

Proposal for Policies and Practices for the Appropriate Disposal of Photovoltaic Residue in Brazil



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Overview

During their lifetime, solar panels do not cause significant environmental impacts, but their production and final disposal can be environmentally harmful. Therefore, the expansion of the photovoltaic market should be associated with national legislation on environmental security. This study shows that solar panels' life cycle can be damaging and hazardous to the natural environment. European practices to reduce environmental damage are also exposed and used as an example to propose measures for Brazil. This proposal aims not only to increase the level of implementation of the National Solid Waste Plan for electronic waste, but also to include photovoltaic panels in the classification of special waste. This will ensure that the involved market prepares itself for the end life of the panels, preventing problems with photovoltaic waste in the future.

Abbreviations: GGE: Greenhouse Gases; WEEE: Waste Electrical and Electronic Equipment Directive; IBAMA: Brazilian Institute of Environment and Natural Resources; INMETRO: National Institute of Metrology, Quality and Technology

Methodology

A literature review was carried firstly to report the emission levels of Greenhouse Gases (GGE) during the lifecycle of photovoltaic panels. This research was followed by an investigation in the international literature about the countries that already face the end life photovoltaic problem. Then, the available photovoltaic panel recycling processes were analysed, as well as the waste policies adopted by the respective countries. Finally, it was inquired which actions the Brazilian government are already adopting to solve this problem, then new policies, based on the international experiences reported, are proposed. This problem, still of low constancy in Brazil, should be foreseen.

Search Results

During its operation lifetime - variable according to the manufacturer-, a photovoltaic panel does not emit GEEs. However, during its life cycle there are several environmental impact such as emissions during the mining of the semiconductor material, the purification of the same, the manufacture of both the cells and the panels and the transportation stages involved [1]. Moreover, the large impact of discarding the panel, once they

reach the end of their lifetime (currently 30 years on average), must be considered.

In many countries, solar energy has been largely explored in the last few decades. Therefore, these countries are already facing the photovoltaic waste problems and looking for solutions to deal with them, leading to the development of the first legal document on photovoltaic panels, in Europe. Classified as special electro-electronic waste, photovoltaic modules were included in the Waste Electrical and Electronic Equipment Directive (WEEE) in July 2012 in the Official Journal of the European Union [2]. This directive states that: the manufacturer is obliged to pay for the disposal operations; the consumer must be informed of the facilities for the treatment of product composition and disposal; it is illegal to export photovoltaic waste to underdeveloped countries; uninstal the panels so they are classified as a residual product; the cost of waste management, including transport; manufacturers have to take responsibility for recycling modules according to their market share; and modules made by manufacturers that have already left the market should become the responsibility of the existing ones. The implementation

is done in accordance with the laws and sovereignty of each country.

Brazil already faces the problem of disposal and destination of electrical and electronic waste. About 2.6 kg per year of this waste is generated per inhabitant Governo Federal Brasileiro, 2012. Electronic waste is considered by Brazilian law as special after-consumption and is thus subject to the regime of shared responsibility for the product lifecycle (art.33 da Law n^o 12305/2010). This fact has raised civil society and government awareness, due to the mass generation of waste and its environmentally inappropriate disposal. However, the level of implementation of the plan is still very low and it depends on agreements with the manufacturers of electrical and electronic products. In order to reverse this scenario, the sectoral agreements process needs to be streamlined. In addition, photovoltaic panels are not yet characterized as electro-electronic waste.

Final Considerations

As much as the solar panel is considered a product of a technology that represents a major breakthrough in the transition to sustainable paradigm, its life cycle needs to be properly planned to guarantee it does not become a false solution. Especially in Brazil, where the Government waits a large growth of this source in energy mix, this problem is very relevant. The civil society recognition of the risk introduced by photovoltaic waste's bad management requires the careful evaluation of human activities, so the necessary changes can be provided in advance to ensure the quality of life in an ecologically balanced environment (Article 225 Constitution of the Republic).

Therefore, it is necessary to be made, together with the expansion of the solar panel market, sectoral agreements for the special disposal of photovoltaic waste. It is also necessary

to predict the final destination of these photovoltaic plates and to prioritize the importation of solar panels of companies compromised in producing a suitable design for easy disassembly and recycling, so that the photovoltaic residues will, in the future, become new solar panels. In Brazil, there are already assembly plants of the panels and the national legislation has to ensure that these factories are responsible for the collection and proper disposal of the plates after the end of their useful life, as in Germany.

The Brazilian Institute of Environment and Natural Resources (IBAMA) could be the body responsible for overseeing the implementation of this law. However, it is also recommended that each municipality is committed to supervise the way the waste is disposed of. Another way of acting could be through an evolution of the competencies of the National Institute of Metrology, Quality and Technology (INMETRO) which, together with product regulation, could specify the materials and the form of manufacturing that generate less impact. In addition, this institute could also classify the type of waste products to unify the guidelines for the producer and the consumer, as environmental preservation ensures the well-being and health of the consumer [3,4].

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