

Digital and Green Transitions: Opportunities and Challenges for Europe and China

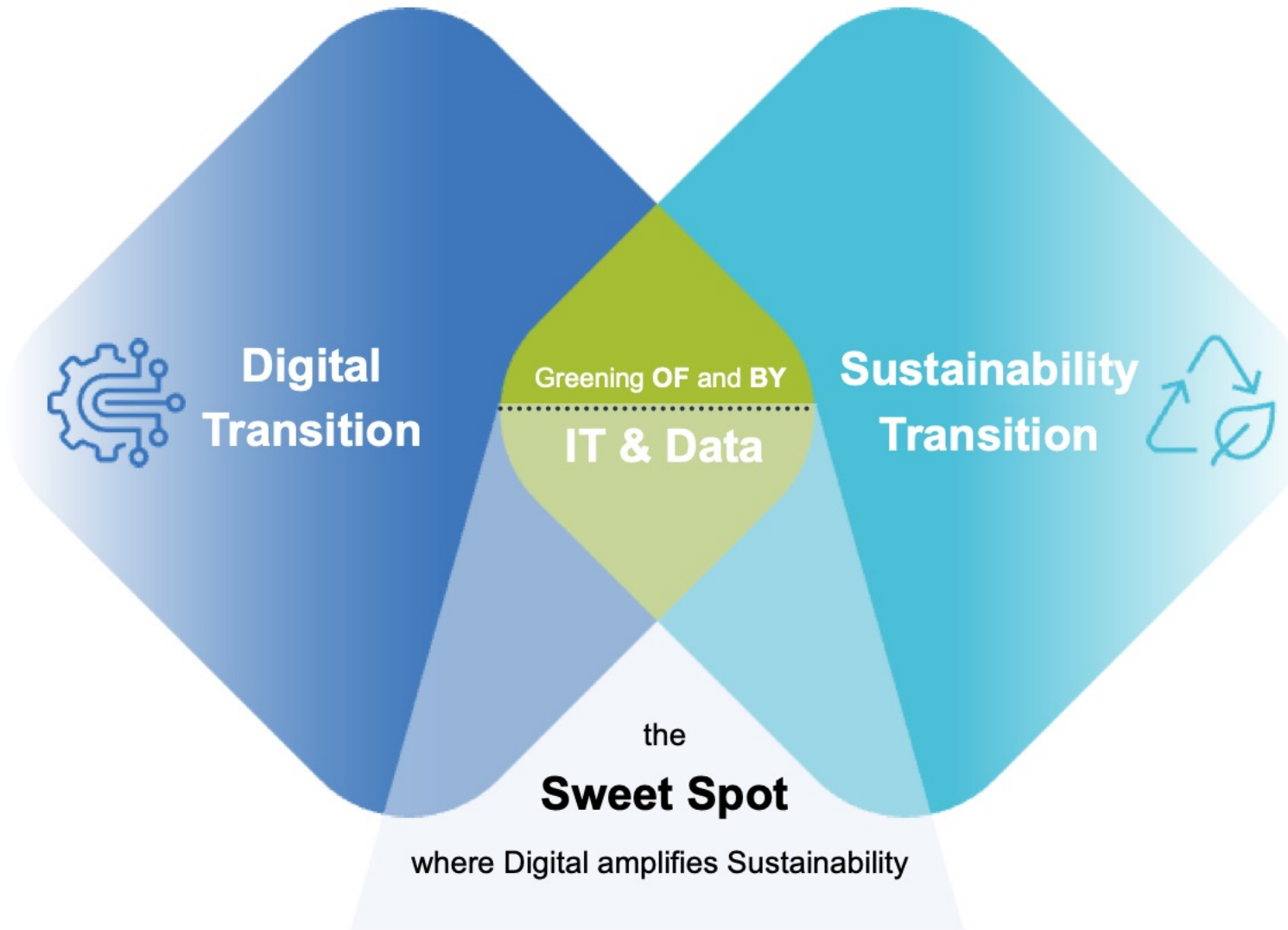
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Twin Transition



- Huge and largely untapped opportunity for technology and data to drive sustainability goals.
- Rather than treating digital and sustainability in isolation, a twin transition strategy combines these critical functions to unlock huge benefits in terms of energy efficiency and environmental sustainability.

Big hype around twin transition but relatively limited policy formulations

- **EU:** many studies and documents (2022 Strategic Foresight Report)
- **China:** so far there is not a framework specifically tying green and digital development together in a comprehensive way.
 - Nevertheless, several national and sectoral development plans do target the benefits of increased efficiency, resource savings that come with digitalization and data-driven governance.
 - At sectoral, local, and industrial level policies are becoming more targeted and effective to these ends.
 - Judging from the thrust seen in existing policy and initiatives, a marked increase in both more specific policies, technical solutions, and institutional and industrial development that deepen China's green and digital transformation should be expected.
 - Especially the policy-focus on decarbonization, and the concerted push to make China's green tech industry a world leader is (indirectly) driving this development.

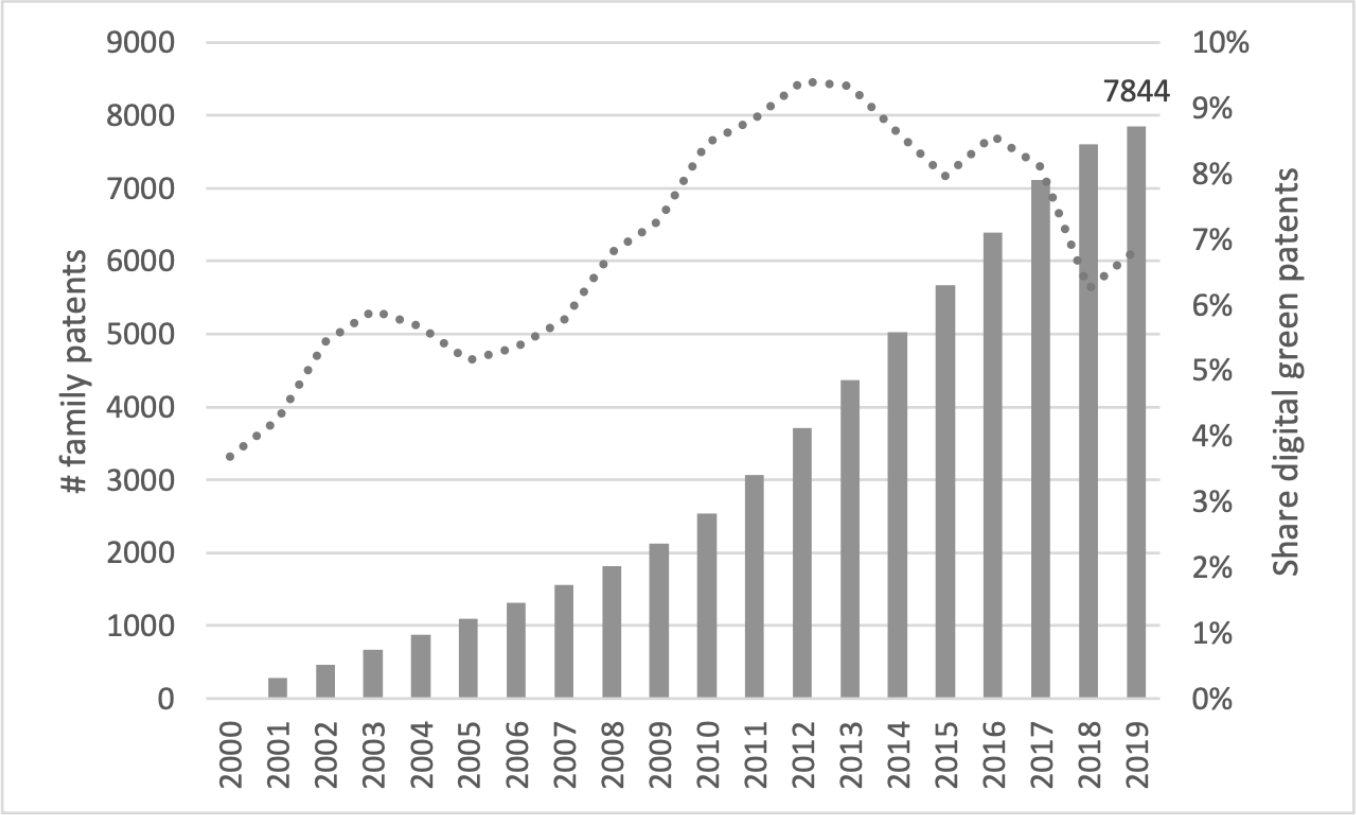
Patent analysis

- **AIM:** To provide evidence about technological development in China, the EU and other main competitors in digital green technologies.
- **DEFINITION**
 - **Digital technologies (DT)** defined as co-evolving technological systems that combine innovations in the fields of digital data transmission, smart connected devices, computing, communication and connectivity technologies
 - **Green technologies (GT):** Defining green technologies implies a challenge since they are not linked to specific sectors or industries, various terms are used to refer to them, and no international agreement exists on its conceptualization. GT include *“technologies or applications which in the broadest sense can be considered as countering the effects of climate change, namely technologies or applications which can decrease greenhouse gases (GHG) emission or remove (and store) GHG from the atmosphere”*.

Identification strategy

- **DATA SOURCE:** EPO-PATSTATS
- **DIGITAL PATENTS** are identified with CPC (Cooperative Patent Classification) codes and text keywords in the titles and abstracts of patents.
- **DIGITAL GREEN PATENTS** are digital patents which are classified with the Y02 (climate change mitigation technologies) and Y04 (smart grid technologies).
- **DATASET:** 47.461 applications linked to 7.844 unique family patents (A patent family is a collection of patent applications covering the same or similar technical content)
- Each patent family have members in at least two patent offices or at a regional jurisdiction such as EPO in order to guarantee a certain level of originality and expected economic value.
- **PERIOD:** 2000-2019 (it will be updated at 2022)

Figure 1. Digital green patents (# and share)



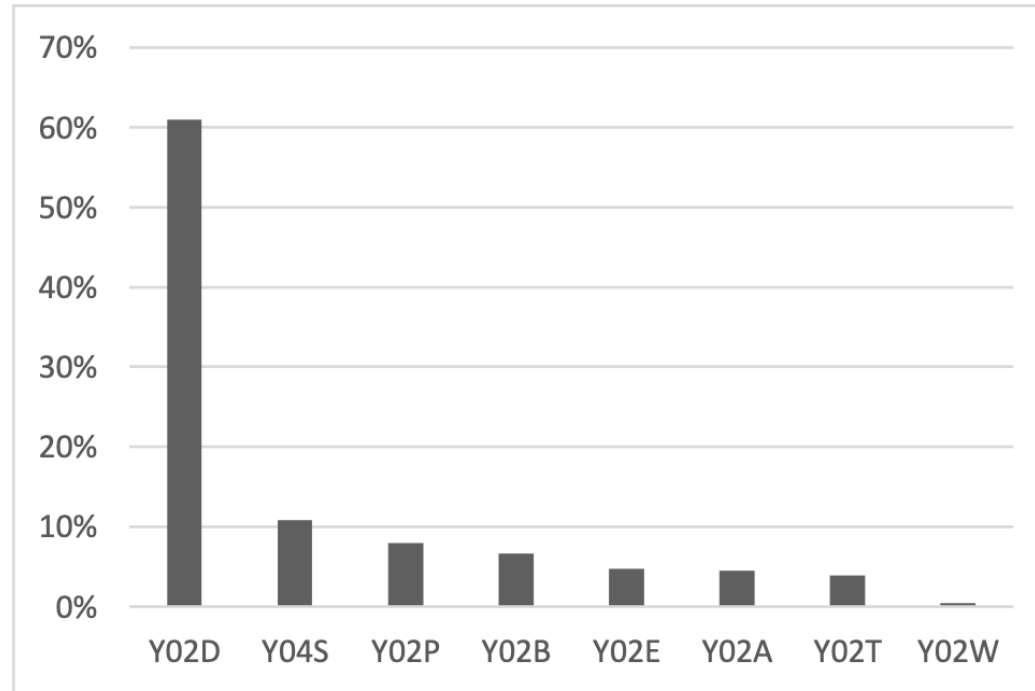
Source: own elaboration based on PATSTATS

Table 2. Digital green patents by countries (2000-2019)

	# of patents	% of total
China	2.472	5,4%
EU	4.666	10,3%
• Sweden	1.424	3,1%
• Germany	1.107	2,4%
• Finland	558	1,2%
• France	535	1,2%
• Netherlands	476	1%
Great Britain	1.148	2,5%
Japan	3.558	7,8%
Korea	3.645	8%
USA	18.986	41,8%
Total	45.474	100%

Source: own elaboration based on PATSTATS

Figure 2. Digital green technologies Y02/Y04 tag (% applications)



Source: own elaboration based on PATSTATS

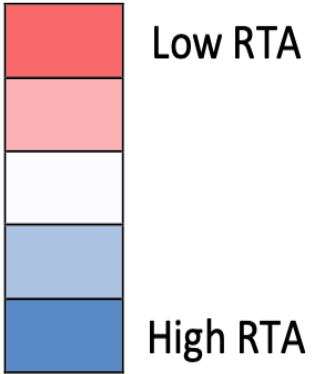
Table 3. Distribution of Y02 per applicant country

	EU	Germany	Sweden	Great Britain	USA	Korea	Japan	China
Y02A	2,5%	0,6%	0,0%	8,6%	5,1%	0,9%	1,7%	2,0%
Y02B	8,1%	6,6%	3,6%	6,7%	7,3%	6,2%	4,2%	5,7%
Y02D	58,0%	37,1%	89,7%	50,3%	61,2%	75,1%	60,5%	70,8%
Y02E	6,6%	9,4%	0,8%	2,5%	4,1%	3,6%	5,4%	5,1%
Y02P	8,3%	22,9%	0,5%	8,0%	7,5%	2,6%	13,0%	4,5%
Y02T	3,2%	6,3%	1,3%	5,4%	3,1%	4,6%	6,9%	3,8%
Y02W	0,6%	0,2%	0,5%	0,4%	0,5%	0,2%	0,3%	0,3%
Y04S	12,7%	16,9%	3,6%	18,1%	11,3%	6,8%	8,1%	7,8%
	100%	100%	100%	100%	100%	100%	100%	100%

Source: own elaboration based on PATSTATS

Table 4. RTA by CPC codes

	EU	USA	Korea	Japan	China
Y02A	-0,2	→ 0,2	-0,6	-0,4	-0,3
Y02B	0,1	0,0	0,0	-0,2	-0,1
Y02D	0,0	0,0	0,1	0,0	0,1
Y02E	→ 0,2	-0,1	-0,1	0,1	0,1
Y02P	0,1	0,0	-0,5	→ 0,3	-0,2
Y02T	-0,1	-0,1	0,1	→ 0,3	0,0
Y02W	→ 0,2	0,0	-0,3	-0,2	-0,2
Y04S	0,1	0,0	-0,2	-0,1	-0,1



Source: own elaboration based on PATSTATS

- The RTA (Revealed Technology Advantage) index provides an indication of the relative specialization of a given country in selected technological domains, based on patent applications
- There is a comparative advantage in Y02/Y04 subfield if their values are higher than 0.

Table 5. Top 10 companies applying for digital green patents

Company	Applications	Country	Patent Office
1.INTEL CORP	3670	US	EP,US
2.QUALCOMM INC	3512	US	EP,US
3.SAMSUNG ELECT CO LTD	1982	KR	EP,US
4.TELEFON AB LM ERICSSON PUBL	1438	SE	EP,US
5.GOOGLE INC	1430	US	EP,US
6.LG ELECT INC	1338	KR	EP,US
7.APPLE INC	896	US	EP,US
8.HUAWEI TECH CO LTD	776	CN	EP,US
9.GOGORO INC	736	CN	EP,US
10.RESEARCH IN MOTION LTD	710	CA	EP,US

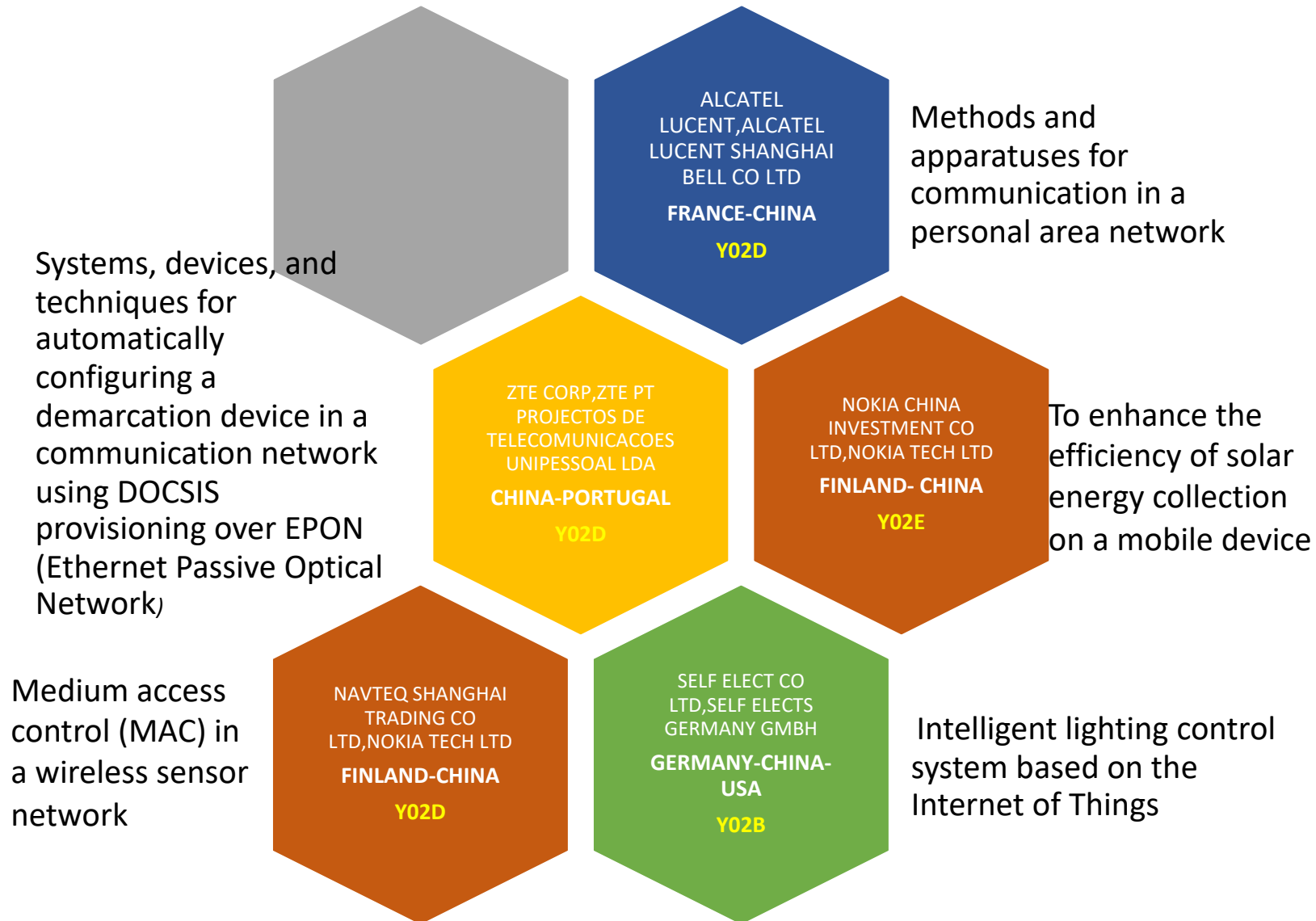
Table 6. Top 5 Chinese companies applying for digital green patents

Company	Applications	Country
1.HUAWEI TECH CO LTD	613	CN
2.ZTE CORP	276	CN
3.GUANGDONG OPPO MOBILE	150	CN
4.XIAOMI INC	104	CN
5.CHINA ACADEMY OF TELECOM TECH	42	CN

Table 7. Top 5 EU companies applying for digital green patents

Company	Applications	Country
1.TELEFON AB LM ERICSSON	1227	SE
2.NOKIA	440	FI
3.SIEMENS	212	DE
4.KON PHILIPS ELECT	192	NL
5.ALCATEL LUCENT	107	FR

Co-applicants: China & EU



- Most of the co-applicants companies belong to the same holding
- Some of companies have experienced processes of acquisition/fusion (Nokia, Alcatel Lucent)

Main preliminary takeaways

- The twin transition is globally still at a very early stage;
- Strong technological specialization in ICT-related innovations aimed at reducing energy consumption (Y02D) but some technology diversification among countries in terms of RTA;
- Top patenting companies are all in ICTs
- China-EU technological cooperation based on Chinese acquisitions of EU companies
 - How this cooperation is affected by recent geopolitical competition?

To do next

- Update the dataset to 2022
- Pick some co-patents with Chinese and EU applicants and investigate in more details what technologies are involved, trying to collect some further qualitative evidence on these technological collaborations
- Investigate EU policies

Thanks!

<https://robertarabellotti.it>

CPC code	
Y02	TECHNOLOGIES OR APPLICATIONS FOR MITIGATION OR ADAPTATION AGAINST CLIMATE CHANGE
Y02A	TECHNOLOGIES FOR ADAPTATION TO CLIMATE CHANGE
Y02B	CLIMATE CHANGE MITIGATION TECHNOLOGIES RELATED TO BUILDINGS
Y02C	CAPTURE, STORAGE, SEQUESTRATION OR DISPOSAL OF GREENHOUSE GASES [GHG]
Y02D	CLIMATE CHANGE MITIGATION TECHNOLOGIES IN INFORMATION AND COMMUNICATION TECHNOLOGIES [ICT]
Y02E	REDUCTION OF GREENHOUSE GAS [GHG] EMISSIONS, RELATED TO ENERGY GENERATION, TRANSMISSION OR DISTRIBUTION
Y02P	CLIMATE CHANGE MITIGATION TECHNOLOGIES IN THE PRODUCTION OR PROCESSING OF GOODS
Y02T	CLIMATE CHANGE MITIGATION TECHNOLOGIES RELATED TO TRANSPORTATION
Y02W	CLIMATE CHANGE MITIGATION TECHNOLOGIES RELATED TO WASTEWATER TREATMENT OR WASTE MANAGEMENT
Y04	INFORMATION OR COMMUNICATION TECHNOLOGIES HAVING AN IMPACT ON OTHER TECHNOLOGY AREAS
Y04S	SYSTEMS INTEGRATING TECHNOLOGIES RELATED TO POWER NETWORK OPERATION, COMMUNICATION OR INFORMATION TECHNOLOGIES FOR IMPROVING THE ELECTRICAL POWER GENERATION, TRANSMISSION, DISTRIBUTION, MANAGEMENT OR USAGE, i.e. SMART GRIDS