

## ECO-INNOVATION – A NEW PARADIGM FOR LATIN AMERICA?

ECOINOVAÇÃO - UM NOVO PARADIGMA PARA A AMÉRICA LATINA?

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### ABSTRACT

Global phenomena of climate change on the one hand and not predictable technological risks of energy supply on the other hand are challenging not only Germany and the European Union but society, politics, science and industry worldwide. The answers to these challenges are very different. Some countries are screening their existing energy concepts and are searching ways of alternative energy, such as legislation on clean technologies, so-called eco-innovation. It is especially this shift to eco—innovation that catches our attention. It is not reserved for energy technologies, sustainable production can also be meant in other industries, such as textile. But in the ongoing of the energy turn policies promoting renewable energies increasingly subsumed the concept (COOKE 2010). In the last decades energy policy lived a process of securitization. The connotation of energy policy with the field of security policy automatically led to a change of steering with rather hierarchical modes of governance. The shift towards innovation policy therefore means not also a reorientation of concepts but also a shift of governance towards multi-level-governance (KERN; BULKELEY, 2009) – so far the debate in Europe. How is this concept discussed in Latin America? While the shift towards renewable energy is a quite new debate for Europe, Brazil had already a share of 58,4% of renewables on total energy production in 1970 (MAIHOLD; MÜLLER, 2012). Nevertheless compliance to renewable energy not always meant sustainable innovation. How is the concept of eco-innovation discussed in Latin America? And how far can we observe the above described shift? In order to shed first insight on these questions we analyze the innovation plans of Argentina, Brazil and Mexico with focus on the link between ecology, innovation and renewable energies. We use the software Atlas.ti to research the plans with a co-occurrence analysis.

**Keywords:** Eco-Innovation. Renewable Energies. Brazil. Argentina. Mexico.

### RESUMO

O fenômeno global das alterações climáticas, por um lado, e os riscos tecnológicos não previsíveis de fornecimento de energia, por outro, estão desafiando não apenas a Alemanha e a União Europeia, mas a sociedade, a política, a ciência e a indústria no mundo todo. As respostas a esses desafios são muito diferentes. Alguns países estão buscando os conceitos de energia já existentes em seus territórios e estão procurando formas de estimular a energia alternativa, como, por exemplo, a legislação sobre as tecnologias limpas, chamadas de ecoinovação. É especialmente essa mudança para a ecoinovação que chama a nossa atenção. O seu foco não está reservado somente para as tecnologias de energia, a produção sustentável também pode ser percebida em outros setores, como o têxtil. Mas, nesse fluxo da energia, as políticas que promovem as energias renováveis estão cada vez mais subordinadas ao conceito (COOKE, 2010). Ademais, nas últimas décadas, a política energética viveu um processo de busca por segurança. A relação da política energética com o campo da política de segurança levou, automaticamente, a uma mudança de direção, com modos bastante hierárquicos de governança. A mudança para uma política de inovação, portanto, significa não somente uma reorientação dos conceitos, mas também uma mudança de governo no sentido da governança de múltiplos níveis (KERN; BULKELEY 2009) - até o momento, o debate está na Europa. Como esse conceito é discutido na América Latina? Enquanto a mudança para a energia renovável é um debate muito novo para a Europa, o Brasil já tinha uma participação de 58,4% de energias renováveis na produção total de energia em 1970 (MAIHOLD; MÜLLER, 2012). Não obstante, o respeito às energias renováveis nem sempre significou a inovação sustentável.

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Como o conceito deecoinovação é discutido na América Latina? E até onde podemos observar a mudança descrita acima? A fim de lançar uma primeira visão sobre essas questões, neste artigo, nós analisamos os planos de inovação da Argentina, do Brasil e do México, focando na relação entre ecologia, inovação e energias renováveis. Usamos o *software* Atlas.ti para pesquisar os planos com uma análise de coocorrência. **Palavras-chave:** Ecoinovação. Energias Renováveis. Brasil. Argentina. México.

## 1 INTRODUCTION

Global phenomena of climate change on the one hand and not predictable technological risks of energy supply on the other hand are challenging not only Germany and the European Union but society, politics, science and industry worldwide. The answers to these challenges are very different. Some countries are screening their existing energy concepts and are searching ways of alternative energy, such as legislation on clean technologies, so called eco-innovation. It is especially this shift to eco-innovation that catches our attention. It is not reserved for energy technologies, sustainable production can also be meant in other industries, such as textile. But in the ongoing of the energy turn policies promoting renewable energies increasingly subsumed the concept (COOKE, 2010). In the last decades energy policy lived a process of securitization. The connotation of energy policy with the field of security policy automatically led to a change of steering with rather hierarchical modes of governance. The shift towards innovation policy therefore means not also a reorientation of concepts but also a shift of governance towards multi-level-governance (KERN; BULKELEY, 2009) – so far the debate in Europe. How is this concept discussed in Latin America? While the shift towards renewable energy is a quite new debate for Europe, Brazil had already a share of 58,4% of renewables on total energy production in 1970 (MAIHOLD and MÜLLER 2012). Nevertheless compliance to renewable energy not always meant sustainable innovation. How is the concept of eco-innovation discussed in Latin America? And how far can we observe the above described shift? In order to shed first insight on these questions we analyze the innovation plans of Argentine, Brazil and Mexico with focus on the link between ecology, innovation and renewable energies. We use the software Atlas.ti to research the plans with a co-occurrence analysis.

## 2 THEORETICAL CONSIDERATIONS

The described phenomenon of policies for transition to renewable energy has been analyzed most prominently by two bodies of research: the field of eco-innovation studies and die literature on climate change. While both research strands add to our knowledge on energy transitions on the subnational level, there remain important gaps. Research in the field of innovation studies focuses on transitions to cleaner or more efficient innovation processes, on spillover processes and technology Transfer (DADDI, 2010; JÄNICKE, 2012; COENEN; BENNEWORTH; TRUFFER, 2012). It integrates the dimension of innovation for environmental changes but shows a certain blindness regarding questions of action and politics. Studies on environmental policy or climate change policy focus

on the question of public policy making (JÖRGENSEN, 2012; RABE, 2011; SCHREURS, 2011). They thereby show a blindness regarding innovation. Furthermore both streams of literature – with some exceptions – focus on Europe/United States and Canada. The literature on eco-innovation is founded in the innovation systems literature and therefore based on the assumption that businesses possess enough absorptive capacity to learn from technological niches and linkages on the business level and with universities can lead to regional clusters. Research on innovations systems in developing and emerging markets has shown that these linkages are often interrupted and that absorptive capacity is often low (MIAN et al., 2010; STEHNKEN, 2010). With this contribution, we not only want to study empirical phenomenon of renewable energy policy in emerging/developing countries but we want to broaden the concept of eco-innovation beyond the European/US-context.

## 2.1 ECO-INNOVATION AS A PHENOMENON OF REFRAMING IN EUROPE

In the last decades energy policy lived a process of securitization. Questions of energy policy increasingly were discussed as a matter of national security. The connotation of energy policy with the field of security policy automatically led to a change of steering with rather hierarchical modes of governance. A good example is the German energy debate: as Monstadt observed for Germany, the states were indeed important engines of socio-technological innovation in the energy sector in the past; nonetheless, when the energy transition developed to be a political project of the federal government the Länders involvement was rather ignored (MONSTADT, 2007).

But there is also a countermovement: the reframing of energy policy as innovation policy. Launched in 2008, the Eco-innovation initiative is part of the EU's Entrepreneurship and Innovation Program (EIP), that aims on improving SMEs innovativeness and competitiveness<sup>2</sup> set up to support innovation among SMEs and to improve their competitiveness. In 2004 the European Commission launched the Environmental Technologies Action Plan (ETAP). It aimed on

further development and use of environmental technologies. Its goal was to tackle the financial, economic and institutional barriers hindering growth of these technologies, as well as to encourage their adoption by the market<sup>3</sup>.

ETAP was followed in 2011 by the Eco-innovation Action Plan (EcoAP) with the EIP as one measure among others. The idea of eco-innovation can be dated back at least to the debate of limits of growth in the 1990s. In the studies of innovation systems Nelson Freeman was the first to introduce the green technologies as a new variable of innovation (ALTENBURG and PEGELS, 2012). As Freeman noted in his book "economics of hope", the debate on limits to growth that followed the volume by Meadows et al. pointed already to two factors that until today are core in the eco-innovation concept:

- regulation of pollution hazards, the need to take a different path of development (sustainable growth);
- the reorientation of world R&D towards environmental objectives.

<sup>2</sup> Disposable at: <[http://ec.europa.eu/environment/eco-innovation/discover/programme/index\\_en.htm](http://ec.europa.eu/environment/eco-innovation/discover/programme/index_en.htm)>.

<sup>3</sup> Disposable at: <[http://ec.europa.eu/environment/ecoap/about-action-plan/objectives-methodology/index\\_en.htm#context](http://ec.europa.eu/environment/ecoap/about-action-plan/objectives-methodology/index_en.htm#context)>.

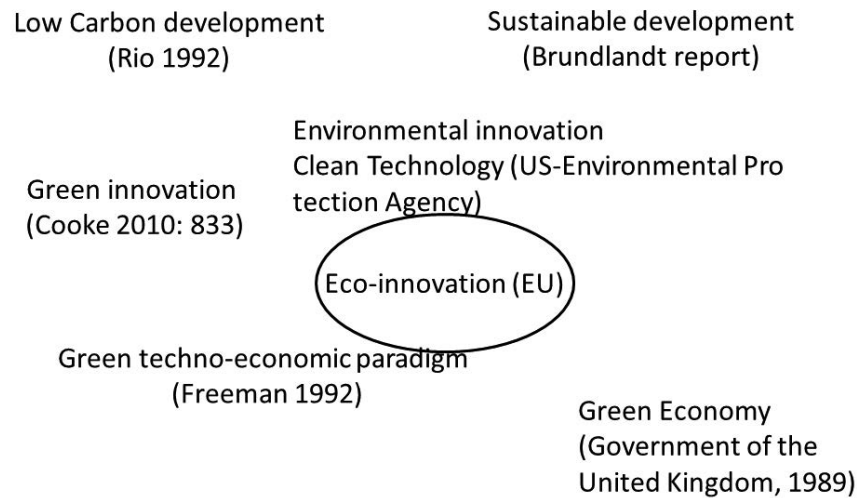
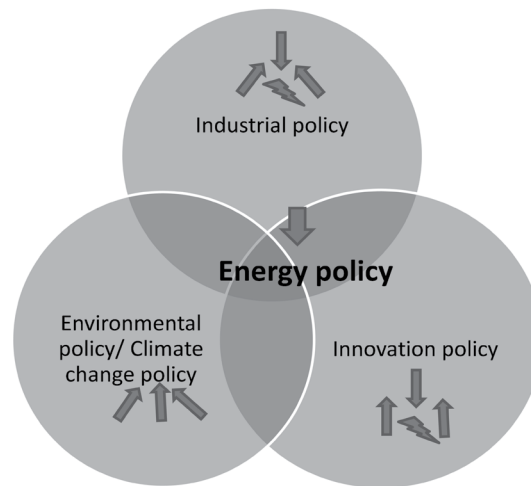


Figure 1 - Eco-innovation and related concepts

As Freeman noted already in the 1990s, the attention of policymakers concentrated on institutional change, not non technological change (FREEMAN, 1992) although in the limits of growth debate both variables were decisive. In his essay Freeman called for the need of a paradigm shift that included not only resource-efficient technologies but also a change in “societal norms and values, motivating new life styles, different ways of accounting for” (ALTENBURG; PEGELS 2012, p. 6). Maybe it is due to this need of a complete paradigm shift that the concept of eco-innovation rather slowly was included in the innovation debate. But step by step it colonized other debates on sustainable development and climate change and last but not least renewable energy. The Eco-Innovation-Initiative of the European-Union can be regarded as a climax of this colonization. It can be regarded as a new sub-field of policy, with still little experience and a high degree of policy experimenting. Subnational units, that position themselves as drivers of eco - innovation, may here be able to capture certain policies (BAIER; DELANEY, 2007): Individual sub-national units can influence federal and European policy making, so that regional development policies are transferred to the federal level or European level. They also have a larger window of opportunity, to anchor global learning processes at the national level by relying on international agreements. They thereby take over the function of “state laboratories” and experiment with new policy instruments. The term of sub-national units as “state laboratories” was initially developed in the US context and “referred to a pioneer-like function of the subnational level in policy initiation as well as implementation” (JÖRGENSEN, 2012, p. 9). In the Climate change and renewable energy debate it was used for some regions in Europe that outperformed regarding the fulfillment of climate change standards or even set new standards. The main argument of this contribution is that in the European case the framing of eco-innovation as an intersection of innovation, the environment, climate change and energy policy led to a change of governance and provided an alternative access for subnational units to the policy field energy beyond the security discourse (Figure 2).

## Eco-innovation as a reframing of energy policy



**Eco-innovation also provides incentives to invest in renewables for countries, that are less vulnerable to climate change**

Figure 2 - Eco-innovation as a reframing of energy policy

So far the debate in Europe and the US – but how is the concept of eco-innovation discussed in Latin America? And how far can we observe the above described shift? In order to shed insight on these questions we first discuss the concept of eco-innovation for developing countries. Then we use the case studies of Argentine, Brazil and Mexico in order to study the link between ecology, innovation and renewable energies.

## 2.2 ECO-INNOVATION-CHALLENGES FOR DEVELOPING COUNTRIES

The transition to sustainable development is a major paradigm shift. Regarding it's feasibility for emerging and developing countries it is therefore associated with the possibility for technological leapfrogging (ALTENBURG; PEGELS, 2012).

Newly industrializing countries may bypass fossil fuel-based development and base their development directly on the latest generation of sustainable technologies. This may even give them a competitive edge over incumbents, whose accumulated investments and relationships may become a burden when radical technological change renders them useless (ALTENBURG; PEGELS, 2012, p. 18).

Nevertheless, the long-term benefits of renewable energy technologies are still unknown. This uncertainty hits developing countries more, as they cannot spread their money but have to “pick the winner” (MAWHOOD, 2013, p. 14) of technologies. Furthermore it is unknown how much the energy system has to be changed to make an effect on emissions/other climate change risks. Third the challenge is to avoid premature path choices under the condition that relative long term merits of different technologies are unknown<sup>4</sup>.

<sup>4</sup>The feed in tariff was such a premature choice for solar technologies.

While investing in eco-innovations is important, for emerging and developing countries the western focus on policies of emission certificates has two flaws: 1) it takes long until effects can be seen; this might be too slow for developing countries that are heavily effected by climate change, e.g. due to coastal geographic situation or problems of desertification; 2) It hinders leapfrogging: carbon pricing policies support technologies that are already on the market or close to marketization (and easy available for companies. Leapfrogging would include developing technologies that are more advanced and still have no commercial status.

Mawhood et al. (2013), therefore, propose:

Policies to encourage renewable energy innovation in developing countries need to consider the range of issues that challenge both technological and socioeconomic development. For example, while policy debate has historically disfavored targeted support for technologies, this may be necessary in the case of renewable technologies, which need to develop rapidly to reduce the greenhouse gas emissions of the energy sector. Innovation in developing countries tends to focus on incremental, rather than radical, developments, and the transfer of foreign technologies. Particular challenges are associated with garnering and stimulating growth in local technological capacity. Thus whilst push-pull market interventions are important to incentivize R&D, progressive policy should also seek to build capacity, improve the institutional framework and facilitate interactions between actors at all levels of the innovation system (MAWHOOD et al., 2013, p. 16).

### **3 THE TRANSITION TO RENEWABLES IN THE LAC REGION**

The question of transition to renewables hits the Latin American Region in a time of increasing demand of energy. Between 1990 and 2009 Electricity Generation growth rate was over 4 percent per year. Regarding the energy transition, the good news is, the renewables have already a high share: Hydropower is the most important source, natural gas is also growing. Oil is declining. The Latin American and Caribbean region (LAC) therefore has a lower carbon footprint than other regions (IJJASZ-VASQUEZ, 2012). Nevertheless, there is also a dark side of this coin: 1) Not all the countries make the same efforts regarding climate change mitigation; 2) Renewable energy production in the past often was not environmentally or socially sustainable, as the Brazilian case shows. Regarding 1) a decisive variable is the differing degree of climate change vulnerability of the LAC region. "Northeast of Brazil, parts of Bolivia, Chile, and Peru, Mexico and several Caribbean islands" are those countries with the highest vulnerability. "Not surprisingly, the arid and semi-arid regions are often the poorest." (IJJASZ-VASQUEZ, 2012, p. 47). Regarding our case selection, the vulnerability of Argentine is much lower than the one of Mexico and Brazil, that have more coastal lines and are subject of desertification.

In the following we consider how Argentine, Mexico and Brazil cope with these challenges. We start from reviewing their efforts regarding climate change.

### **4 MEXICO, BRAZIL AND ARGENTINE IN COMPARISON**

According to Pulver "Mexico stands out among emerging economies as a leader on climate policy" (PULVER, 2013, p. 174). It is the only developing country to legislate long term emission reduction targets.

Mexico is also the country with the highest emissions compared to Brazil and Argentina. In 2009 its emissions were higher than the ones of Brazil, the Andean Zone and the Southern Cone together.

**Figure 2: Scenario CO2 Emissions, Latin America and the Caribbean**

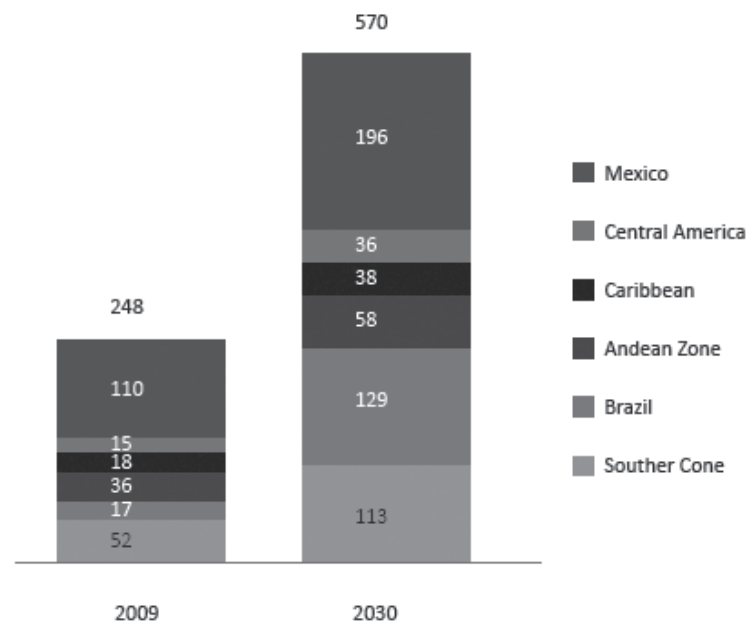


Figure 3 - Scenario CO2 Emissions, Latin America and the Caribbean  
 Source: Ijjasz-Vasquez, 2012, p. 23

Regarding eco-innovation in **Mexico**, there is a growing interest in renewable energy on the part of the Mexican government. In 2008 the law for renewable energies came into force and was quickly followed by a law for bioenergetics. Furthermore, there exists a program to develop the area of solar thermals<sup>5</sup>. According to ProMéxico, the Mexican government’s institution for trade promotion, Mexico is “the main supplier of photovoltaic solar modules in Latin America, with an annual production capacity of over 276 MW<sup>6</sup>”. Nevertheless, the governmental project of reforming the energy sector reveals at least four limitations: 1) Renewables tend to be seen as supplementary to the fossil fuel sector, which remains the government’s main focus; 2) Existing renewable plants are not questioned with regard to eco-innovativeness, that is, development of energy- and resource-efficient technologies; 3) Cases of disregarding local interests/indigenous rights are not an issue on the political agenda, nor is the role of local/regional politics in the green turn reflected; 4) The interest in renewables is overall driven by cross-border initiatives with the US (IBARRA-YUNEZ, 2012).

Our analysis of the **Mexican Innovation Plan** shows, that there is an interesting connection between consumer demand and environmentally friendly technologies that cannot be seen in the plans of the other countries (See Figure 4).

<sup>5</sup> Disposable at: <<http://www.renovables.gob.mx/>>.

<sup>6</sup> Disposable at: <[http://www.promexico.gob.mx/en\\_us/promexico/Renewable\\_Energy](http://www.promexico.gob.mx/en_us/promexico/Renewable_Energy)>.

## Interpretations of Eco-Innovation

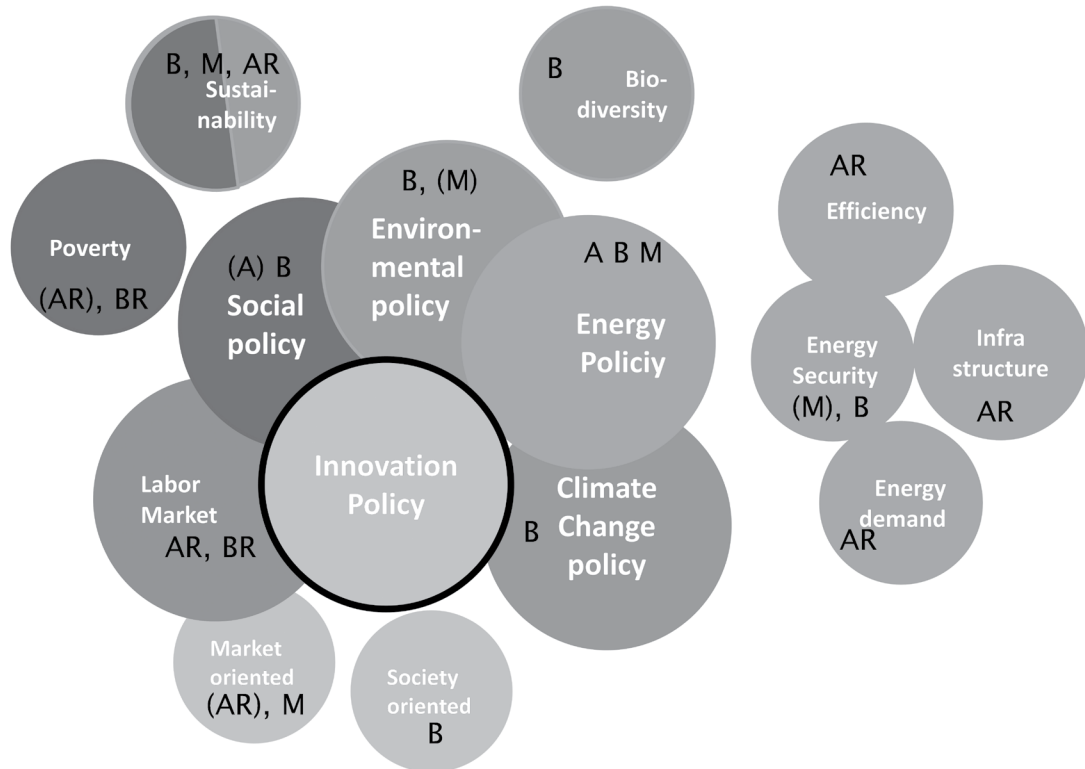


Figure 4 - Interpretations of Eco-Innovation

These technologies are clearly seen as a market niche. Although Brazil refers to biofuel as a competitive advantage, Mexico much more clearly takes over the speech of the market oriented variants of the eco-innovation concept. In the plan the role of growth that respects the environment and biodiversity is also emphasized. But there is no clear link between climate change and innovation policy as can be seen in the Brazilian case. As in the Argentine case the job creation is named as a target but there is no special reference to green jobs (neither in the Argentine nor in the Brazilian case).

**Brazil** is the leader in renewable energies in Latin America. There have been deep changes in the last 40 years. While in the 1970s 78% of energy demands were satisfied mainly by petrol and coal, hydro power more than doubled from 6.1% in 1973 to 13.8% in 2008. Renewable energies such as biomass (mainly sugar), water, and wood always were important, and there is the paradoxical situation that their share declined from 58.4% in 1970 to 45.3% in 2008, which is mainly due to the loss of importance of charcoal (MAIHOLD; MÜLLER, 2012). The growth of the renewables sector has also been associated with environmental losses and social cleavages, such as the abuse of indigenous rights. Though there have been various initiatives in the area of green or eco-friendly cities (e.g., Curitiba), it is only recently that researchers in the field of sustainable innovation and renewable energy in Brazil have started making reference to the concept (BASSO, et al., 2013). Existing studies remain conceptual, working on indicators and concepts rather than empirical observations (MAÇANEIRO; CUNHA, 2013).

In the recent **Brazilian Innovation Plan** there is made up a clear relation between Green economy and climate change. E.g. the plan contains a whole chapter on the green economy. In the chapter the themes of renewable energies and biodiversity are lined to the dangers of climate change for oceans and coastal areas. This connection is a clear relation to the shape of the field of policy under Lula da Silva. In Brazil both Climate change and renewable energies were priorities under Lula da Silva (PLAN DE ACCIÓN SOBRE CIENCIA, TECNOLOGÍA E INNOVACIÓN, 2007-2010, cited in ZURBRIGGEN, 2010).

Remarking is the definition of the green economy:

A economia verde, entendida como uma economia que promoverá o crescimento econômico tendo como vetor central a vertente ambiental e a inclusão produtiva, pode ser a grande aposta estratégica brasileira. Para ser viável, deverá promover profunda transformação no setor produtivo: envolverá novos processos de produção e novos produtos e materiais recicláveis, os quais evitarão a utilização crescente de recursos naturais, dentre outros aspectos que serão necessariamente abordados para atender a hábitos de consumo de uma sociedade ambientalmente consciente. Ou seja, não basta apenas desenvolver tecnologia e inovação, elas tem de conduzir a um novo paradigma de produção e consumo. Essa é uma das vertentes centrais de onde pode provir o salto tecnológico brasileiro (BRAZILIAN INNOVATION PLAN, 2011, p. 36).

This interpretation, compared to Mexico and Argentina, is the closest to the one of eco-innovation given above.

Among the policies for green economy the development of technologies for renewable energies have priority. This domain is perceived as a domain where the country has a competitive advantage, as the plan counts on the long history of the country in renewables. Regarding competitiveness the focus is primarily on Biofuel, including the estimation that demand will increase up to 60% until 2020.

The Brazilian plan also makes reference to energy security. It seems that the policy field is closely linked to security issues. This makes the Brazilian case a very interesting one, as we find the most intersections with other policy fields: energy policy is a matter of security policy, climate policy, environmental policy, innovation policy and social policy. The latter can be regarded as the biggest innovation regarding the framing of eco-innovation in comparison to the western concept. There is a clear connotation of Energy as a question of social inclusion and poverty reduction due to the risen demand in energy. Therefore the biofuel program is combined with social inclusion programs, aiming on the reduction of the price for biofuel (BRAZILIAN INNOVATION PLAN, 2011).

According to Zurbriggen (2010), **Argentina** in its Technology Plan 2005-2015 already focused on knowledge for innovations with a responsible use of resources and repeated its commitment in the 2012-2015 plan. This stands in contrast to the observations of Franchini (2013) of Argentina as a climate change laggard. The focus of the **Argentine Innovation Plan** regarding eco-innovation is sustainable development that concentrates on competitive advantages and job creation. Sustainability and competitiveness are the codes that often co-occur in the analysis of the Argentine Plan.

Regarding renewable energy, the plan states that both renewables and traditional energies shall be related to technology development. Energy efficiency is also an important theme in the Argentine plan, thereby putting the Argentine interpretation of eco-innovation close to the one of the EU: What distinguishes the Argentine Plan from Mexican and the Brazilian one is the recognition of the necessity of an infrastructure for renewable energies and the reference to the smart grid theme.

Though the electrification of rural regions is regarded as important in the Brazilian plans, there is no reference to the according infrastructure technologies.

## 5 CONCLUSION

As we have seen the concept of eco-innovation not only has entered research on Latin American environment an economy but also the policy making process. In all the three countries innovation plans we found reference to the necessity of regarding environment and sustainability as intersecting variables of innovation. This goes hand in hand with societal changes of risen energy demand on the one hand and increased importance of environmental issues in the public.

Despite many similarities regarding the perception of environment and sustainability as intersecting category of innovation, we found big differences between the technology plans of Brazil, Mexico and Argentine. Mexico clearly is the case where the classical market driven definition of innovation and growth prevails despite all efforts of the country to combat climate change. The Argentine plan differs from the other two as it is the only one that makes reference to efficiency and infrastructure, two themes that are very high in the European interpretation of eco-innovation. The Brazilian case surely is the one with the strongest connection of climate change mitigation and innovation. The plan contains also the strongest alternative interpretation of eco-innovation, compared to the other two countries, by focusing on the social dimension of eco-innovation. This comes close to the concept of eco-innovation from below formulated by Pansera and Owen (2014).

Regarding the explanation of the differences, this paper is very preliminary. One explanation is the difference in climate change vulnerability: As Mexico and Brazil are much more vulnerable, they earlier had to find ways to combine economic growth with sustainability. Argentine did not have a strong path in climate change policy and therefore the development of a green economy could not be linked to preliminary policies. Nevertheless, the Argentine case shows, that eco-innovation is also an opportunity for less vulnerable countries to step into sustainable development and innovation.

This leads to our research agenda. Further research should focus on the role of interaction, as policy making and interpretation does not occur in a void but is negotiated among several actors. First insights show that the strong cleavage of land rights and indigenous rights in Brazil and Mexico also led to a connection of innovation policy, social policy and environmental policy. Further research could shed light on the heterogeneous actors in the field and their modes of interaction.

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