffic Control
- Battery Charger For Vehicle
- Climate Efficient Ship Propulsion
- Connected Cars & Road Traffic Interaction
- Efficient Car Design, Weight Reduction, Aerodynamics, Tires, Rolling Resistance etc.
- Efficient Car Management
- Efficient Traffic/Car Management/Platooning
- Electric Vehicles
- Electrical, Solar, Fuel Cell Aircraft
- Exhaust Catalyst
- Hybrid Vehicles
- Low Sulfur Marine Diesel
- Maglev & Hyperloop
- Platooning
- Railroad & Tramway
- Synthetic Fuels

Sustainable Consumption

- Agricultural Waste Handling & Reuse
- Aquaculture
- Biopolymers
- Cement Substitution, Recycling and Waste Reuse
- Marine Recycling & Waste Management
- Plastic, Glass, Paper, Electronics & Consumer Waste Recycling
- Recycling
- Sustainable Packaging
- Waste & Refuse Management
- Waste Gas, Garbage Handling, Waste Combustion

Energy & Material Efficiency

- 3D Printed & Robotic Automated Building
- Additive Manufacturing
- Chips of Reduced Power Consumption
- Digital Agriculture, Precision Farming
- Dynamic Glass
- Efficient Building
- Efficient Glas, Ceramic, Sand Production
- Efficient Metal Processing
- Efficient Production, Chemical, Petrochem, Textile
- Energy Efficient Computing
- Energy Efficient Lighting, Building, Office
- HVDC High Voltage Direct Current
- MLED, Micro-LED
- OLED
- Power & Energy Saving
- Power Saving Wireless/Connected
- Smart City
- Smart Factory
- Smart Grid & Smart Meter
- Smart Home
- Superconductor
- Urban Logistics & Automated Warehousing

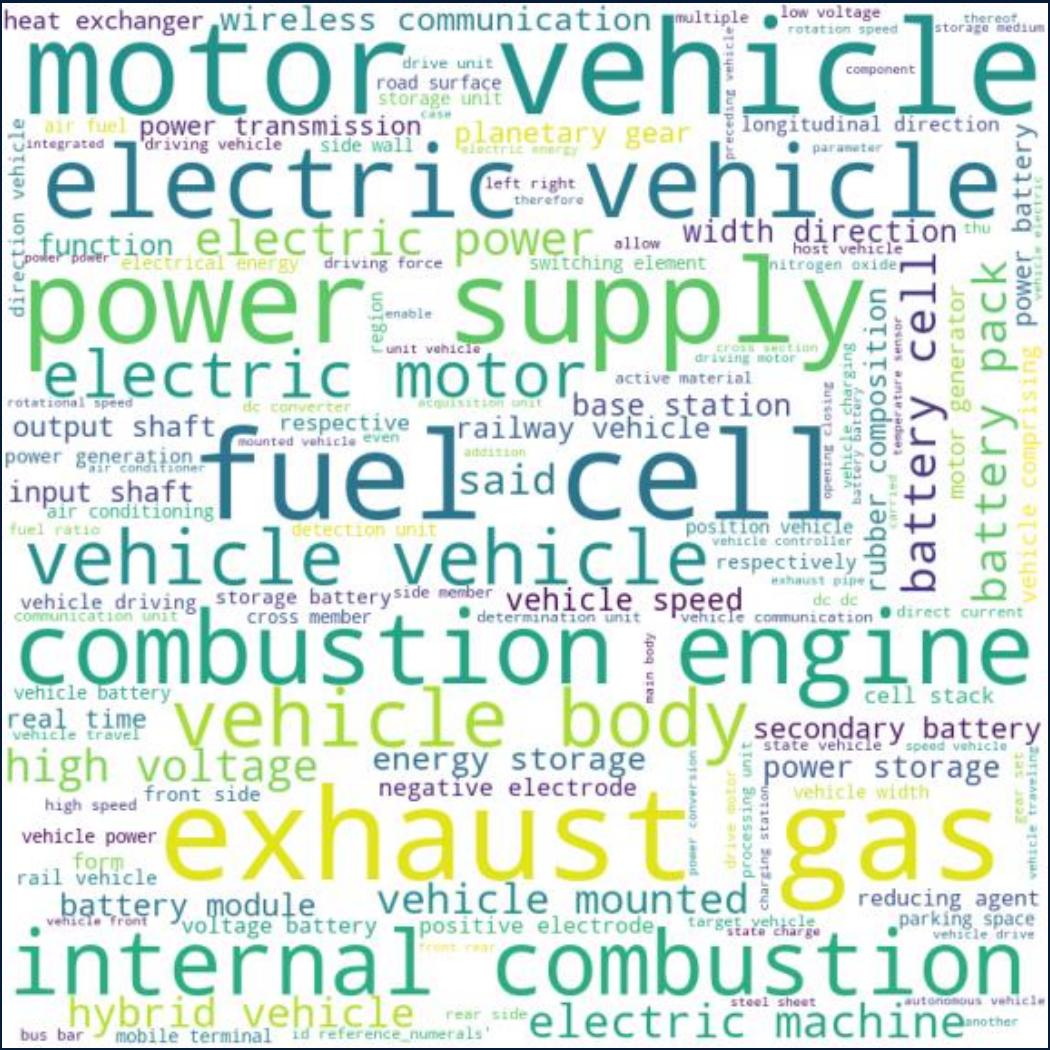
Total 453.439 Active Patents in 19 Subtechnologies
Cluster View 2021 (only on the patents filed in the last 5 years)

*Combustion Engines and a part of exhaust catalysts refer to patents about Hybrid Cars, which will be phasing out of green in few years.

ESG3 Green Mobility by EconSight

Automated Nearest Neighbor Analysis
of more than 800 Players active in ESG
in Mobility in the last 5 years, based on
text analysis.

Example Bosch, BAIDU, BMW



Climate Relevant Technology Players

Green Players Rating & Automated Nearest Neighbor Measuring

Example: Green Mobility

Who is the closest follower of a target company?

Which company shall I compare with, when GICS does not work anymore?

Example BMW

Ranking	Owner
Target	BMW
1	VW Group
2	Audi (in: VW Group)
3	Volkswagen (in: VW Group)
4	Daimler
5	Bosch
6	Renault
7	Valeo
8	PSA (in: Stellantis)
9	Hyundai Wia
10	Honda Motor
11	MAN (in: VW Group)
12	Ford
13	Volvo
14	GM
15	Kia Motors
16	Hyundai Motor
17	Volvo Cars (in: Geely)
18	Porsche (in: VW Group)
19	Tata Motors
20	Nissan Motor

Example BAIDU

Ranking	Owner
Target	Baidu
1	Baidu Netcom (in: Baidu)
2	TuSimple
3	Tencent
4	Hikvision
5	Automotive Research & Testing Center
6	Neusoft
7	Alibaba Group
8	Waymo (in: Alphabet)
9	Inventec
10	Alphabet
11	Alps Alpine
12	Uber
13	Harman (in: Samsung)
14	BOE
15	DGIST Korea
16	DiDi Chuxing
17	JD.com
18	IBM
19	SHANGHAI SAIWEI INVESTMENT CENTER LIMITED PARTNERSHIP
20	Amazon

Example Bosch

Rank	Owner
0	Bosch
1	Volkswagen (in: VW Group)
2	BMW
3	VW Group
4	Audi (in: VW Group)
5	Daimler
6	GM
7	Renault
8	Volvo
9	Valeo
10	Kia Motors
11	Hyundai Motor
12	Ford
13	Hyundai Wia
14	Denso
15	Honda Motor
16	PSA (in: Stellantis)
17	Toyota Motor
18	Hella
19	Hitachi
21	KKR
23	MAN (in: VW Group)

EconSight TechBI

Company Focus: Bosch

Green Potential Analysis

Total Company Patents
51'765

Company Green Patents
12'626

Company Green Share
24.4%

Company Controv. Patents
11'959

Bosch Development in Green Technologies

Company Green and Controversial Trend

● Green Patents ● Controversial Patents

Company development of green and controversial patents. Controversial = Oil, Fracking, Gambling, Tobacco, Weapons, Nuclear Power, Diesel, Combustion Engines. Green = sum of 100 individual green techs

Company Patent Portfolio by Filing Year

● Green Patent Filings ● Controversial Patent Filings

The filing year of the current active patent portfolio of the company. This shows the dynamics of the company's green and controversial activities.

Company Green Share

● Controversial Share ● Net Green Share ● Green Share

The development of the overall green share of the company. net green share = green share - controversial share

Company/Competition Development

● Company Green Share ● Competition Green Share

The development of the green share of the company compared to the average green share of the competition.

Bosch Top Green Techs

TECHNOLOGY_NAME	Patents	Share
Battery Technology	4581	1.65 %
Electric Vehicles	2688	2.49 %
Lithium Batteries	2398	2.17 %
Connected Cars & Road Traffic I...	2014	2.37 %
Battery Handling and Other Bat...	1406	1.22 %
Battery Charger For Vehicle	1337	1.61 %
Smart Home	1315	2.42 %
Exhaust Catalyst	1195	2.86 %
Hybrid Vehicles	902	2.55 %
Fuel Cell	896	1.10 %
Smart City	771	0.97 %
Fuel Cell Manufacturing	621	1.19 %
Smart Factory	555	0.88 %

Bosch Green Technology profile

World share and development of selected green technologies

Company world shares for selected green technologies. World share = share of company patents in a technology in relation to total worldwide patents in this technology. This allows for a comparison of the activities of the company in different technologies. Bubble position at top = world share of the respective technology is high (vertical axis). The horizontal axis shows the dynamics of the technology as the change of the world share in recent years. Bubble size = number of green patents in the technology.

Bosch Profile relative to the Competition

Company green performance relative to green performance of the competition

World shares for selected green technologies relative to the average world share of the competition (set as zero in the centre). Bubble position top right area = company has higher world share in this technology than the competition average (vertical) and also a higher momentum (horizontal). Top left = higher world share than the competition average but less dynamic, competition is catching up. Bottom right = lower world share but higher growth than competition average. Bottom left = lower than average and also losing ground. Bubble size = number of green patents in this technology.

Competitive Environment Green Shares

Share of green technologies in total company patents and recent dynamics

The vertical axis = overall green share of the company ; horizontal axis = change of green share in recent years in %-points. Bubble size = total number of green patents of the company.

● Renewable Energy & Storage

● Energy & Material Efficiency

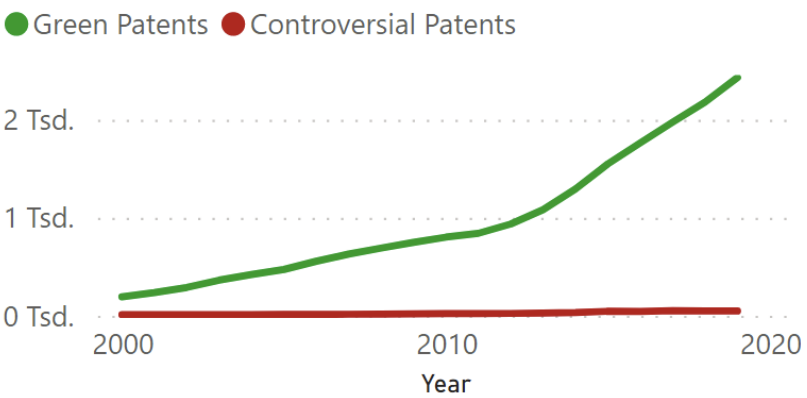
● Mobility

● Climate ChangeMitigation

● Sustainable Consumption

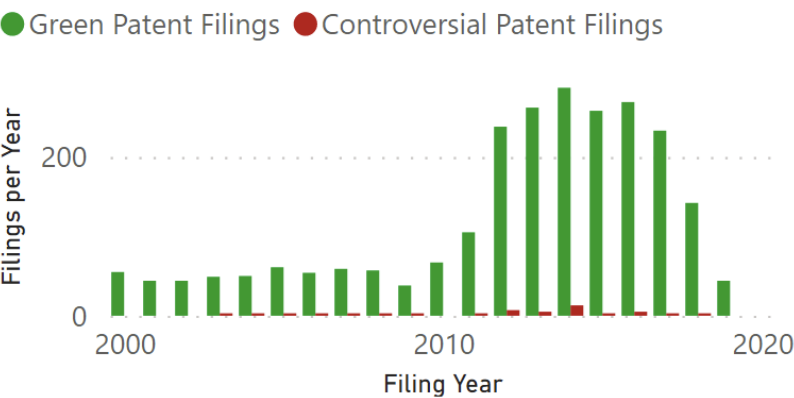
Alphabet Development in Green Technologies

Company Green and Controversial Trend



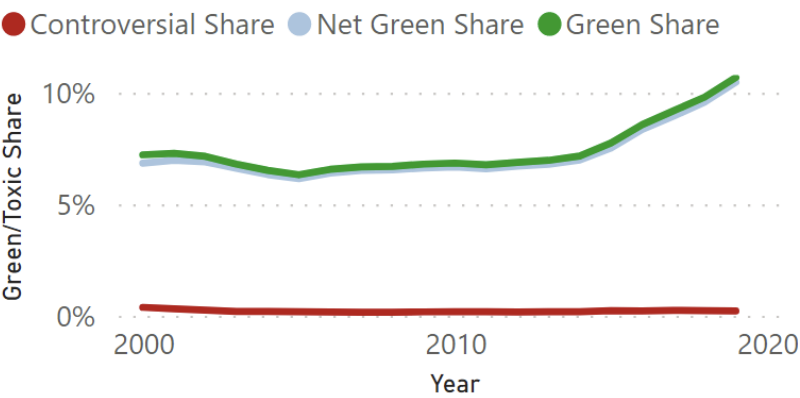
Company development of green and controversial patents. Controversial = Oil, Fracking, Gambling, Tobacco, Weapons, Nuclear Power, Diesel, Combustion Engines. Green = sum of 100 individual green techs

Company Patent Portfolio by Filing Year



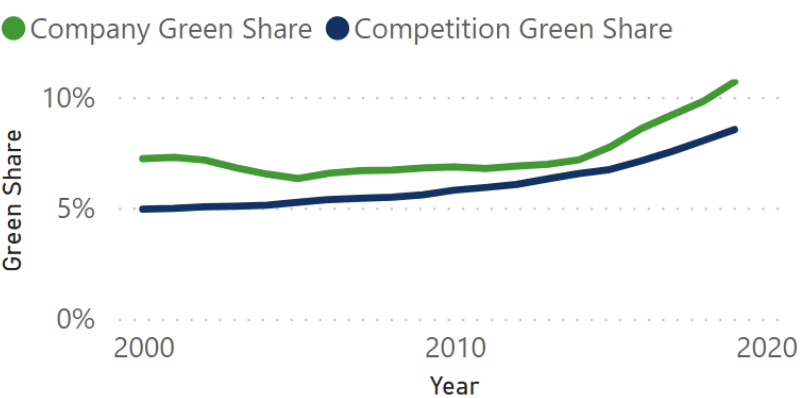
The filing year of the current active patent portfolio of the company. This shows the dynamics of the company's green and controversial activities.

Company Green Share



The development of the overall green share of the company. net green share = green share - controversial share

Company/Competition Development



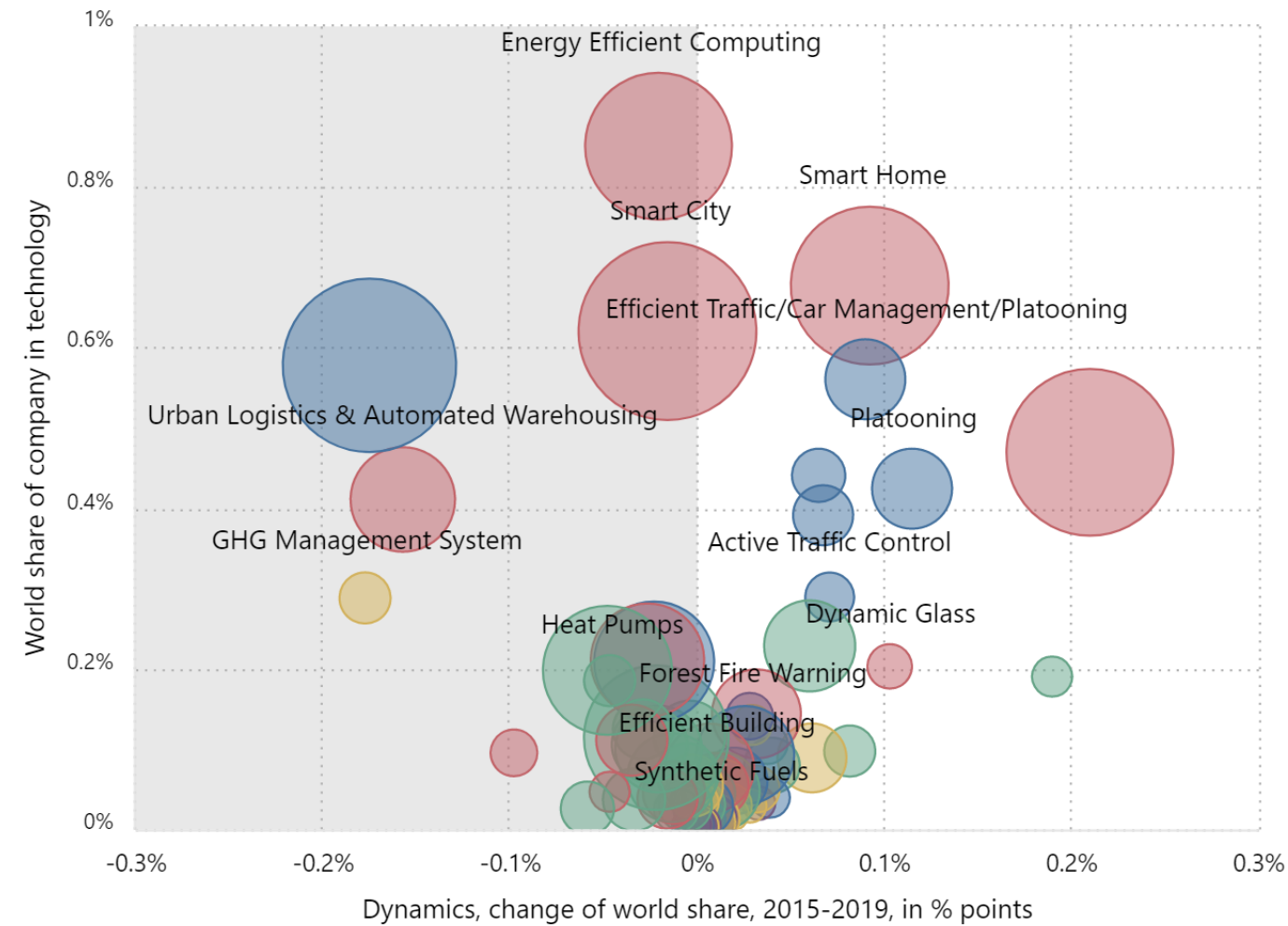
The development of the green share of the company compared to the average green share of the competition.

Alphabet Top Green Techs

TECHNOLOGY_NAME	Patents	Share
Smart City	486	0.62 %
Connected Cars & Road Traffic I...	455	0.58 %
Smart Factory	404	0.47 %
Smart Home	349	0.68 %
Energy Efficient Computing	288	0.85 %
Battery Technology	284	0.11 %
Battery Handling and Other Bat...	209	0.20 %
Battery Charger For Vehicle	173	0.21 %
Digital Agriculture, Precision Far...	145	0.21 %
Urban Logistics & Automated ...	112	0.41 %
Electric Vehicles	95	0.09 %
Wind Energy	74	0.23 %
Energy Efficient Lighting & B...	70	0.11 %

Alphabet Green Technology profile

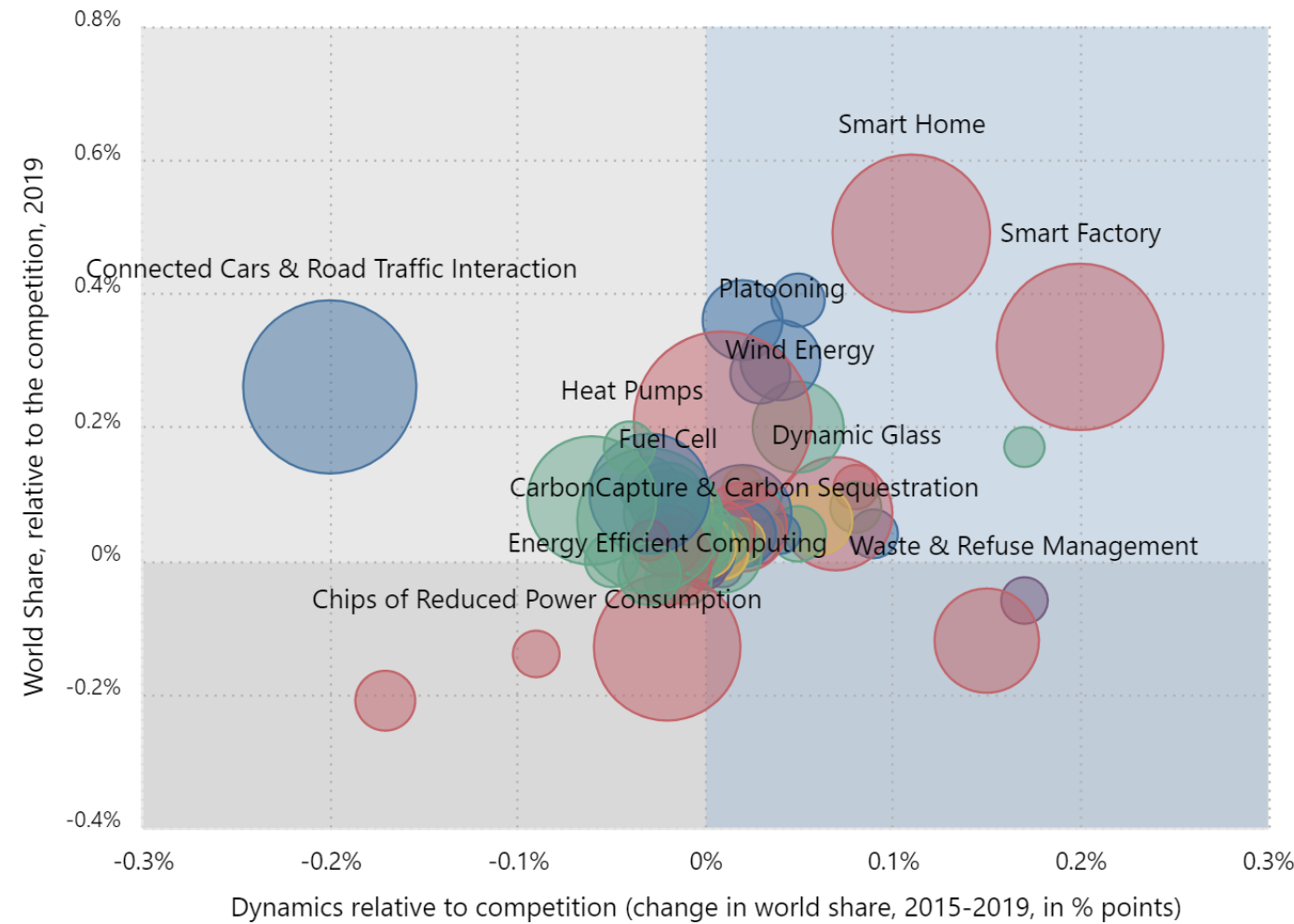
World share and development of selected green technologies



Company world shares for selected green technologies. World share = share of company patents in a technology in relation to total worldwide patents in this technology. This allows for a comparison of the activities of the company in different technologies. Bubble position at top = world share of the respective technology is high (vertical axis). The horizontal axis shows the dynamics of the technology as the change of the world share in recent years. Bubble size = number of green patents in the technology.

Alphabet Profile relative to the Competition

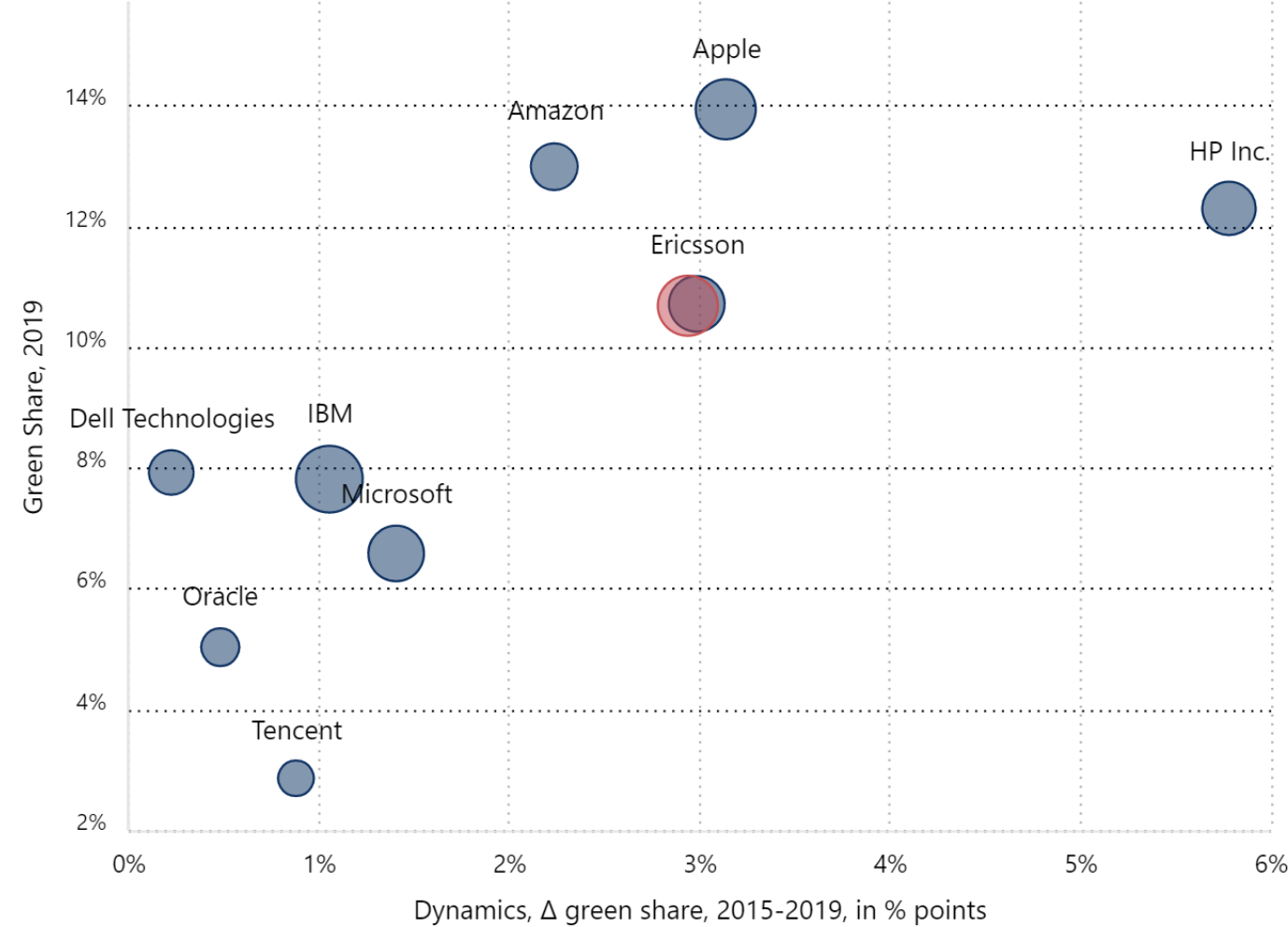
Company green performance relative to green performance of the competition



World shares for selected green technologies relative to the average world share of the competition (set as zero in the centre). Bubble position top right area = company has higher world share in this technology than the competition average (vertical) and also a higher momentum (horizontal). Top left = higher world share than the competition average but less dynamic, competition is catching up. Bottom right = lower world share but higher growth than competition average. Bottom left = lower than average and also losing ground. Bubble size = number of green patents in this technology.

Competitive Environment Green Shares

Share of green technologies in total company patents and recent dynamics



The vertical axis = overall green share of the company ; horizontal axis = change of green share in recent years in %-points. Bubble size = total number of green patents of the company.

- Renewable Energy & Storage

Energy & Material Efficiency

Mobility

Climate ChangeMitigation

Sustainable Consumption

EconSight TechBI

Company Focus: Microsoft

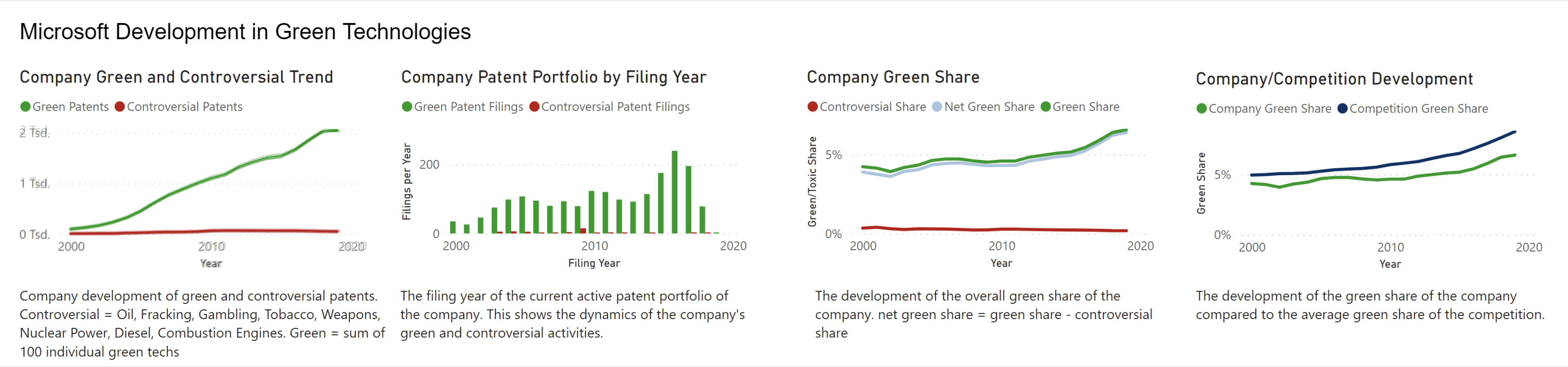
Green Potential Analysis

Total Company Patents
30'106

Company Green Patents
1'982

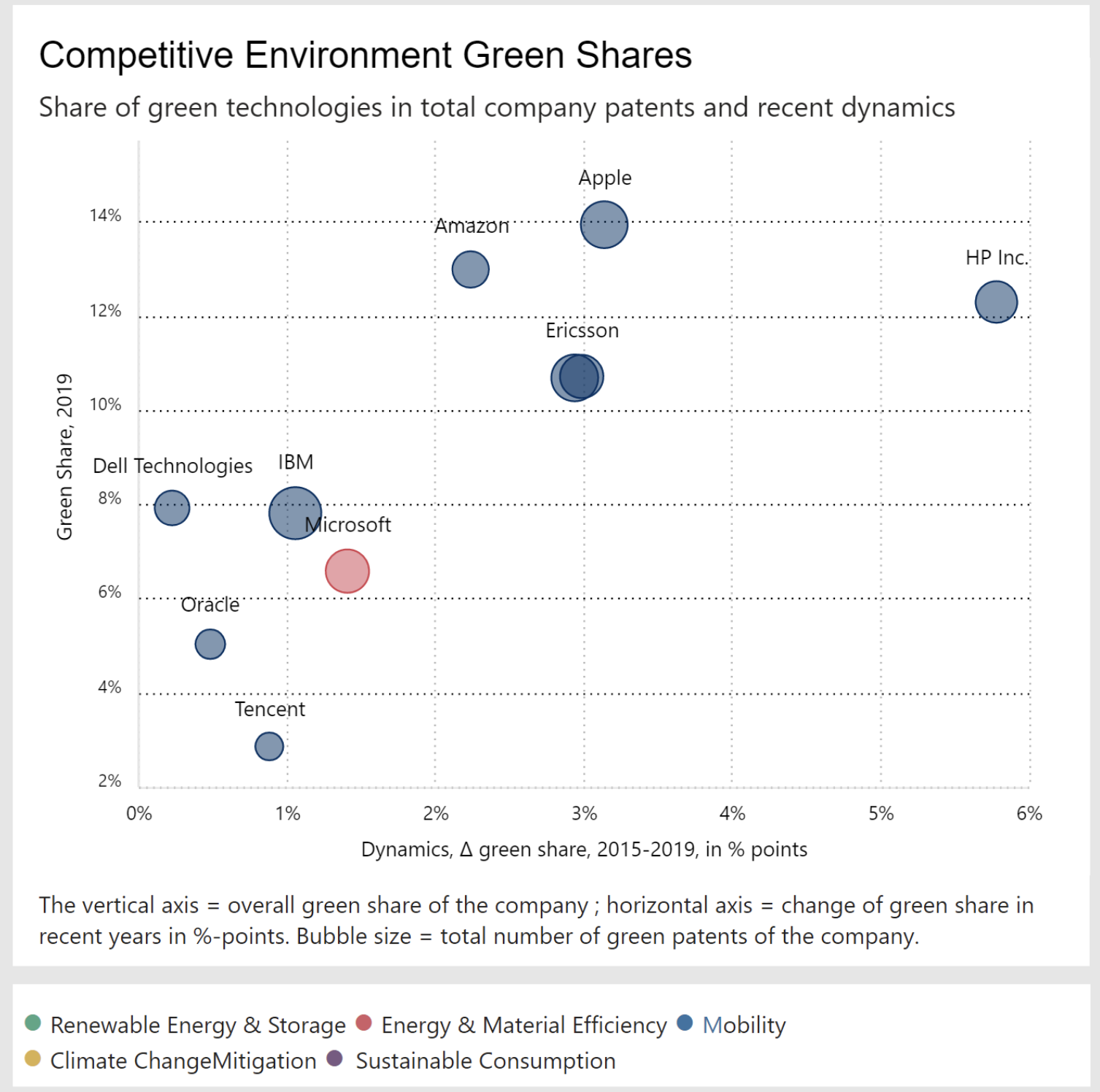
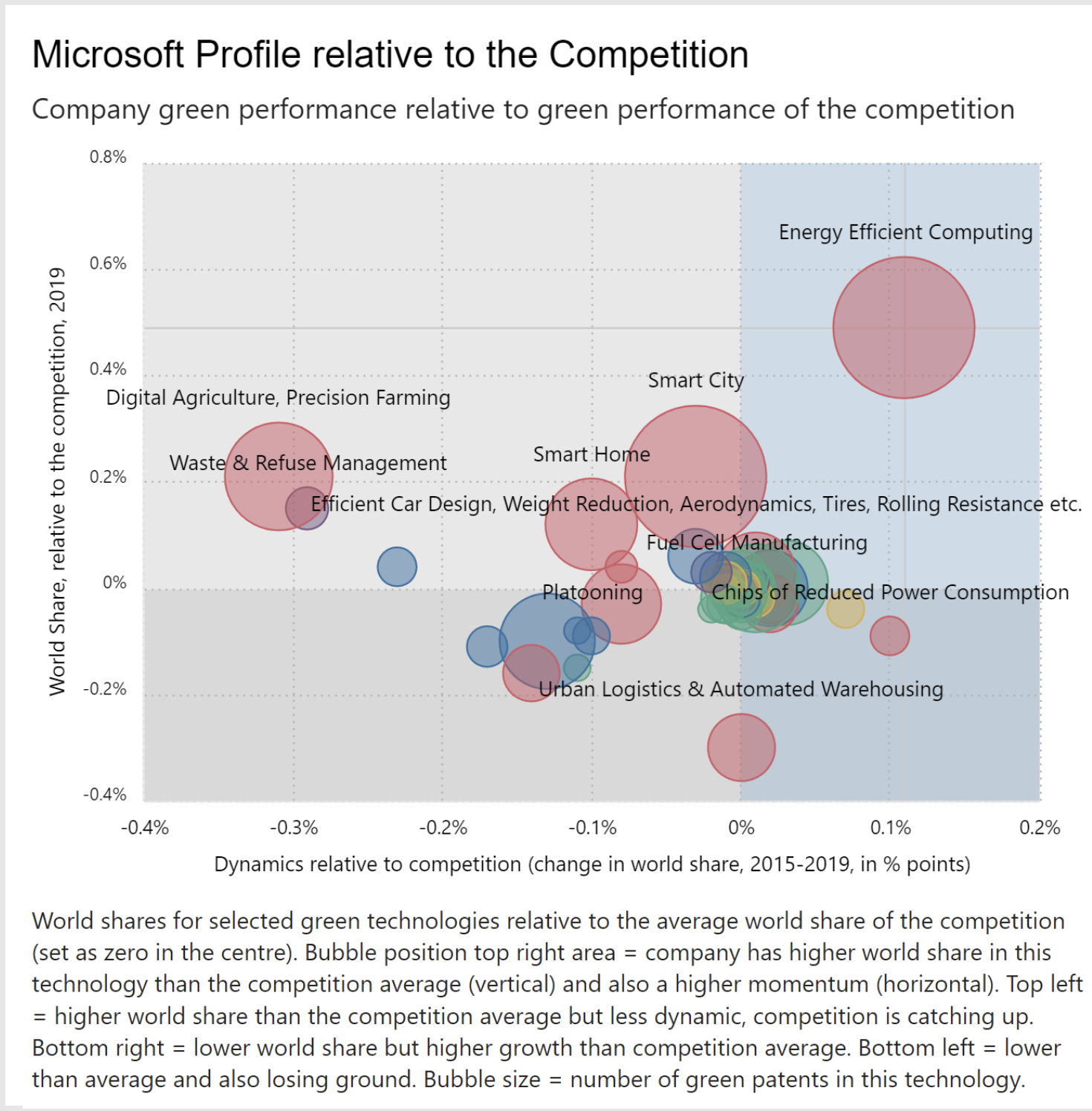
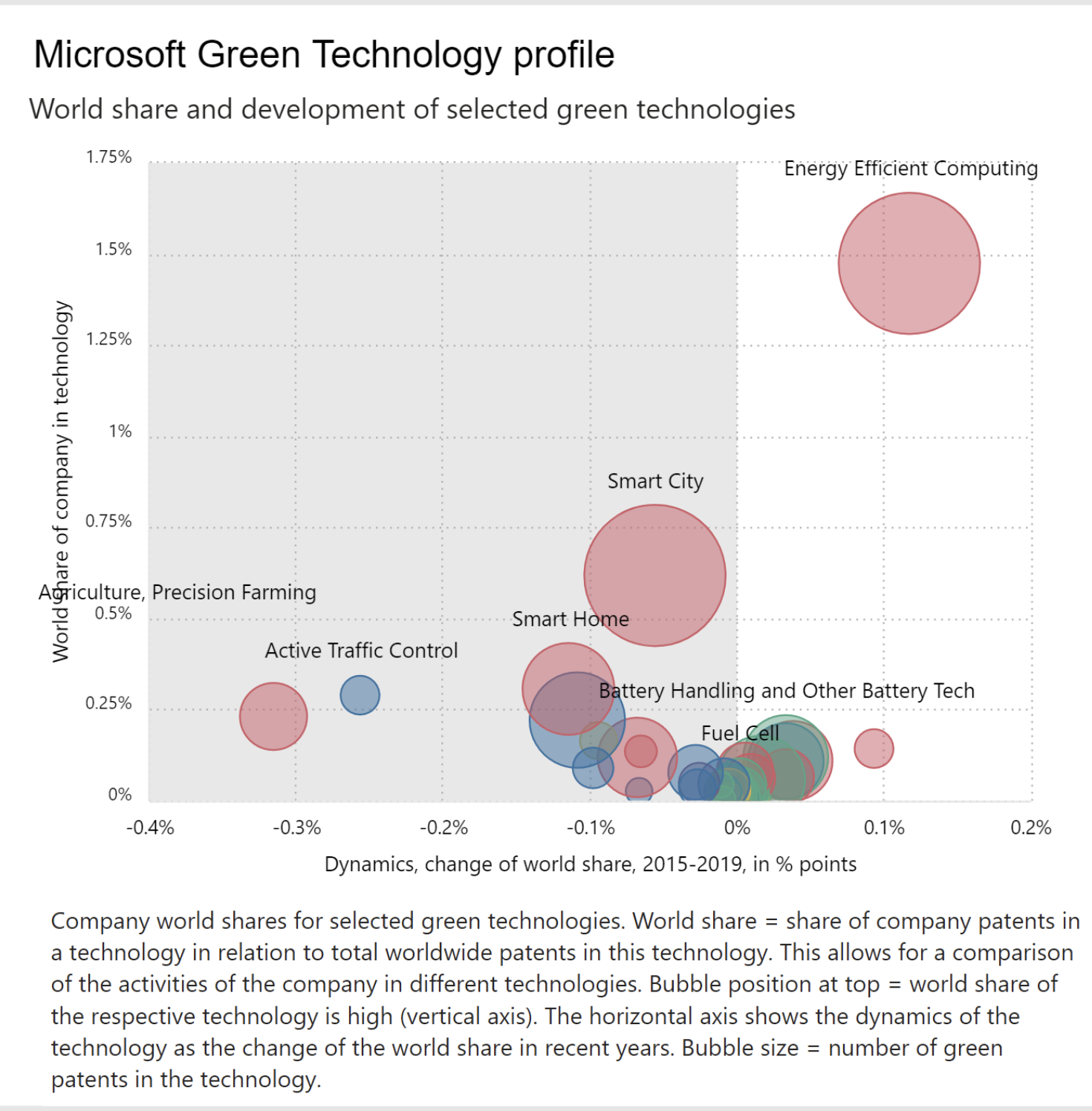
Company Green Share
6.6%

Company Controv. Patents
52



Microsoft Top Green Techs

TECHNOLOGY_NAME	Patents	Share
Energy Efficient Computing	499	1.47 %
Smart City	484	0.62 %
Digital Agriculture, Precision Far...	245	0.36 %
Connected Cars & Road Traffic I...	174	0.22 %
Smart Home	158	0.31 %
Battery Technology	142	0.06 %
Battery Handling and Other Bat...	125	0.12 %
OLED	102	0.11 %
Smart Factory	102	0.12 %
Battery Charger For Vehicle	90	0.11 %
Urban Logistics & Automated ...	63	0.23 %
Additive Manufacturing	32	0.08 %
Energy Efficient Materials & P...	22	0.06 %



EconSight Identifying Green Patents

Standard Approach



Mapping

Technologies

Recycling
Water Desalting
Electric Vehicles
Wind Energy
Biopolymers
Smart Factory,...

Classical Way: Using Patent Classes

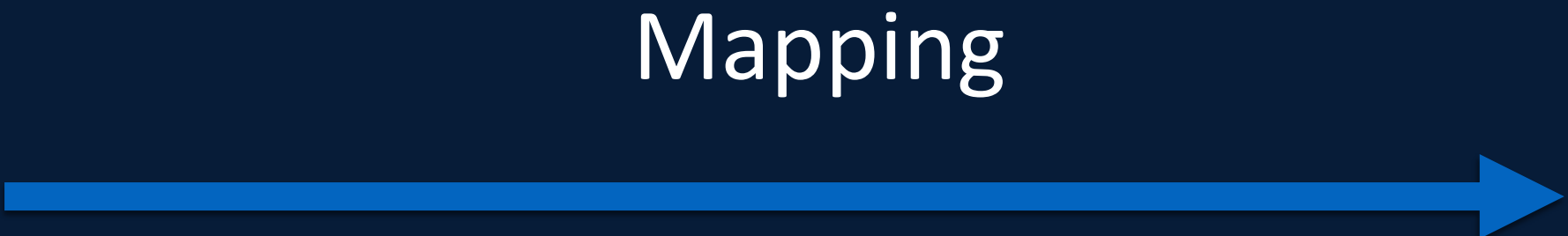
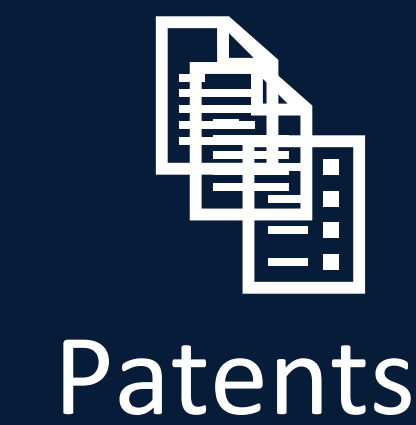
IPC Green by WIPO

CPC Y02 by EPO

▼ ADMINISTRATIVE, REGULATORY OR DESIGN ASPECTS		
COMMUTING, E.G., HOV, TELEWORKING, ETC.	G06Q	G06Q
TOPIC	IPC	PATENTSCOPE
CARBON/EMISSIONS CREDITS		
▼ ALTERNATIVE ENERGY PRODUCTION		
▼ BIO-FUELS		
▼ SOLID FUELS	C10L 5/00 , 5/40-5/48	C10L 5/00 , 5/40-5/48
TORREFACTION OF BIOMASS	C10B 53/02 C10L 5/40 , 9/00	C10B 53/02 C10L 5/40 , 9/00
► LIQUID FUELS	C10L 1/00 , 1/02 , 1/14	C10L 1/00 , 1/02 , 1/14
BIOGAS	C02F 3/28 , 11/04 C10L 3/00 C12M 1/107	C02F 3/28 , 11/04 C10L 3/00 C12M 1/107

Sub-group	Description	Comment
Y02B	Climate change mitigation technologies related to buildings, including housing and appliances or related end-user applications	Integration of renewables in buildings, lighting, HVAC (heating, ventilation and air conditioning), home appliances, elevators and escalators, construction or architectural elements, ICT, power management
Y02C	Capture, storage, sequestration or disposal of greenhouse gases (GHG).	CO ₂ capture and storage, also of other relevant GHG
Y02E	Climate change mitigation technologies in energy generation, transmission and distribution	Renewable energy, efficient combustion, nuclear energy, biofuels, efficient transmission and distribution, energy storage, hydrogentechnology
Y02P	Climate change mitigation technologies in the production or processing of goods	Metal processing, chemical/petrochemical industry, minerals processing (e.g. cement, lime, glass), agroalimentary industries,
Y02T	Climate change mitigation technologies related to transportation	e-mobility, hybrid cars, efficient internal combustion engines, efficient technologies in railways and air/waterways transport
Y02W	Climate change mitigation technologies related to wastewater treatment or waste management	Wastewater treatment, solid waste management, bio packaging
Y04S	Smart grid technologies	Power networks operation, end-user applications management, smart metering, electric and hybrid vehicles interoperability, trading and marketing aspects

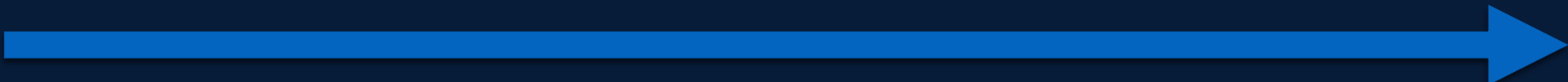
EconSight Identifying Green Patents



Technologies

- Recycling
- Water Desalting
- Electric Vehicles
- Wind Energy
- Biopolymers
- Smart Factory,...

Patent Classification Problems



IPC Green by WIPO

Problem:
Large classes must be combined with keywords, intensive searches must be conducted, selective areas only, broad coverage not adressed

ADMINISTRATIVE, REGULATORY OR DESIGN ASPECTS			
COMMUTING, E.G., HOV, TELEWORKING, ETC.	G06Q	G06Q	
	G08G	G08G	
CARBON/EMISSIONS TRADING, E.G. POLLUTION CREDITS	G06Q	G06Q	

CPC Y02 by EPO

Problem:
CPC covers only 55% of all patents, some areas (f.ex. Railroad) are missed out, other areas are incomplete (Batteries,..) and some segments are questionable or slowly adapting.

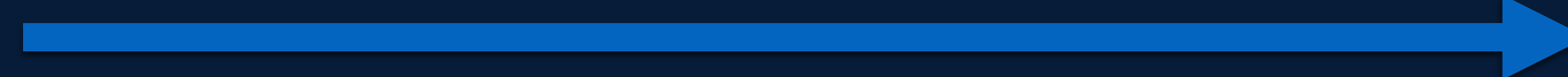
<input type="checkbox"/>	Y02T 10: Road transport of goods or passengers	153.347
<input type="checkbox"/>	> Y02T 10/00: Road transport of goods or passengers (...)	6
<input type="checkbox"/>	Y02T 10/10: Internal combustion engine [ICE] based ...	58.548
<input type="checkbox"/>	> Y02T 10/12: Improving ICE efficiencies	39.126
<input type="checkbox"/>	> Y02T 10/14: Technologies for the improvement ...	0
<input type="checkbox"/>	> Y02T 10/16: Energy recuperation from low temp...	0
<input type="checkbox"/>	> Y02T 10/17: Non-reciprocating piston engines, e...	0
<input type="checkbox"/>	> Y02T 10/18: Varying inlet or exhaust valve opera...	0
<input type="checkbox"/>	> Y02T 10/20: Exhaust after-treatment	1
<input type="checkbox"/>	> Y02T 10/30: Use of alternative fuels, e.g. biofuels	7.010
<input type="checkbox"/>	> Y02T 10/40: Engine management systems	21.259
<input type="checkbox"/>	> Y02T 10/50: Intelligent control systems, e.g. con...	0
<input type="checkbox"/>	Y02T 10/60: Other road transportation technologies ...	89.154
<input type="checkbox"/>	> Y02T 10/62: Hybrid vehicles	20.954
<input type="checkbox"/>	> Y02T 10/64: Electric machine technologies in el...	12.439

EconSight Identifying Green Patents



Patents

Mapping



Technologies

Recycling
Water Desalting
Electric Vehicles
Wind Energy
Biopolymers
Smart Factory,...

Patent Classification Problems

In Short:

Access and usability for Non-Experts
Availability for Finance
Incomplete or questionable coverage
No alignment with EU taxonomy,
Slow adaption to changes,
Many wrong classified patents
...

Solution:

Explainable AI trained on Expert sets
Clear and understandable topics
Alignment with EU Taxonomy
Proper aggregation on company level


EconSight Approach:



Patent Example

Family of US2021268934.A1 et al.


Information providing system

 Honda Motor

First filing in family28.2.2020

First publication in family31.8.2021

Provided is an information providing system capable of promoting reuse of secondary batteries. An information providing system includes a supplementing target device and a server. The supplementing target device includes: a power calculating unit configured to calculate maximum required power; an air temperature acquiring unit configured to acquire past air temperature data; and a supplementing target information requesting unit configured to transmit, to the server, supplementing target information. The server includes: a secondary battery reuse determining unit configured to determine whether or not a secondary battery that satisfies a condition is available for reuse based on the supplementing target information and the past air temperature data. The condition is that the maximum required power is less than or equal to a predetermined value.



10
SUPPLEMENTING TARGET DEVICE

11
STORAGE UNIT

12
COMMUNICATION UNIT

13
DISPLAY UNIT

14
SUPPLEMENTING TARGET INFORMATION REQUESTING UNIT

InventorsKazuno Shuichi, Onoue Yukiko, Uchida Tsubasa

ApplicantHonda Motor Co Ltd

Classical:
No Y02 = Not Green

Technologies

EconSight Expert Search Approach
Green: EV, Fuel Cells, Batteries
(but also Reuse/Recycling Keywords)

EconSight Multi-Label AI Approach
Green: **Recycling** (not EV, Batterytech)
+ Green Digital

Recycling
Water Desalting
Electric Vehicles
Wind Energy
Biopolymers
Smart Factory,...

SUMMARY OF THE INVENTION

In recent years, it has been proposed to introduce a secondary battery such as the battery mentioned above, stationary fuel cells, and the like into urban areas, and effectively use such secondary batteries by reusing secondary batteries capable of supplying power. However, it has been difficult to effectively perform the reuse of secondary batteries by matching a vehicle or the like desired to receive the supply of power from the secondary battery, and a secondary battery capable of supplying power.

It is, therefore, an object of the present invention to provide an information providing system capable of promoting reuse of secondary batteries.

EconSight Approach

- We identify Green/Climate relevant Patents
- We categorize them into understandable concepts
- We measure the companies activity in green patents
- We compare them to a conceptual neighborhood
- And we finally find out if and what a company might be able to, in green technology,
in the years to come...



EconSight – Measuring Technological Progress

Jochen Spuck

CTO EconSight GmbH

EconSight
Thiersteinerrain 126
CH-4059 Basel

jochen.spuck@econsight.ch
T +41 61 811 1010
M +41 79 6217401

www.econsight.ch