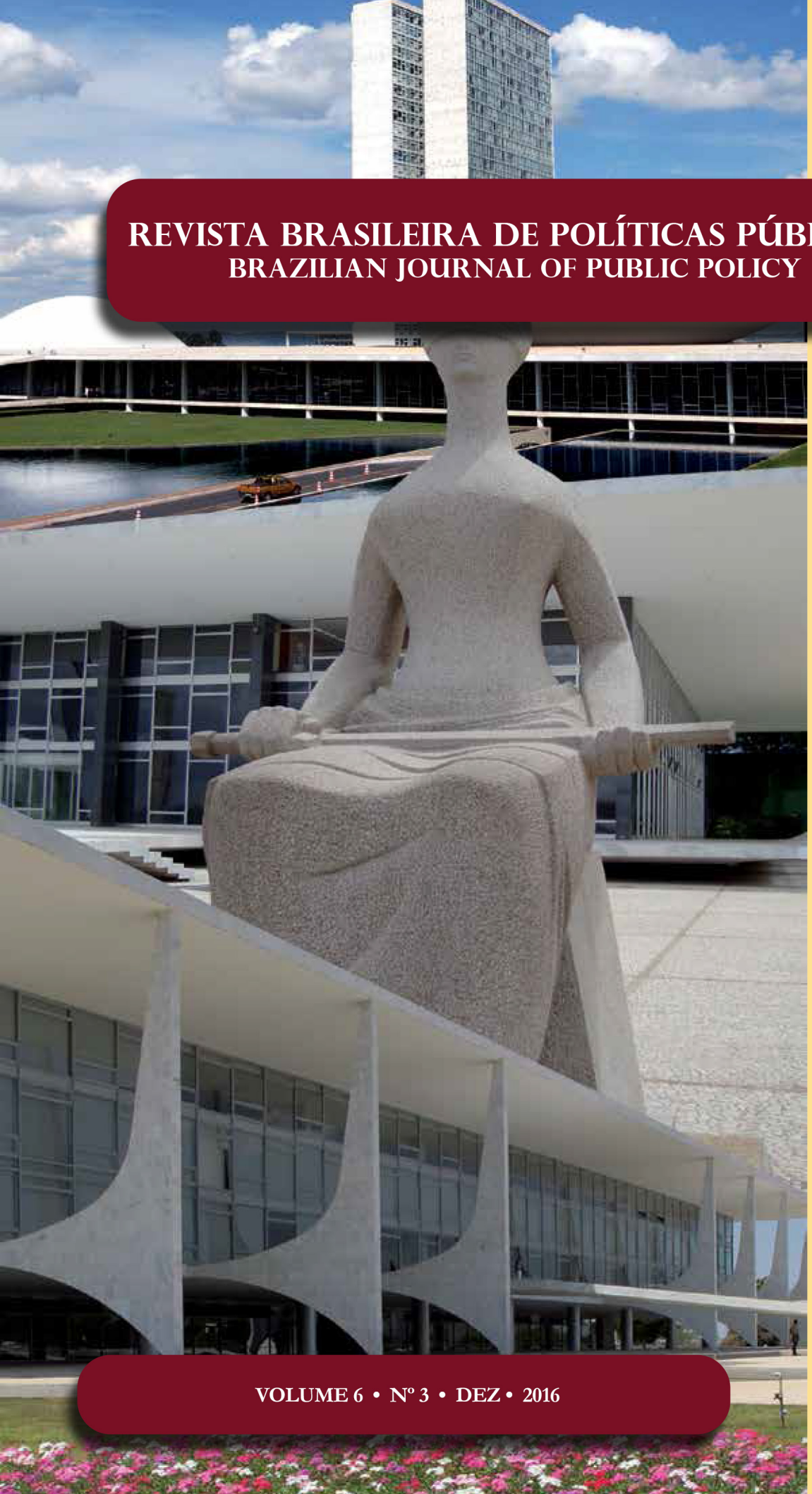

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Painéis solares no Brasil: uma política pública viável

Henrique Pissaia de Souza

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Sumário

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Solar panels in Brazil: a feasible public policy*

Painéis solares no Brasil: uma política pública viável

Henrique Pissaia de Souza**

Abstract

Brazil has a huge area with constant and long solar exposition. The country is already facing some energy bottlenecks and need to expand its energy matrix. In this context the implementation of photovoltaic solar panels, in houses' rooftops, is a viable initiative that should be encouraged by government. This paper proposes a public policy intervention to incentive the use of photovoltaic solar panels. It provides an analysis of Brazilian background, further consumption and planning, the policy intervention, the needed tools, political feasibility and implementation. The logic model will be used showing the main inputs, activities and results. The data was collected from official sources. The main limitation is the missing mathematical approach in the cost-benefit analysis that can be extended in the future. The paper presents a new approach to the energetic problem in Brazil and shows that the proposal is feasible with some goodwill from authorities.

Keywords: Photovoltaic solar panels. Energy. Public policy.

Resumo

Brasil tem uma área enorme com longa e constante exposição solar. O país já enfrenta alguns problemas de falta de de energia e precisa ampliar sua matriz energética, para o consumo futuro. Neste contexto, a implementação de painéis solares fotovoltaicos, em telhados de casas, é uma iniciativa viável que deve ser incentivada pela autoridades. Este trabalho propõe uma intervenção de políticas públicas de incentivo a utilização de painéis solares fotovoltaicos. O artigo fornece uma análise do atual contexto brasileiro, e o consumo futuro e planejamento da matrix energética futura; a intervenção pública; as ferramentas necessárias; a viabilidade política e a implementação. A principal limitação é a abordagem matemática ausente na análise custo-benefício que pode ser estendida no futuro. O livro apresenta uma nova abordagem para o problema energético no Brasil e mostra que a proposta é viável com alguma boa vontade das autoridades.

Palavras-chaves: Painéis solares fotovoltaicos. Energia. Políticas públicas.

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1. Introduction

This paper will presents a public policy proposing the use of solar panels, photovoltaic (PV), in house`s rooftops to supply house energy usage`s in Brazil. The proposal will take into account the expected demand, the use of this technology in other countries and the Brazilian potential.

The logic model will be used showing the main inputs, activities and results. The public policy tool used will be incentive-based subsidies. A cost-benefit analysis will be presented to emphasize the benefits of this policy. And political feasibility analyses will be presented showing that are almost no actors playing against the policy. The data used was collected over official fonts and research institutes, some further mathematical analyzes will be needed to show the real costs associated.

This proposal takes into consideration that Brazil will have an increase in energy`s demand of 3,5% a year until 2030, in average. That the main alternatives are not eco-friendly, which is important in a scenario of climate changes due to emission of polluting gases. Will consider that the solar energy represents only 0,2% of Brazilian`s energetic matrix, and in Germany only in PV panels represents up to 6% of its energetic matrix. The costs of implementation will be only governmental ones. It is likely that no political opposition will be present. The main difficulty to achieve the goals will be to convince people to buy the PV panels. And the main results will be a decrease in polluting gases emission and in an overall increase in air quality and human quality of life.

In Chapter 2 will be presented Brazilian's background, and the environmental aspects involved. In Chapter 3 will be present the public policy to be used, the tools required, a cost-benefit analysis and political feasibility. In Chapter 4 will be presented the implementation proposal. In Chapter 5 the conclusions will be exposed.

2. Analysis

2.1. Background

According to the Ministry of Energy, the energy consumption increase in Brazil is expected to be between 2,2% and 4,2% a year, (in this paper 3,5%), in scenarios with low economic increase and high economic increase respectively[1]. To face the expected demand the government is building some hydropower power plants, coal plants, some experimental solar and wind plants, and studying the construction of a nuclear power plant, but no house photovoltaic (PV) policy is being developed[2].

According to the same Ministry and the Energy Research Agency (EPE)[3], linked to the Ministry, the solar energy production contributes to only 0,2% of Brazilian`s energetic matrix[4] and in the last nation plan National Energetic Matrix 2030[5], from November 2007, no strategic plan for PV development was presented. According to the International Energy Agency (IEA) the leading countries in PV usage are respectively

1 Increase scenarios between the years of 2010-2030. BRASIL. Ministério de Minas e Energia. *Matriz energetica nacional 2030*. 2016. Disponível em: <http://www.mme.gov.br/documents/1138787/1732860/Matriz+Energ%C3%A9tica+Nacional+2030/39d39feb-1307-4f4f-9658-039b86b94bbd;jsessionid=663523DDBACC54787760CDC404F8C998.srv155>. Acesso em: 28 jun. 2015

2 BRASIL. Ministério de Minas e Energia. Matriz energetica nacional 2030. 2016. Disponível em: <http://www.mme.gov.br/documents/1138787/1732860/Matriz+Energ%C3%A9tica+Nacional+2030/39d39feb-1307-4f4f-9658-039b86b94bbd;jsessionid=663523DDBACC54787760CDC404F8C998.srv155>. Acesso em: 28 jun. 2015

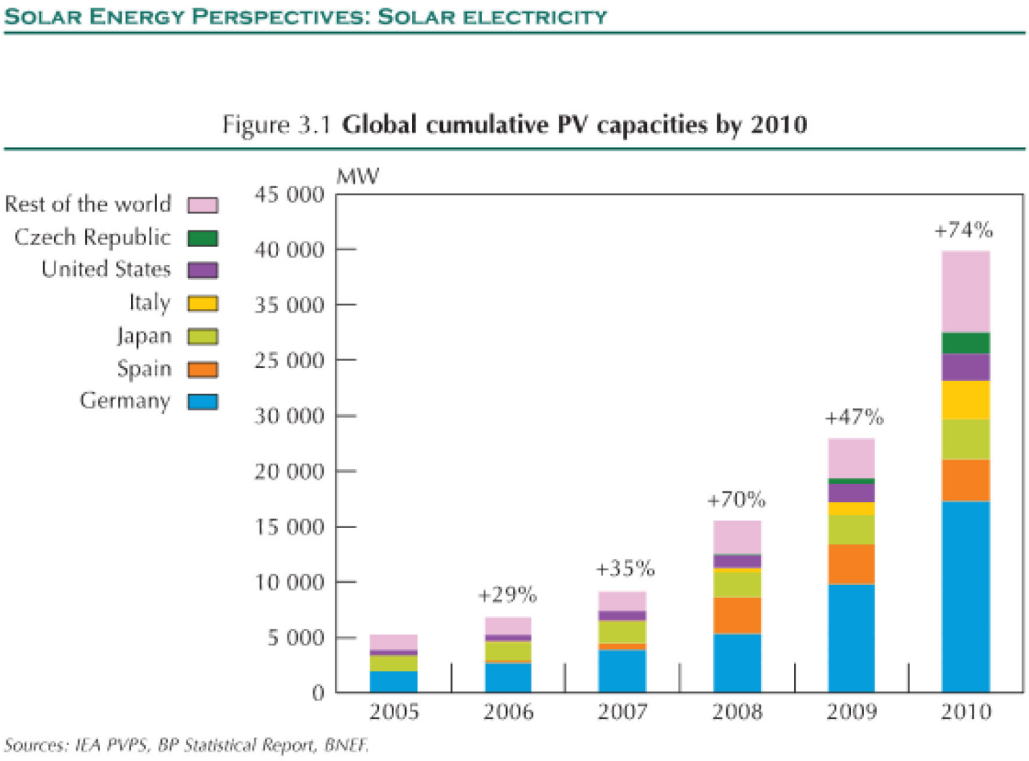
3 Empresa de Pesquisa Energetica.

4 C.f.: <http://www.mme.gov.br>. Access in: 28 jun. 2015..

5 Matriz Energetica Nacional 2013

Germany, Spain, Italy, United States and Czech Republic (image 1). In Germany "PV and total [renewable energy] RE in Germany's gross electricity consumption stood at ca. 6.1 percent and 27 percent respectively[6]. In United States the PV represents 1% of the matrix[7]. Moreover, "between 2000 and 2013, solar electricity generation worldwide increased by a factor of nearly 68%"[8].

Image 1 – Solar Energy Perspectives[9]



2.2. Environmental aspects

Specialists discuss the impact of the emission of carbon dioxide (CO2) in the atmosphere as the main global warming factor. Most of the studies show that it contributes to the climate change and we urge to minimize its emission.

> Anthropogenic greenhouse gas emissions have increased since the pre-industrial era, driven largely by economic and population growth, and are now higher than ever. This has led to atmospheric concentrations of carbon dioxide, methane and nitrous oxide that are unprecedented in at least the last 800,000 years. Their effects, together with those of other anthropogenic drivers, have been detected throughout the climate system and are extremely likely to have been the dominant cause of the observed warming since the mid-20th century[10]

The main factors that contribute to the emission of these gases are fossil combustion`s burning. "CO2 emissions from fossil fuel combustion and industrial processes contributed about 78% to the total GHG

6 C.f.:<http://www.ise.fraunhofer.de/en/publications/veroeffentlichungen-pdf-dateien-en/studien-und-konzeptpapiere/recent-facts-about-photovoltaics-in-germany.pdf>. Access in June 28th, 2015. p.5.

7 C.f.:<http://www.nrel.gov/docs/fy15osti/62580.pdf>. Access in: 28 jun. 2015. p. 23.

8 C.f.:<http://www.nrel.gov/docs/fy15osti/62580.pdf>. Access in: 28 jun. 2015. p.4.

9 SOLAR energy perspectives. Available in:< http://www.iea.org/publications/freepublications/publication/solar_energy_perspectives2011.pdf>. Access in: 28 jun. 2015.

10 CLIMATE CHANGE. 2014. Available in: <https://www.ipcc.ch/pdf/assessment-report/ar5/syr/SYR_AR5_FINAL_full.pdf>. Access in: 28 jun. 2015. p.46.

emission increase between 1970 and 2010, with a contribution of similar percentage over the 2000–2010 period."[11] The coal, natural gas and oil combustion plants contribute to the global warming and bad quality of life, because of the gases thrown in the atmosphere. The hydropower plants, considered clean energy, also have a big environmental impact, because to create the dam, that provide sufficient water to generate the power, several animal and vegetal species are sacrificed in this inundation process.

After the Tsunami that affected Japan and made damages to the Fukushima`s Nuclear Power Plant, the world started to question this former clean and safe energy font. Several countries turned off their plants and stopped projects that were under development[12].

3. Policy proposed

Taking into consideration that Brazil will need to support a supply demand of energy of around 3,5% a year, in the next 15 years, and that we are facing an environmental problem related to the emissions of CO2 in the atmosphere, here is proposed the implementation of a program to incentive the production of energy through photovoltaic panels (PV) located in house`s rooftops.

Nowadays energy is an essential good to people`s lives, and its production is costly in short scale. In their houses people need energy to cook, take showers and use their basic electrical equipment, it can be understood as a public good (non-rival and non-excludable)[13]. The air, its quality and the whole environment are public goods, whit a predisposition to tragedy of the commons problem. If the government doesn't step in, the quality of the air will be (more) unhealthy, whit enhancement in climate changes, bringing unknown prejudices to the human kind.

3.1. Intervention policy tool

The Government should start a subsidize program. This program would advance in three fronts. The first front will be composed by incentive the entrance of imported PV panels from abroad reducing import`s taxes and intrastate and interstate commerce`s taxes to reduce prices to the final consumer. The second front will be to provide incentives to the consumers to buy the PV panels, since the investment cost is high, the government should create credit lines to make allow people to pay in more and lower installments the panels bought. The third front would be a long term incentive to local and international PV panels` factories to establish their productions in Brazil, minimizing the prices to final consumer too through a more competitive market.

This tool will be effective if it reaches a number of people enough to minimize the CO2 emission. And will be efficient since is guaranteed competitive prices with the electric and gas energy provided by companies and people stop or diminish using completely the polluting fonts, and if the government can take off all the subsidies in a considerable lapse of time. If the government executes the steps in time the policy will be effective and efficient.

11 CLIMATE CHANGE. 2014. Available in: <https://www.ipcc.ch/pdf/assessment-report/ar5/syr/SYR_AR5_FINAL_full.pdf>. Access in: 28 jun. 2015. p. 46.

12 C.f.:<http://www.usnews.com/news/business/articles/2015/06/28/germanys-oldest-remaining-nuclear-plant-shuts-down>. Access in: 28 jun. 2015. C.f.:<http://www.world-nuclear.org/info/Country-Profiles/Countries-G-N/Germany/>. Access in: 28 jun. 2015. C.f.:< http://www.theguardian.com/world/2013/oct/21/fukushima-turn-off-nuclear-power>. Access in: 28 jun. 2015.

13 Even though there are some discussions about its nature.

3.2. Cost-benefit analysis

The first cost to be taken into account is the cost for the final consumers some research shows that:

> Solar domestic hot water systems cost in Europe from EUR 85/MWh to 190/MWh of heat, which is competitive with retail electricity prices in some countries, if not yet with natural gas prices. These costs are expected to decline by 2030 to EUR 50/MWh to 80/MWh for solar hot water systems. In China, Cyprus and Turkey, low-cost solar water heaters are already an economic alternative for households. In Israel, they are ubiquitous and save 6% of total electricity demand. In South Africa, electric water heating accounts for one-third of the power consumption of the average household. The government has identified the massive deployment of solar water heaters as one effective option to avoid electricity shortages, and launched a programme to install one million solar water heaters by 2014.[14]

The research shows that the solar energy is already competitive with energy supplies and will be more competitive than gas in some countries. Some studies show that the prices will keep decreasing. If taken into consideration that the sun incidence in Brazil is almost 4 times bigger than in Europe, it can be inferred that the savings will be bigger and the payback time will be faster.

Image 2 – Electric costs and feed-in tariffs in Germany[15]

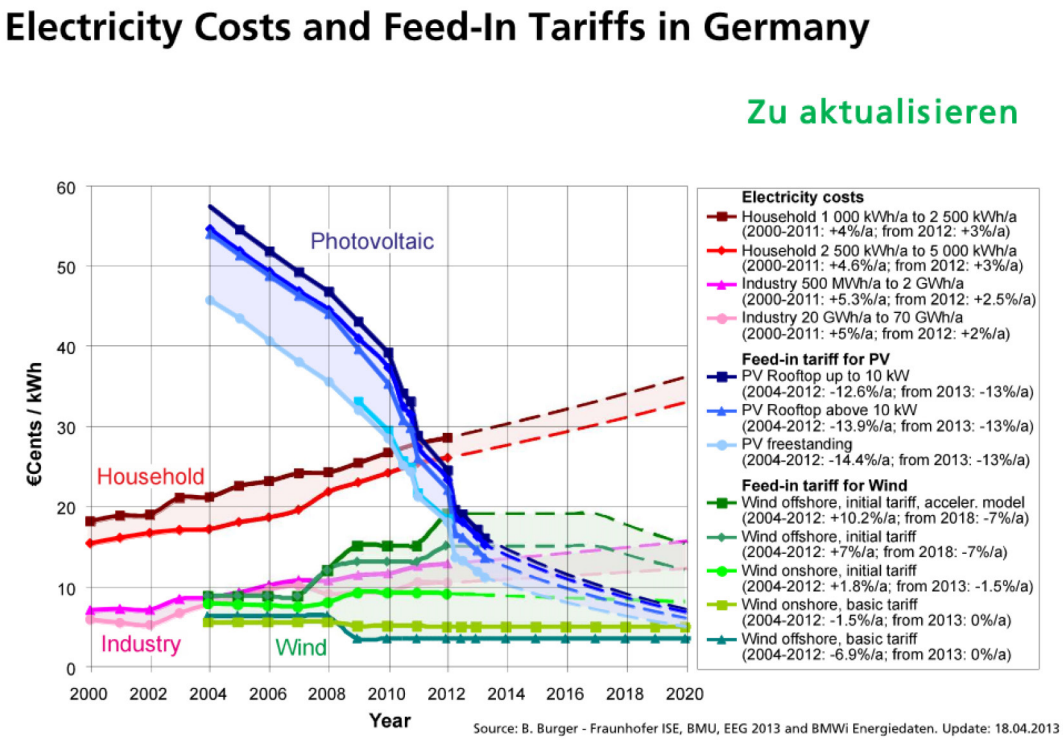
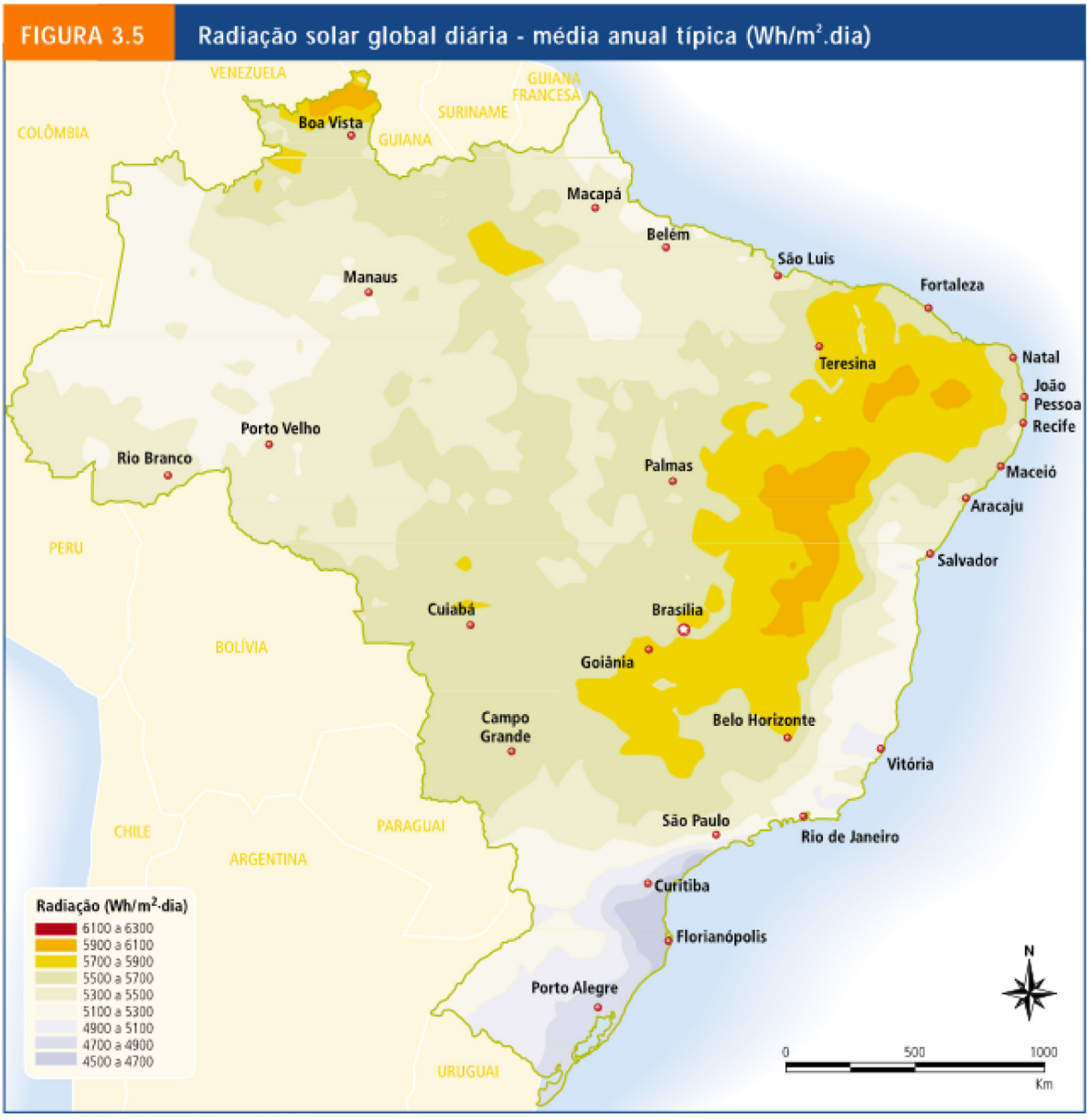


Image 3 – Brazilian daily solar radiation[16]

14 C.f.:<http://www.iea.org/publications/freepublications/publication/solar_energy_perspectives2011.pdf>. Access in: 28 jun. 2015. p. 70-71.

15 PHOTOVOLTAICS REPORT. Fraunhofer institute for solar energy systems ISE. Freiburg. 2014. p.37.

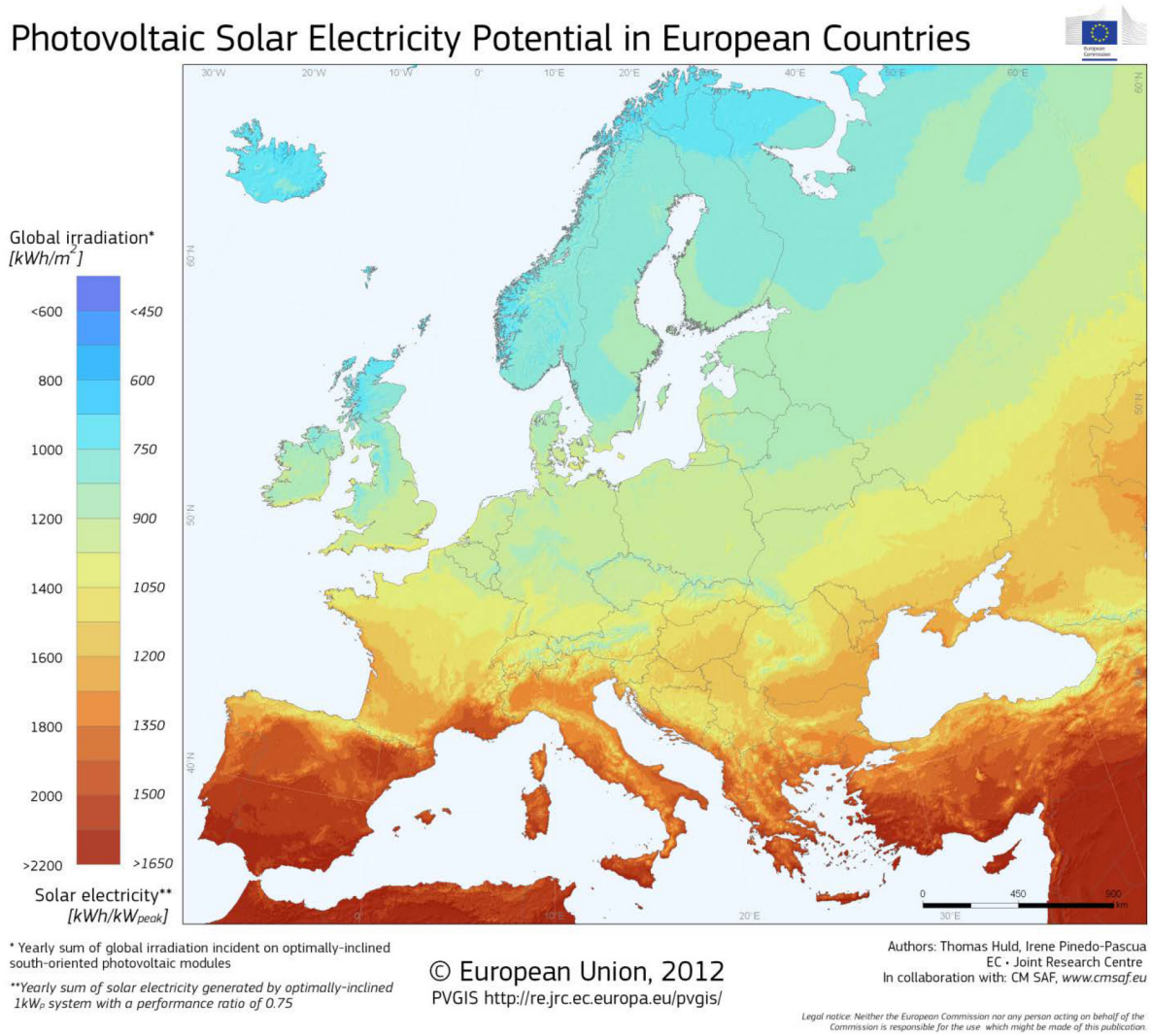
16 ATLAS de irradiação solar no Brasil. Ano. Disponível em: <http://www2.aneel.gov.br/aplicacoes/atlas/energia_solar/3_3.htm>. Acesso em: 20 set. 2016.



Fonte: ATLAS de Irradiação Solar no Brasil. 1998 (adaptado).

Image 4 – PV electricity potential in european countries[17]

17 JOINT RESEARCH CENTRE. Institute for Energy and Transport. *Photovoltaic Geographical Information System*. Available in: <http://re.jrc.ec.europa.eu/pvgis/cmaps/eur_old.htm>. Access in: 25 sep. 2016.



In this way the costs of the policy will be the money spent by the government in subsidies; the advertisement and training (agents, businessmen and tax collectors). All these costs can be monetized by simple metrics with projections and benchmarks of previous programs.

The benefits will be the diminishment of carbon emission; less direct investment in building new power plants; less dependence in the grid; less economic damages related to blackouts and natural disasters; better quality of air and less respiratory diseases. The carbon emission can be monetized by the carbon credits value. The investment in building new power plants can be a metric of the new need, 3.5% a-year, and the cost in the long term of the construction diminished by the energy saved. The dependence and the losses due to blackouts and disasters can be measured in hours of productivity lost due to blackouts. And the quality of air and respiratory diseases can be measured by the number of people that goes to hospitals due to respiratory problems, especially in times that the air quality of air is poor, times the cost of treatment and days out of work.

3.3. Political feasibility

The politics behind the policy proposed is an "interest group politics". That is why we need to subsidize the acquisition of the panels, to minimize the costs for the final consumers. A rational actor only will buy the PV panel when: Up = a+ B*(k-1) – c > Unp = B*(k-1) – p. Here the cost of participating is really big,

because the consumer will have to buy the PV panel, with a big cost. The personal benefit is low, because he will keep having energy. The punishment will only happen if several blackouts or energy savings start to occur, but it is not likely to happen soon, and the air quality. The benefit of a better quality of air and life is really big, however everybody has to participate otherwise no improvement will happen.

In this way, the government should act to minimize the costs and to advertise showing that everybody has to act to improve the air quality for this and future generations.

This policy will have some pro-groups that include environmentalists, politics and NGOs. It will have not many groups contrary, if any. The energy supply is a monopoly. Each State gives a concession to a single company (usually a state owned company), that provide energy to the whole state. Since the investment in new power plants is really big and the environmental issues involved usually postpone the construction in several years it seems that they will not oppose to the construction, moreover the demand will increase 3.5% a-year, in average.

The real problem to make it feasible is convince the final consumer to join and buy the PV panel.

Frame 1 – **Policy Outlook Policy Outlook**

Policy	Expected Outcome	Costs	Benefits	Positive Externalities
Market subsidies	Diminish prices to consumers	Money	Lower prices	Create a new demand incentivizing the economy
Consumers subsidies	More PV's sold	Money, governmental banks will have to devote people and lose profits	Less dependence in the grid, less economic losses due to blackouts	Better quality of air and life
Factory subsidies	Long term price diminishment	Money, time to bids and road shows	Lower prices	New jobs, market competition

Frame 2 – **Distributive Politics Spreadsheet**

Pro Groups	Substitutes	Group Mag	Mag Per Capita	Size	Coverage	Political Resources	Cost of Organization	Expected Impact
Politics	Votes/ Power	Big	Big	Big	Big	Money/ Lobby	Low	Big
NGO	Public Opinion	Small	Big	Big	Medium	Money/ Lobby	Low	Low
Environmentalists	Public Opinion	Small	Big	Small	Small	Influence	Low	Low

Con Groups	Substitutes	Group Mag	Mag Per Capita	Size	Coverage	Political Resources	Cost of Organization	Expected Impact
Energy Concessionaries	Power	Small	Small	Small	Big	Money/ Lobby	Low	Low

4. Implementation:

Inputs

The main inputs will be: i) governmental money; iii) time agencies` staff and governmental planners; and iii) governmental banks.

The government will need to spend money to provide the subsidies and will loose the collectable money from taxes and to advertise. Time from the staff to be trained and to think on strategies to best reach the goals. The governmental banks are already established and will help to provide the loans.

Activities

The main actions will be: i) create the credit lines; ii) hire advertisement companies and publish the advertisement in all media explaining the advantages of the PV panels; iii) provide training to agencies` staff to answer questions; iv) provide training to agencies` staff related to the tax collection to help in the implementation; v) rounds of training to retail sellers to explain the importance of selling PV panels; vi) national and international rounds of business to attract investors to build the new plants.

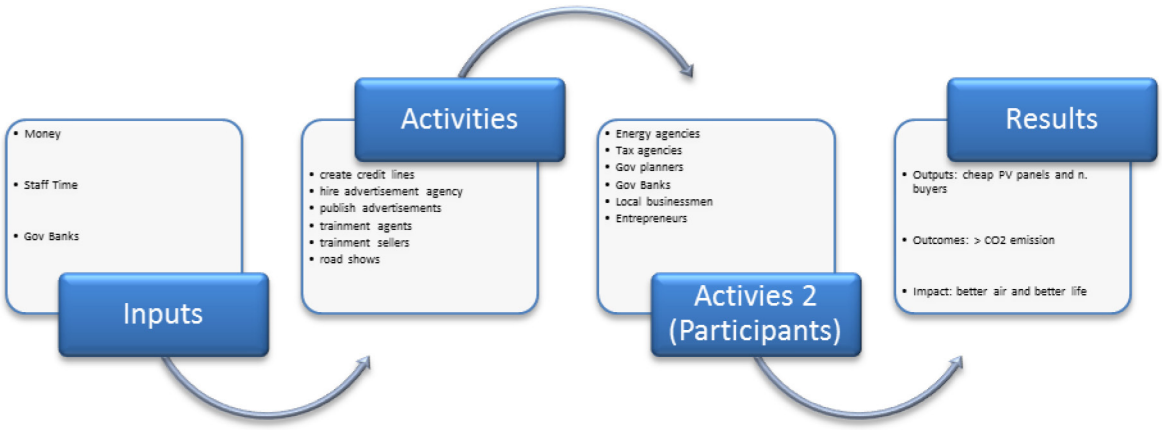
The main participants will be: i) energy agencies; ii) tax agencies; iii) governmental planners; iv) governmental banks; v) local businessmen; vi) entrepreneurs.

Results

Outputs: affordable PV panel and number of people that buy PV panels.

Outcomes: decrease in CO2 emission

Impact: increase in air quality and human quality of life.



5. Final conclusions

The national need of energy will grow in the next 15 years and we can clearly see a gap between the need and the actual and projected generation. The gap can be filled with an eco-friendly solution. The costs, time and environmental problems of the traditional matrices is huge. The costs for consumers of having a solar panel in theirs rooftops are diminishing every year around the world and we have good experiences, especially in Germany, that can be incorporated to Brazil. The Brazilian weather is more than appropriate for the initiative. The timing is perfect, and the policy should face no political opposition, unlikely what happen in other countries as United States.

We showed that adopting the public policy is feasible, the next steps should be convince the local authorities to launch the national project and follow the proposed implementation steps described. The actions taken now can make a difference to this and future generations.

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