Belgium's transition and transition potential to a green economy

Estelle Cantillon
(ULB and CEPR)

Mattia Nardotto
(ULB and CEPR)

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PRELIMARY

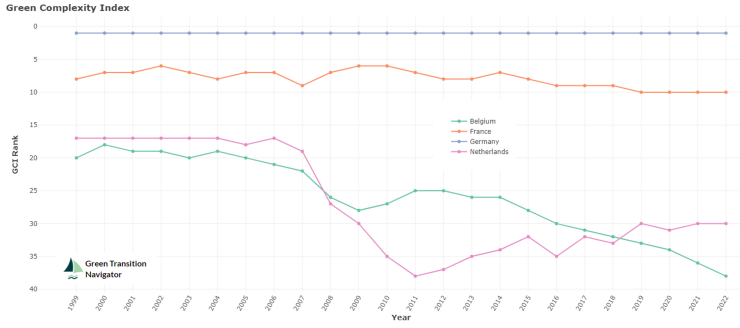
Motivation

Climate and energy transition will reshape the competitive landscape for firms, regions and nations

- Access to cheap low-carbon energy critical for energy-intensive sectors
- Growing and shrinking markets (e.g. batteries vs. exhaust systems)
- New competitive products and activities due to changes in costs and policies (recycling, waste mgt, energy efficiency, ...)

Countries' ability to take advantage of the green transition will depend on their current economic structure (capabilities) and their ability to seize new opportunities.

Our starting point: The Green Complexity Index



Source: https://green-transition-navigator.org/

- GCI is a trade-based index based on green products
- Belgium is steadily losing its competitiveness against the rest of the world

What does the Green Complexity Index capture?

At the country-product pair level:

- **Revealed Comparative Advantage** (Balassa, 1965): RCA_{cp} measures the extent to which country c exports more of product p (in relative terms) than other countries formula
- **Product Complexity Index** (Hidalgo et al., 2007; Hidalgo and Hausmann, 2009): PCI_p captures the degree to which product p is related to other products and how ubiquitous it is formula
- **Green Complexity Index** (Mealy and Teytelboym, 2022): GCI_c captures the product complexity of the set of green products for which country c has a revealed competitive advantage

$$GCI_c = \sum_p 1_{\{RCA_{cp}>1\}} PCI_p \qquad \text{where } p \text{ is a green product}$$

Green products

Different approaches exist to capture the ability of economies to adapt and take advantage of the climate and energy transition:

- **Green products**: products and services that measure, prevent, limit, minimize or correct environmental damages (OECD, 1999), for statistical and trade purposes
- **Green firms**: firms producing goods and services for environmental protection and the management of natural resources (Eurostat's CEPA and CReMA classifications)
- **Green innovation**: EPO's 2010 classification schemes for Climate Change Mitigation Technologies (CCMT)

We follow Mealy and Teytelboym (2022) and use their combined APEC-OECD-WTO list of green products: 295 products at HS6 level. more

Research questions (this presentation)

- What explains the relative decline in Belgium's Green Complexity Index?
  - Underlying industry dynamics → Reduction of the portfolio of products for which Belgium has competitive advantage, but with heterogeneity across products, → reduction in the average RCA
- What *explains* the reduction in RCA of the Belgian economy?
  - Manufacturing lost ground, but less so looking at green firms
  - Investments seem to growing at an insufficient pace
  - We rule out alternative explanations (e.g., shift to domestic use of green products)

Positioning within the literature (selected)

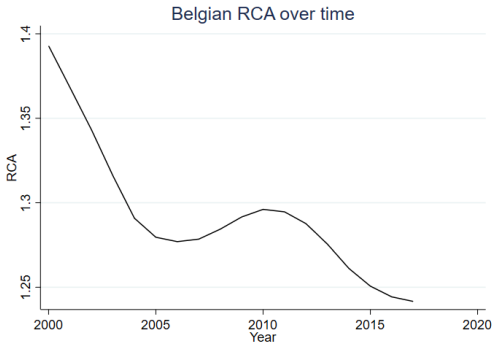
- **Economic linkages**: Supply chains (Acemoglu et al., 2012; Magerman et al., 2016), capabilities (Hidalgo and Hausmann, 2009; Hausmann et al., 2014)
- **Industry transformation**: Path dependence (Aghion et al., 2016), supply-chain interdependencies (Lenox et al., 2007; Dugoua and Dumas, 2021), the role of innovation (Probst et al., 2021), transition risks (Fankhauser et al., 2013; Andres et al., 2023)
- **Green industrial policy**: Porter hypothesis (Porter and Linde, 1995; Ambec et al., 2013), directed technical change (Acemoglu et al., 2023) and policy mix (Vollebergh et al., 2023)

What do we know already?

- **Linkages in the transition**: Green products tend to be more complex than others (Mealy and Teytelboym, 2022) and innovation in clean technologies involve more spillovers (Dechezleprêtre et al., 2014)
- **Distorted incentives:** Policy uncertainty and low energy prices reduce incentives for investment (Bloom et al., 2007; Berestycki et al., 2022)
- **Belgium-specific**:
  - Declining position of Belgium's patenting activity in Climate Change and Mitigation Technologies (Swartenbroekx, 2021)
  - Belgian banks reluctant to lend to innovators or diffusors of disruptive environmental technologies (Degryse et al., 2022)
  - Environmental goods and services sector growing faster than the rest of the economy, but slower than exports (Belgian Federal Planning Bureau, 2023)

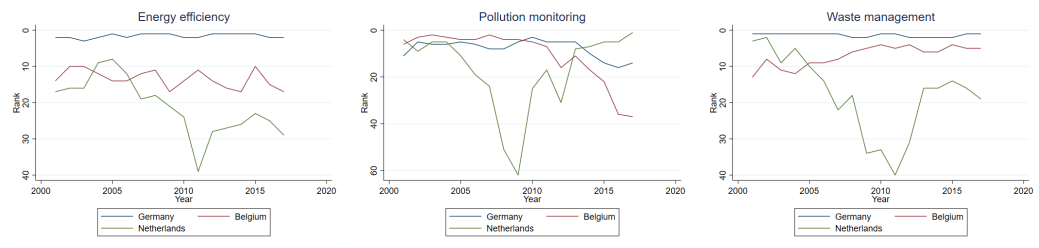
Decomposing the change in the Green Complexity Index

$$\Delta GCI_c = \sum_g \Delta 1_{\{RCA_{cg}>1\}} PCI_g + \sum_g 1_{\{RCA_{cg}>1\}} \Delta PCI_g$$



- Change in Belgium's CGI driven by a reduction in the number of products for which Belgium has a comparative advantage
- Changes in PCI later

Compositional effect



- Heterogeneity between product categories:
  - Competitiveness in energy efficiency products and waste management products stable/improved
  - Decline in CGI driven by pollution monitoring

Firm-level data

- We leverage access to the Microeconomic Research Data Hub (MiRDH)
- The datasets include:
  - Balance sheet data (at firm/year level)
  - Prodcom (at firm/year/CN8 level)
  - Trade (at firm/year/HS6 level)
  - We integrate the data with information on Green products obtained from LSE's Green Navigator Project
  - We will leverage other datasets which are also available (e.g., employment survey)

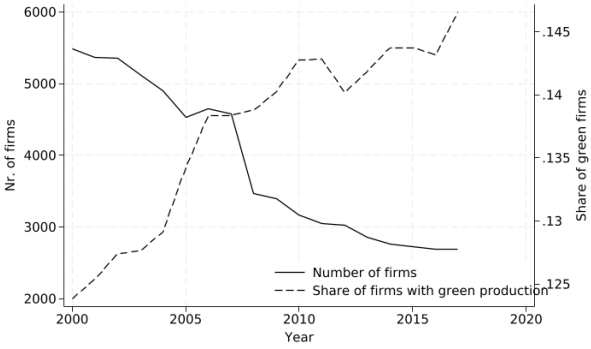
- Data spans the period 2000-2022 but for this presentation we restrict the analysis to 2000-2017

Firm-level data

- For this presentation, we mainly focus on:
  - Number and size of firms
  - Volumes/values of production of green products
  - Volumes/values of trade of green products
  - Investments
  - Employment
  - Value added

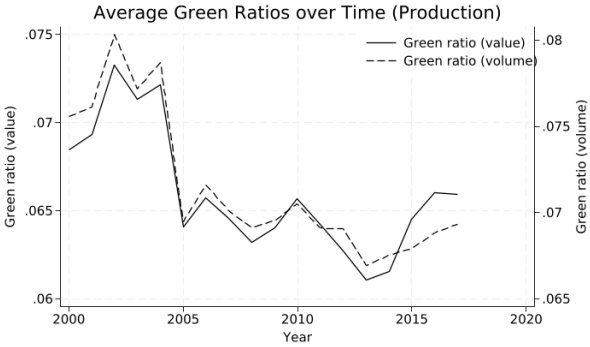
- NOTE: because we exploit Prodcom's detailed information of firms' productions, the analysis is restricted to **manufacturing**

Number of firms and share of *green* firms



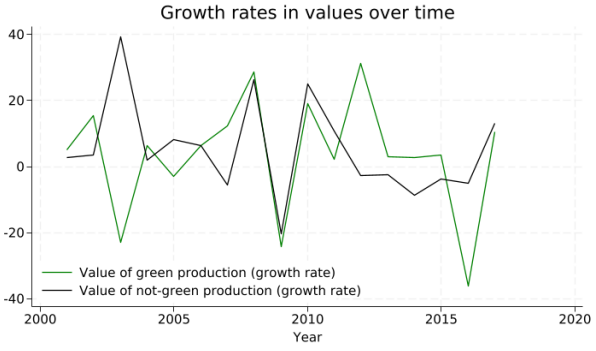
- Num. of firms in 2000 is 5,491, of which 680 produce at least in one green prod. category
- Num. of firms in 2017 is 2,695, of which 395 produce at least in one green prod. category
- Increase of share of firms producing in at least 1 green product category from 12.5% to 14.5% (+16 percent)

Green production



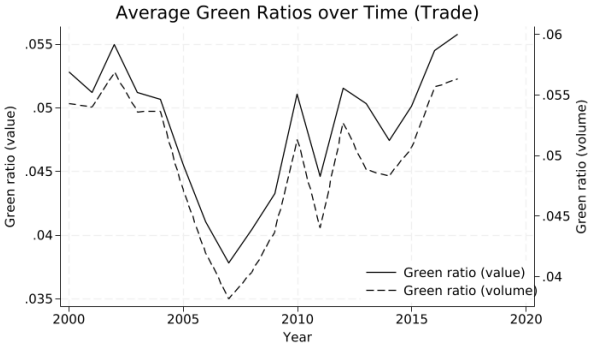
- Based of the full sample of firms, the share of green products
- Non negligible decline in terms of volumes (-8.2 percent)
- Small decline in terms of value (-0.3 percent)

Green and non-green production growth



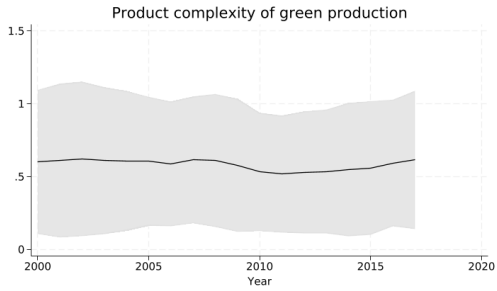
- Year-to-year changes in the value of production
- Average growth in value between 4% and 5%, with sizable variation
- Neither green nor non-green products outperforming the other group (in value)
- Excluding 2008, often negatively correlated

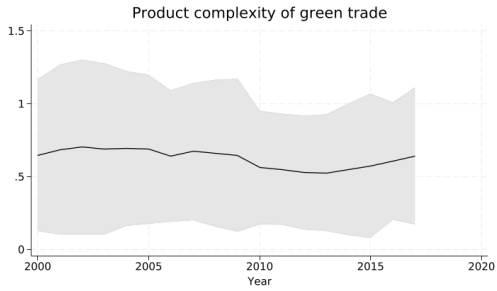
Green trade



- Share of trade coming from green products was approx. 5% at the beginning of 2000s (both in volume and value), after a contraction during the financial crisis, in 2017 it is back a approx. 5%

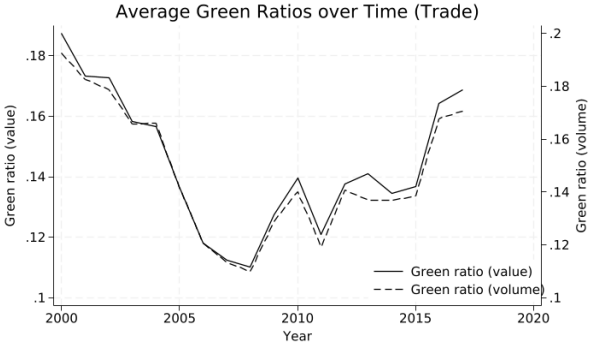
Product complexity of green products





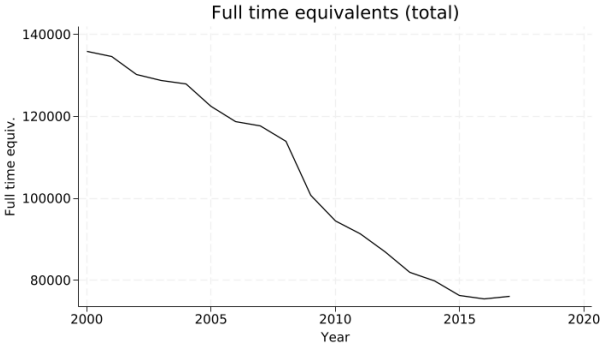
- The products produced and traded by Belgian firms are stable in terms of their complexity

Green trade of green firms



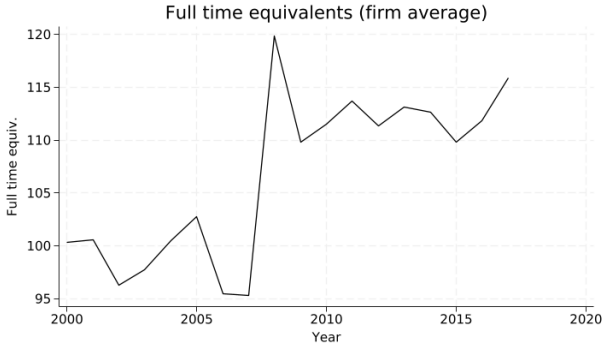
- Restricting to firms with green product lines:
- Similar dynamic as trade ratio of average firm $\longrightarrow$ green trade is relatively more important than for the average firm, but it did not display a more resilient pattern during the financial crisis

Full-time equivalents of green firms



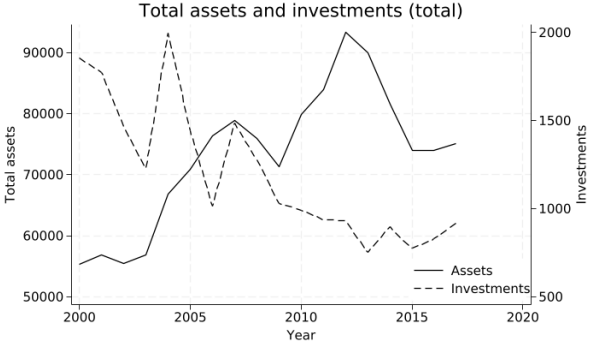
- Due to the large exit of firms, FTEs have steadily declined (-43.5 percent)
- Similar pattern if we do not restrict to green firms

Average full-time equivalents of green firms



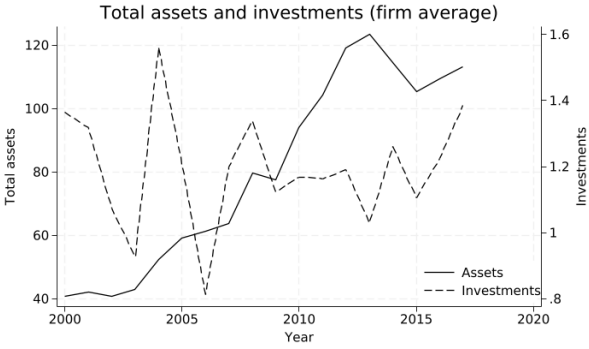
- Firms that did not exit increase their FTE by approximately 15 percent
- Again, similar pattern if we do not restrict to green firms

Total assets and investments of green firms



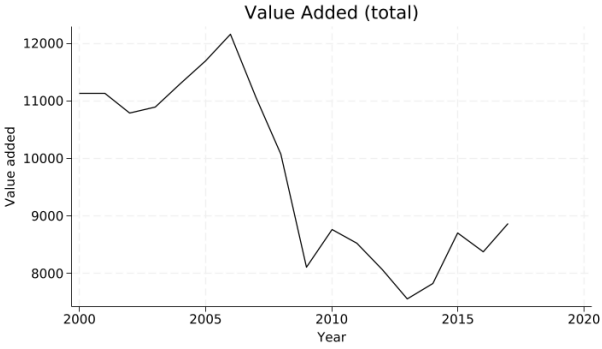
- Increase in total assets but aggregate decrease in total investment by Belgian firms producing green products (values are expressed in millions and deflated to 2000 euro)

Average assets and investments of green firms



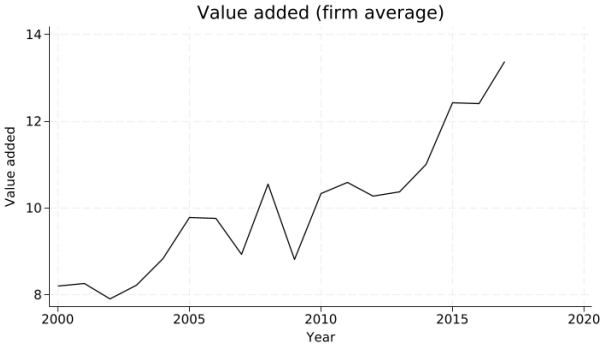
- Sizable increase in assets by green firms (values are expressed in millions and deflated to 2000 euro)
- Relatively stable pattern for investments, amounting to 1.2mln euro per year for the average firm (values are expressed in millions and deflated to 2000 euro)

Total value added of green firms



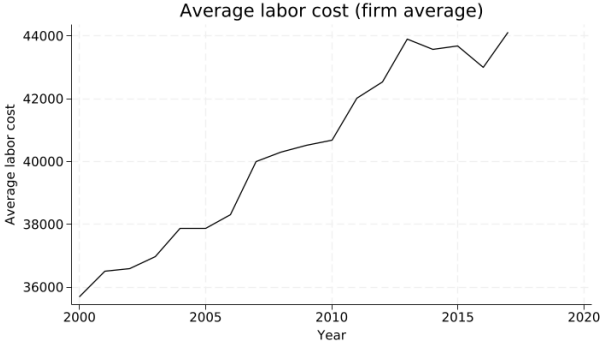
- Sizable decrease of value added due to exit by green firms (values are expressed in millions and deflated to 2000 euro)

Average value added of green firms



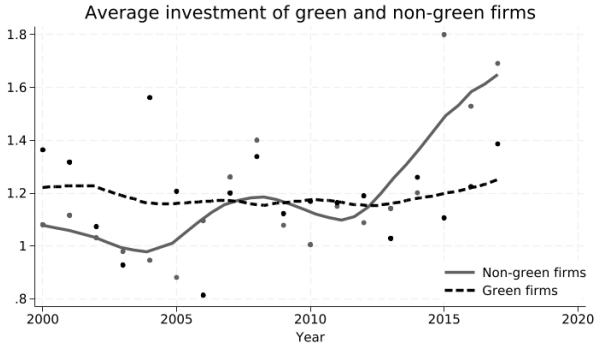
- Sizable increase of value added by the remaining green firms (values are expressed in millions and deflated to 2000 euro)

Average cost of labor of green firms



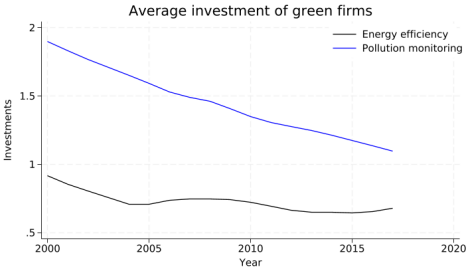
- Sizable increase in compensations in green firms (values are expressed in 2000 euro)
- Do not forget the role of selection

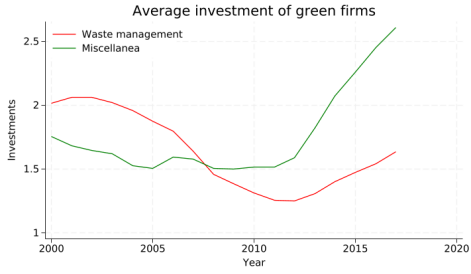
Average investments of firms



- Green firms started the 2000s investing more on average than not-green but over time they lost ground (values are expressed in millions and deflated to 2000 euro)
- (Relatively) low investments can help explaining the lost competitiveness

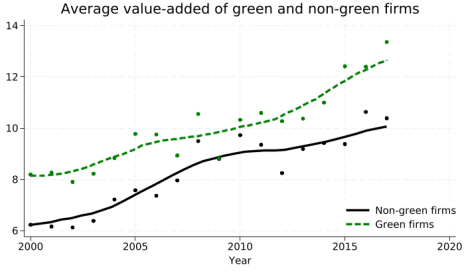
Average investments of green firms by product category

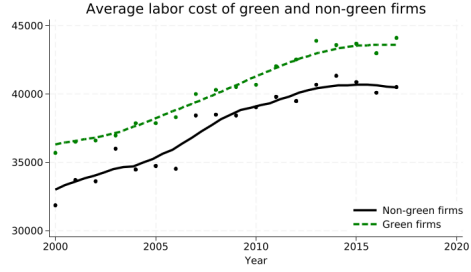




- Heterogeneity across firms producing in different product categories

A final comparison between green and non-green firms





- Green firms (on average) generate more value-added and offer higher salaries than non-green firms
- Growth rates in value-added and salaries are similar

Findings thus far

- Observed decline in Belgium's Green Complexity Index, driven by **loss in competitive advantage in green products**, not by a decline in their complexity
  - Underlying heterogeneity between product categories
- Role of industry dynamics to explain this trend(s):
  - Sizable contraction of the manufacturing sector, lower for firms producing green products
  - **Investments** seem to play a role, lower in green firms than in non-green, with important heterogeneity
- Still, some positive signs from the green sector: on average, higher value-added and higher salaries

Understanding the mechanisms underlying the observed dynamics

- **Within product categories**: What distinguishes the firms that perform well from others ?
  - Investments, patenting activity
  - Organisational commitments (cluster memberships, SBTi, ...)
- **Across product categories**: What explains the strong performance of some products versus others ?
  - Capabilities, as measured, e.g., by the proximity with other products with which Belgium has a revealed competitive advantage (Hidalgo et al., 2007)
  - Industrial policy (cf. regional competitiveness clusters)

Green goods versus green services

Our analysis has focused on manufacturing but manufacturing is declining.

As an alternative, Eurostat curates since 2014 a firm-level database of environmental goods and services (EGS) (19 domains linked to environmental protection and resource management).

According to Belgian Federal Planning Bureau (2023):

- 13,000+ companies are involved in environmental goods and services (EGS) in Belgium, a third of them being specialized

Thank you for your attention

Revealed Comparative Advantage

RCA_{cp} measures the extent to which country c exports more of product p (in relative terms) than other countries

$$RCA_{cp} = \frac{x_{cp} / \sum_p x_{cp}}{\sum_c x_{cp} / \sum_c \sum_p x_{cp}}$$

where x_{cp} is country c's export of product p

$RCA_{cp} > 1$ when country c's product p represents a larger share of its exports than the world average.

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Product Complexity Index

PCI_p captures the degree to which product p is related to other products when it comes to competitive advantage *and* how ubiquitous it is.

Let $M_{cp} = 1$ if $RCA_{cp} > 1$

Define $\tilde{M}$ as the $p \times p$ matrix with the following elements

$$\tilde{M}_{pp'} = \sum_c \frac{M_{cp} M_{cp'}}{u_p d_c}$$

where u_p is the number of countries with a competitive advantage in product p (ubiquity) and d_c is the number of products for which country c has a comparative advantage (diversity)

Product Complexity Index (cont'd)

Hidalgo and Hausmann (2009) and Hausmann et al. (2014) define the product complexity index as the eigenvector Q associated with the second eigenvalue of $\tilde{M}$, normalized:

$$PCI = \frac{Q - < Q >}{\text{stdev}(Q)}$$

where $< Q >$ stands for the average of Q

Intuition: The eigenvector associated with the first eigenvalue is the unit vector so not informative. The eigenvector solves a recursive equation that accounts for the diversity of the countries trading each product and the ubiquity of these products.

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OECD-APEC-WTO list of green products

The compiled list of green products contains 295 products whose *use* provides environmental benefits (the list is uninformative concerning the life-cycle impact of the product).

Examples of products in the list:

- 283210 - Sodium sulphites (environmental benefit: used in chemical recovery systemas for waste water management)
- 681091 - Prefabricated structural items of cement or concrete (environmental benefits: heat/energy savings and management)
- 730820 - Towers and lattice masts, iron or steel (environmental benefit: Used to elevate and support a wind turbine for the generation of renewable energy)
- 854140 - Photosensitive/photovoltaic/LED semiconductor devices

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