

Eco-innovation in South African manufacturing enterprises: Trends and benefits

Summary

Climate change, energy insecurity and increasing scarcity of resources are some of the major concerns of economic growth and expansion. Manufacturing industries have responded to these concerns by showing greater interest in sustainable production and adopting corporate social responsibility initiatives. This policy brief examines how innovative manufacturing enterprises have embarked on eco-innovative initiatives and contribute to sustainable manufacturing. The research results indicate that the refined petroleum, coke and nuclear fuel sector and the food and beverage sector are the most likely to introduce innovations with environmental benefits. The percentage of innovation-active enterprises is much higher than the percentage of enterprises that introduce innovations with environmental benefits. This shows that there is an 'eco-innovation gap' that needs to be addressed.

Introduction

Faced with rising costs for producing goods and managing waste products, the competitiveness of enterprises and

even countries are increasingly linked to their ability to eco-innovate. But when it comes to the growing global trade in environmentally beneficial goods and services, very little is known. Eco-technologies have been largely neglected in economic statistics. We also know very little about the adoption of eco-innovations as a means of reducing environmental impact.

Defining eco-innovation

The Organisation for Economic Co-operation and Development (OECD) describes eco-innovation as 'the *creation* of new, or significantly improved, products (goods and services), processes, marketing methods, organisational structures and institutional arrangements which – with or without intent – lead to environmental improvements compared to relevant alternatives' (OECD 2008: 19).

Eco-innovation can result from 'unintended environmental innovation' (in other words, the environmental benefit can be a side effect of other goals such as recycling heavy metals to reduce costs). It is thus important to clearly distinguish between

measuring the creation of product innovations and the implementation of products, technologies, services and practices. One should also distinguish between whether the innovation is an incremental improvement of something that already exists or is something entirely new.

Eco-innovation and policy

Innovative products, services, processes or business models can benefit the environment by reducing pressure on natural resources and/or the emission of pollutants. At the same time, environmentally friendly innovation can foster economic development. The environmental goods and services industry is growing fast in OECD member and non-member countries alike. A number of OECD member countries' governments see eco-innovation as a major driver of green growth.

Because innovators may not reap all the benefits of their innovations and environmental benefits may not be appropriately valued by markets, market mechanisms alone will not provide an appropriate amount of eco-innovation at the right time. Policy intervention is therefore needed. The question is: What is the best way to support the development and diffusion of eco-innovation? More specifically, from an environmental policy perspective, the issue is to stimulate innovation that will benefit the environment.

The consequences of this perspective are that (1) it acknowledges that eco-innovations may originate in a variety of contexts and that environmental performance may not be the initial driver; (2) non-technical innovation matters; and (3) the way innovations are used (whether more or less competently) matters.

Most OECD member countries have developed national strategies to

support eco-innovation. In Europe, the Environmental Technology Action Plan encourages European Union (EU) members to develop eco-innovation roadmaps to account for initiatives taken at national level to support eco-innovation. Similarly, the OECD Secretariat has compiled country profiles for eight non-EU OECD members (Australia, Canada, Japan, Korea, Mexico, New Zealand, Turkey and the United States) and for China.

Eco-innovation in the South African context

Building innovation – particularly eco-innovation capabilities – is critical to the sustained improvement of living standards, green economic development and the preservation of natural resources based on productivity driven growth (OECD 2011a). South Africa is committed to the dual objective of being a competitive player in global markets and transforming its economy away from its former dependence on primary resource production and associated commodity-based industries.

South Africa emphasises eco-innovation in three parts:

- (1) Innovation in the research and development of technologies or techniques for environmental protection;
- (2) Innovation in regulatory approaches and standards; and
- (3) A focus on the impact of eco-innovation mechanisms as reflected in the national priority of sustainable development.

Sustainable development is a national priority for a rapidly developing country like South Africa. Eco-innovation is therefore implicitly addressed in several national policies, strategies and action plans which promote research and development that meet sustainable development objectives. In essence, it is promoted in so far as its impact

can drive sustainable development in the country and this is based on the assumption that South Africa can no longer meet its socioeconomic goals if its ecosystems and natural resources are depleted and degraded (CSD 2010).

Why should eco-innovation be measured in South Africa?

Policy-makers must be able to understand, analyse and determine the overall trend of eco-innovation activity, as well as trends in specific product categories. This can only be done if eco-innovation activities are measured. Measuring eco-innovation activities will help policy-makers to better identify the drivers and barriers of eco-innovation. This in turn can inform the design of effective policies and framework conditions such as pollution taxes. The analysis of the benefits of measuring eco-innovations for companies, sectors and nations is useful to raise awareness of eco-innovation among stakeholders and encourage companies to increase their eco-innovation efforts. The measurement of eco-innovation can help society to decouple economic growth from environmental degradation. Consumers can be made aware of the differences in the environmental consequences of products and life styles (Arundel & Kemp 2009).

South Africa does not have a specific national eco-innovation policy. However, several government departments, research institutions and particularly large private companies have developed policies, strategies and programmes to promote research and development (R&D) in technological and non-technological innovations that have a favourable impact on the environment, whether deliberate or not. Eco-innovation is indirectly addressed in a number of legislation, programmes and initiatives due to the importance placed on sustainable development at

a national level. However, regulation and public initiatives are still not fully developed or coordinated inter-departmentally (OECD 2011b).

Challenges to measuring eco-innovation in South Africa

South Africa's commitment to eco-innovation has not yet developed into binding law because its national policy landscape is younger than that of most OECD countries. Regulation and public initiatives have not been fully developed or coordinated for eco-innovation as much as for other innovation domains. These are just two of the challenges regarding policy support for eco-innovation.

The number of white papers, policies and national strategies that indirectly address eco-innovation is proof of the South African government's policy commitment, but it will take time to implement this commitment into law. Research on eco-innovation is currently driven by the National White Paper on Science and Technology of 1996; the National Advisory Council on Innovation Act 55 of 1997; the Ten-Year Innovation Plan; the National Research and Development Strategy of 2002; and, more recently, the Department of Science and Technology (DST) Strategic Plan 2015–2020. These policy documents have contributed to the expansion of the environmental mandate in South Africa. The framework for the development of a national system of innovation that promotes eco-innovation is specifically driven by the National White Paper on Science and Technology of 1996.

The DST Strategic Plan 2015–2020 indicates that Programme 5: Socio-economic Innovation Partnerships of the DST has a Sector Innovation and Green Economy Directorate that provides policy, strategy and support for R&D-led growth of strategic economic sectors

and enhances science and technology capacity to support the transition to a green economy. This is done through facilitating the implementation of high-impact science and technology programmes that support the growth of the environmental technologies and services sector in South Africa and facilitating policy and strategy development of R&D interventions that support the growth of the information and communications technology sector (excluding the retail sector). It also provides innovation policy and planning support to economic actors in priority economic sectors and provincial and local governments.

What drives eco-innovation?

There are at least five reasons why enterprises introduce eco-innovations. Enterprises introduce them as a means of responding to existing environmental regulations and taxes on pollution. Some enterprises eco-innovate because of the incentive of funding for these types of innovations. Current or expected market demand for environmental innovations is an important driver of eco-innovation. Other drivers may include improving the image of the enterprise, reducing costs or even achieving some form of accreditation for environmental innovation.

There are various policies in place to promote eco-innovation. But are these policies relevant to South African enterprises and, in particular, enterprises in the manufacturing sector? The only way to determine this relevance is to evaluate the eco-innovation practices in these enterprises.

Evaluation of eco-innovation in South Africa

A study was undertaken in 2015 to evaluate the practices of manufacturing firms with regard to eco-innovation. The data used was obtained from the South

African Business Innovation Survey 2010–2012 carried out by the Human Sciences Research Council's Centre for Science, Technology and Innovation Indicators. The survey was based on the guidelines of the OECD's Oslo Manual (OECD 2005) and, more specifically, the methodological specifications for round four of the Community Innovation Survey (CIS 4) of 2006 for EU countries as provided by Eurostat. The survey design was also informed by the structure of the Business Register of Statistics South Africa, from which a random stratified sample was drawn. The results reported here are not intended to represent the entire business population of South Africa, but only the realised sample of manufacturing enterprises that responded to the survey. The generated statistics are thus purely descriptive.

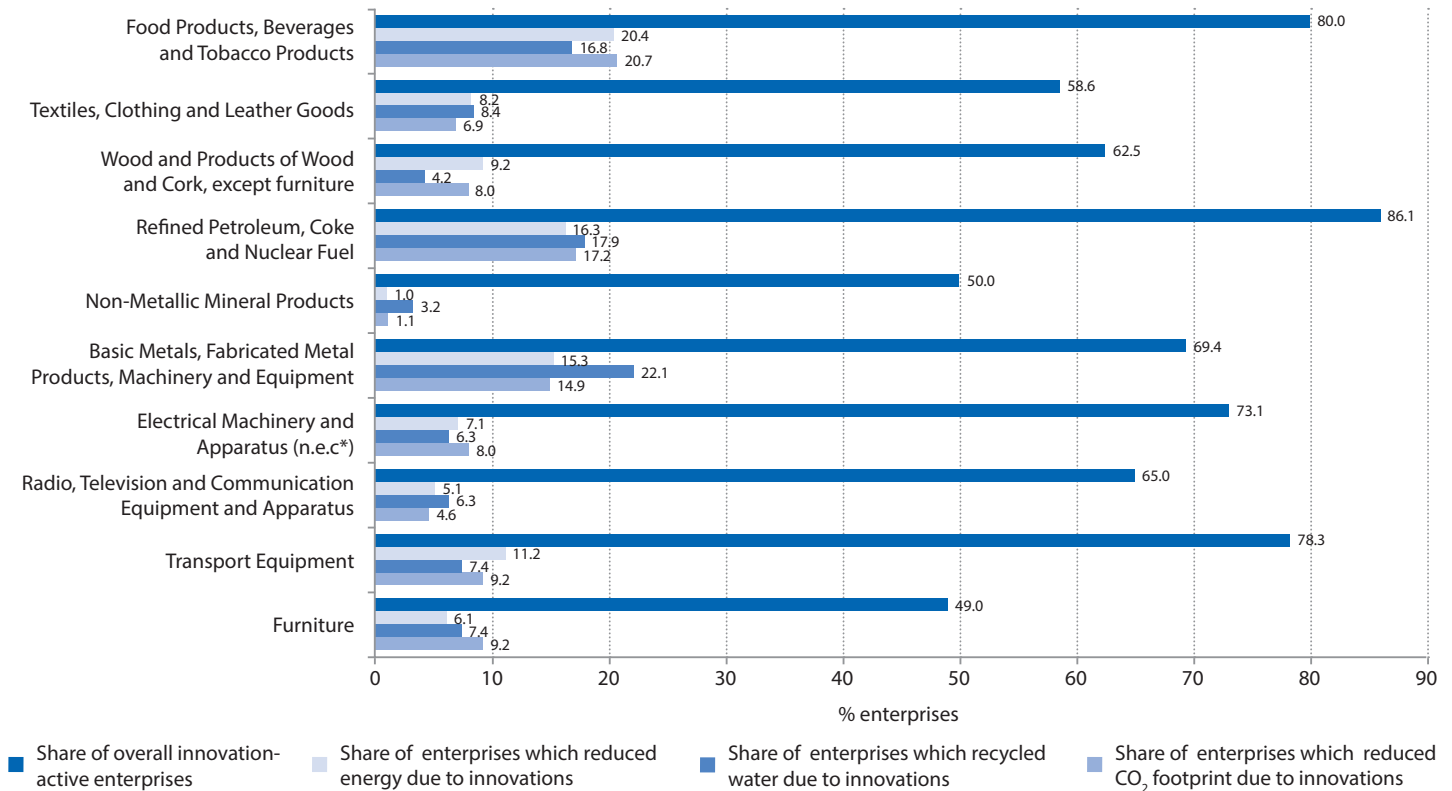
Research findings

Figure 1 shows that at least 50% or more enterprises in the respective manufacturing subsectors were innovation active. The refined petroleum, coke and nuclear fuel sector had the highest number of innovation-active enterprises (86.1%), followed by the food products, beverages and tobacco products sector (80%). Overall, the reduction of energy was the highest reported impact of innovation implementation, followed by the recycling of water.

The percentage of innovation-active enterprises was much higher than the percentage of enterprises that introduced innovations with environmental benefits. This shows that there was an eco-innovation gap, which indicates great potential for improving eco-innovation in manufacturing enterprises.

There was a significant difference in eco-innovation among the different sectors. The food products, beverages and tobacco products sector had the

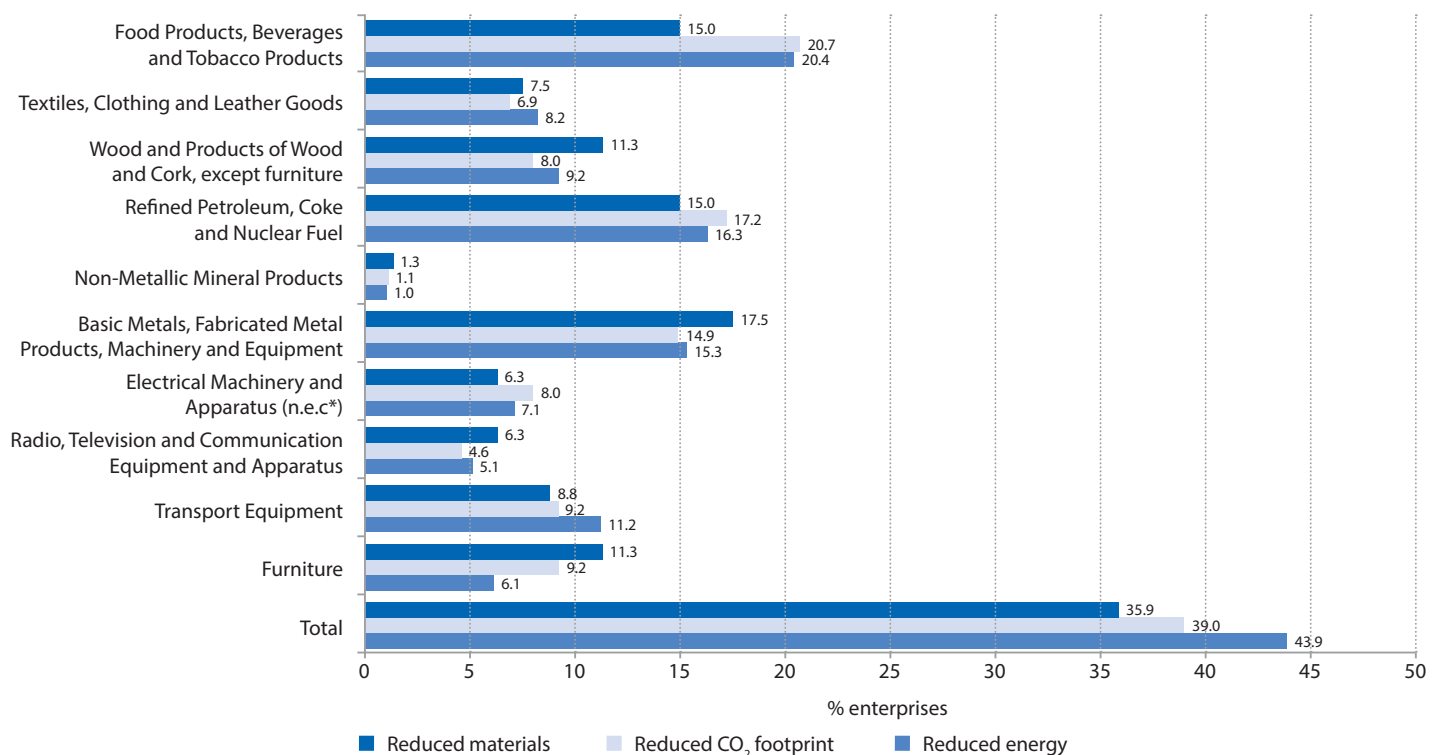
Figure 1: Eco-innovative enterprises in the South African manufacturing sector (2010–2012)



Note: * not elsewhere classified

Data Source: South African Business Innovation Survey 2010–2012, HSRC

Figure 2: Material, CO₂ or energy efficiency gains as a result of innovation (2010–2012)



Note: * not elsewhere classified

Data Source: South African Business Innovation Survey 2010–2012, HSRC

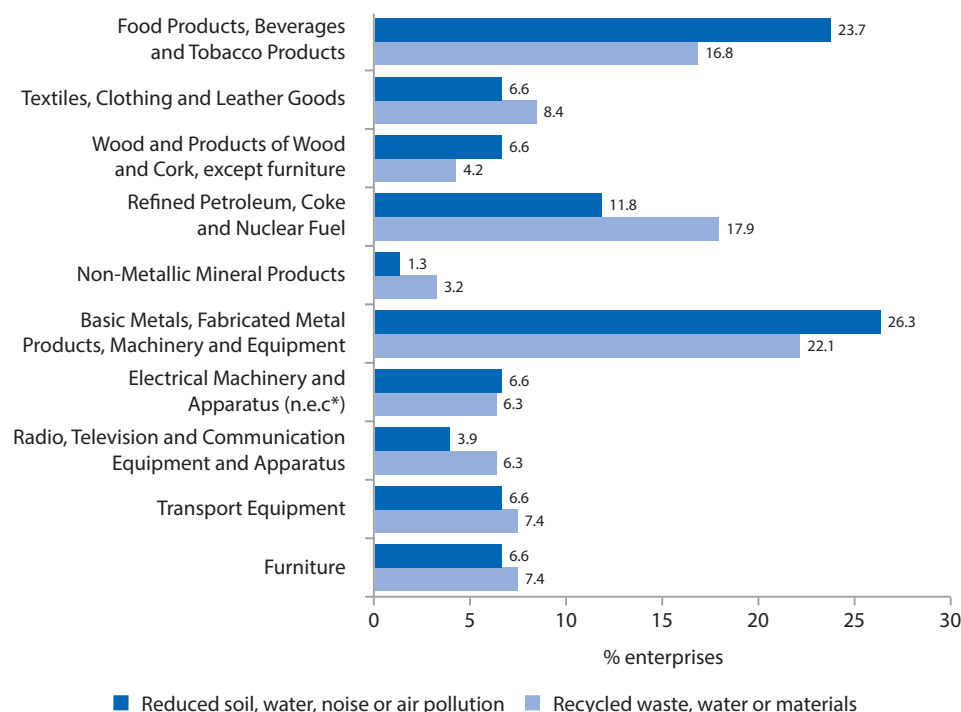
highest percentage of enterprises which reduced their CO₂ footprint due to innovations. In the manufacture of basic metals, fabricated metal products, and machinery and equipment, the highest percentage of enterprises reported having recycled water due to innovations.

In general, it seems that the food products, beverages and tobacco products sector; the basic metals, fabricated metal products, and machinery and equipment sector; and the refined petroleum, coke and nuclear fuel sector had the highest share of enterprises that introduced some form of environmental benefit from their innovation activities.

It is generally observed that enterprises more often introduce innovations that result in reduced energy per unit output. Results for the South African manufacturing sector confirm this trend by showing that 43.9% of all manufacturing enterprises introduced innovations that resulted in reduced energy per unit output. This is followed by 39.0% of manufacturing enterprises that introduced innovations that lead to a reduction in the CO₂ footprint.

The food products, beverages and tobacco products sector, and the basic metals, fabricated metal products, machinery and equipment sector had the highest percentage of enterprises that introduced innovations that led to reduction in soil water and noise pollution (Figure 3). Recycling of waste, water or materials was a direct result of innovation implementation for a higher percentage of enterprises in the food products, beverages and tobacco products sector, the basic metals, fabricated metal products, and machinery and equipment sector and the refined petroleum, coke and nuclear fuel sector than the other manufacturing sectors.

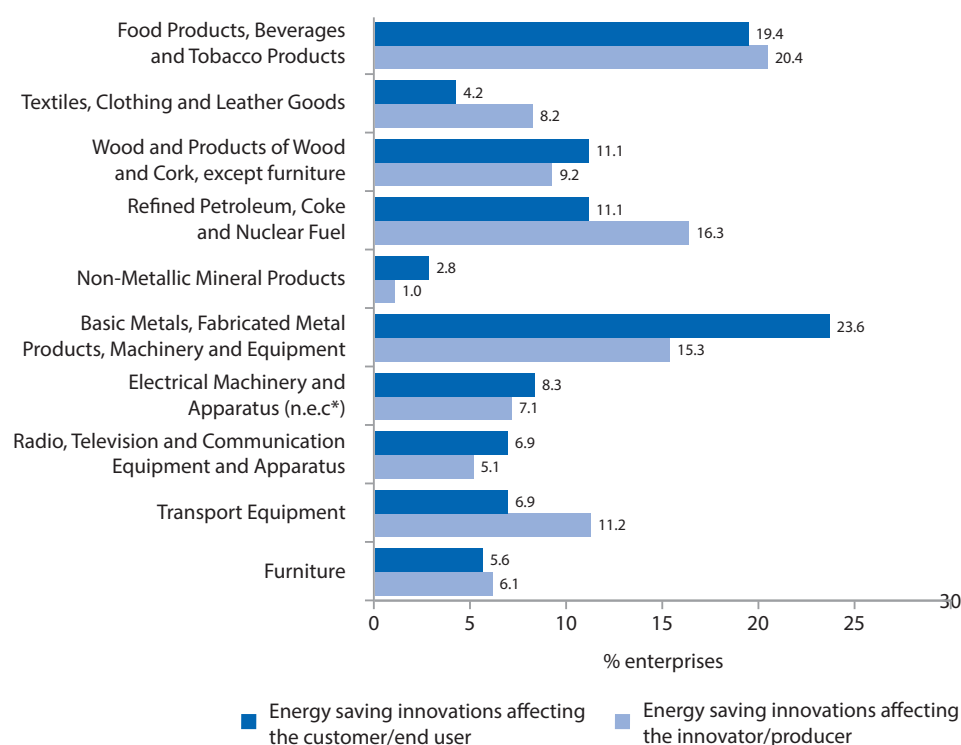
Figure 3: Share of enterprises that reduced pollution or recycled due to innovation



Note: * not elsewhere classified

Data Source: South African Business Innovation Survey 2010–2012, HSRC

Figure 4: Share of firms with innovations leading to reduced energy use per unit output divided into producer and end user benefits (2010–2012)



Note: * not elsewhere classified

Data Source: South African Business Innovation Survey 2010–2012, HSRC

Innovators themselves can benefit from energy saving innovations (for example, reduced material and energy usage in the production process), and so too can the end user (for example, improved energy performance of the product, see figure 4). A higher percentage of enterprises in the basic metal, fabricated metal products, machinery and equipment sector developed energy saving innovations with benefits for the end user than any of the other manufacturing sectors. A higher percentage of enterprises in the food products, beverages and tobacco products sector produced energy efficient innovations that benefit their own production process than the other manufacturing sectors.

Conclusions

- Most of the innovative manufacturing enterprises did not report eco-innovation.
- The food products, beverages and tobacco products sector; basic metals, fabricated metal products, machinery and equipment sector; and refined petroleum, coke and nuclear fuel sector had the highest share of enterprises that reported eco-innovation.
- The basic metals, fabricated metal products, machinery and equipment sector had the highest share of enterprises with innovations leading to materials efficiency improvements.
- The eco-innovation gap suggests a lot of untapped potential to improve eco-innovation performance in the manufacturing sector.

Recommendations

- Government support programmes should be promoted to make the private sector aware that support for innovation with environmental benefits does exist.
- The government should continue to offer incentives to businesses

(especially micro, small and medium-sized enterprises) and improve their accessibility to these incentives in an effort to boost investment in renewable energy, promoting more efficient use of energy and friendlier environmental practices.

- The government should fund the environmental sector to continue to create jobs with green growth as the focus.
- The government should create policies to support various sectors in implementing innovations with environmental benefits.

References

- Arundel A & Kemp R (2009) *Measuring eco-innovation*. UNU-Merit Working Paper Series No. 2009–2017, United Nations University
- CSD (Commission of Sustainable Development) (2010) *South African Country Report for the Eighteenth Session of the United Nations Commission on Sustainable Development (CSD-18)*. Accessed March 2013, http://www.un.org/esa/dsd/dsd_aofw_ni/ni_pdfs/NationalReports/south_africa/SouthAfricanCSD18CountryReport.pdf
- Human Sciences Research Council (2013), *South African Business Innovation Survey 2010–2012*. HSRC, Pretoria
- OECD (Organisation for Economic Co-operation and Development) (2004) *The Fourth Community Innovation Survey (CIS4) Methodological recommendations*. Paris: OECD
- OECD/European Commission (2005) *Oslo Manual: Guidelines for collecting and interpreting innovation data* (3rd edition). Paris: OECD
- OECD (2008) *Sustainable manufacturing and eco-innovation: First steps in building a common analytical framework*. Paris: OECD
- OECD (2011a) *Better policies to support eco-innovation, OECD studies on*

environmental innovation. Paris: OECD

OECD (2011b) *Eco-innovation policies in South Africa*. Free document, Environment Directorate, OECD

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