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How Green Is Green Entrepreneurship? – the Paths and Pathways of Eco-Modernization in the Case of the Automotive Industry

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HOW GREEN IS GREEN ENTREPRENEURSHIP ? – THE PATHS AND PATHWAYS OF ECO-MODERNIZATION IN THE CASE OF THE AUTOMOTIVE INDUSTRY

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Abstract: *Environmental and social crises have put humans at the forefront of their entire developmental dilemma. How to survive on a limited planet with a growing population and declining livelihoods? The current neoliberal policy has not met people's expectations, neither on a social level or on an environmental level. Inequality in society is increasing, environmental problems continue and escalate and human-human conflicts and their nature deepen. Finding solutions to emerging problems for space is becoming a necessity for all living things on the planet. If we adopted the concept of sustainable development in the mid-1980s, we can summarize today that we have not reduced the problems but further deepened them. Just as in the case of sustainability, where there is ambiguity in the interpretation of the concept and precisely because of this realization of its goals in space, the concepts of green entrepreneurship and green capitalism must be considered constructively critical. The very concept of "green" does not yet mean a truly environmentally and socially successful transformation which will be presented below.*

Keywords*: environmental crises, neoliberal policy, sustainable development, green entrepreneurship*

Introduction

The concept of Green Entrepreneurship began to emerge in the so-called era of eco-capitalism when neoliberalism began to integrate the environment into its concepts due to the growing social crises caused by negative environmental impact[1]. For the beginning of sustainable development[2] we can look to the mid-1980s where it formed part of the conclusions of the Brundtland Commission[3] which, in the political field (UN), also advocated a more caring attitude towards the environment and society. In spite of the many positive stresses on society and the environment the idea of sustainable development in practice, due to the different interpretations of what social actors actually represent in society, did not come to fruition in a way that would reduce the pressure on the environment and society. The very fact that there was no unified concept of sustainable development led to the realization of an idea that in practice was not so successful despite high initial expectations. A step in the right direction is a comprehensive consideration of all segments and all factors in the field.

Today, the green economy could be a step in the right direction by linking it to the idea of a circular economy, which in the economies of developed EU countries currently, represents the fundamental emphasis of reducing greenhouse gas impacts and developing a carbon-free society of the future. Green economies thus formed may not only represent the potential for green, a more socially and environmentally sustainable development but also the potential to reduce social and environmental conflicts. A prerequisite for the successful green transformation of a neoliberal, economically social mindset is the comprehensive consideration of the positive and negative effects of measures to restructure the economy in practice.

The example of the car industry shows that in order for a true green breakthrough all segments in the development of electric cars need to be addressed. From sources for building batteries, technological systems and the energy used to convert substances into the elements needed to build batteries to aggregates, charging stations and producing green energy for charging stations to restructuring and transforming jobs of employees who are losing jobs as a result of switching to power units in the sector of classic diesel and petrol units. For true green production, the following areas and activities need to be considered in the automotive industry:

- Environmental impacts due to the extraction of (lithium) ore
- Base metal production for battery production, resources consumed, and conversion time
- Construction of batteries and their decomposition after use

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[1] Negative environmental influences can be defined as direct, occurring in space and indirect, and both as consequences of human anthropogenic influences.

[2] Sustainable development is interpreted differently by neoliberal theoretical economists and economists, than environmentalists. Economists as a continuation of consumerism, economists as a continuation of growth, and environmentalists reduce pressure on the environment, which in relation to the first two (economists) is a contradictory concept. Sustainable development for the first two actors is ultimately a continuation of growth and thus a burden on space and pressure on resources, for environmentalists it is the opposite, sustainable and extreme careful exploitation of natural resources and their exploitation, which should not exceed the self-renewal capacity of nature and the environment .

[3] Ms Gro Harlem Brundtland was a former Prime Minister of the Kingdom of Norway, a physician and member of the WHO, which, together with the Commission on Sustainable Development, formulated guidelines for sustainable development.

- Installation of additional power grids for charging electric batteries and their impact in space
- Efficiency of e cars in terms of greenhouse gas production compared to conventional units
- Generation of electricity from RES for the purposes of mobility
- Transformation of jobs to move to e-mobility (job loss)
- Exploitation of (human) resources in the production of base metals for batteries and
  the impact of multinationals on the exploitation of cheap labor (Žnidarič, 2018).

Environmental impacts from lithium ore excavation.
Given that by 2030 between 15 and 25 percent of cars will use electric propulsion and 75 to 90 percent will use lithium-ion batteries. This means that by the year 2030, between 65,000 and 145,000 tonnes of lithium carbonate will be need to be obtained to meet lithium requirements(Co Not, 2011). Lithium production itself is not yet a critical process. Mining and transportation potential being the main problem while intermediate chemical processes due to refining and lithium production do not pose any major risks for environmental impacts. Cobalt production, which is an indispensable element in battery production is extremely environmentally controversial. The problem is in the refining materials and refining of the ore (cobalt) itself where in addition to various acids (sulfuric and hydrochloric) chlorine, ammonia, hydrogen sulfide, sodium hydrogen sulfide, lime and the use of a lot of energy.

Base metal production for battery production, resources consumed, and conversion time
For 1 ton of lithium, we need 750 tonnes of lithium brine and 24 months to prepare (Battery UN, 2018). Recycling 20 t of lithium-ion batteries yields 1 t of lithium for further use, or 5.3 t of lithium carbonate for 1 t of lithium (121 Group). How much lithium is in individual batteries depends on the chemical structure and of course the size of the battery in kWh. On average, the amount of lithium in a battery varies between 150 and 300 grams. If the battery is 100 kWh, this amounts to between 15 and 300 kg of lithium for a car (Vitas, 2016). Lithium-ion batteries contain in addition to lithium, which is not a dominant element in batteries at all, the following metals, whose production is, as previously mentioned, more environmentally controversial and harmful (Žnidarič, D.; Senegačnik, M.; Vuk, D. 2018).

Table 1: Lists the metals and their values used in batteries.

Metals and batteries	Quantity in mg / kg
Aluminum	195,000
Cobalt	124,000
Baker	104,000
Lithium	18,000
Nickel	13,000
Iron	4,700
Manganese	1,700

Barium	1,200
Lead	300
Thallium	180
Zinc	160
Antimony	80
Chrome	30
Silver	30
Vanadium	20

Source: Hsing Po Kang D. Environ. Sci. Technol. (2013) v Huš, 2016

In the initial phase of building batteries for e-cars in the production of the necessary metals (15 metals) and technologies themselves compared to conventional diesel gasoline units more than two-thirds (74%) of CO_2 is released on 500 kg batteries which is more than would be generated by the production of more efficient classic cars using fossil fuels (Enavex, 2017; Battery University, 2018). The fact that this data shows is that the production of batteries for electric cars is not as green as that shown by supporters of current electric cars. Just to compare, the owner of an average classic car could travel 50,000 km before equaling the release of an electric Nissan Leaf with a 30 kWh battery. It should be noted that the Nissan battery is one of the smallest on the market, as the BMW i3 has a 42 kWh battery, the Mercedes EQC 80 kWh and the Audi e-tron 95 kWh (Rolander. N; Starn.J; Behrmann. E, 2018). The International Organization for Cleaner Transport (ICCT, 2018) states that between 56 and 494 kg of CO_2 are released for the production of batteries for each kilowatt hour or battery capacity (kg CO_2 / kWh). It accounts for an additional 1-2 g CO_2 per kilometer per kWh of battery (ICCT, 2018).

Installation of additional energy networks for charging electric batteries and their impact in space

Existing electricity grids are already on the verge of capacity even in some so-called developed countries. The Energy Concept Strategy in Slovenia envisages achieving 100% e mobility in the public and private transport sectors by 2055. Bold plans that collide with the problems of worn out and congested transmission systems, and especially the lack of green electricity (Agencija za energijo, 2017). For the needs of mobility, the construction of charging stations is needed, which can be an additional problem in larger cities due to space constraints (Etrel; Polni si, 2018).

The problem is also individual deficient parking / filling sites, which are not constructed for additional electric consumption (Schrak, 2018). All of these problems represent an additional logistical, charging problem if we want to successfully move to a fully electric automotive section (Elektro Ljubljana, 2019).

Generation of electricity from RER[4] for mobility purposes

For the sake of e-mobility and more efficient use of energy or if we are to meet the country's 100% eligibility criteria for e-mobility and heating we would need to double our electricity production. From today 10 TWh (produced in Slovenia), we would need an additional 10 TWh. (Žnidarič; Valenčič, 2018). For green mobility, it should be produced from RER. Therefore, an appropriate energy strategy is needed at the level of countries

[4] RER is shortly Renewable Energy Resources

and local communities that are moving towards the maximum use of RER (Žnidarič, Valenčič, 2018). At the moment almost all energy for charging batteries in electric cars come from fossil fuels. Because of this fact we cannot speak of green mobility.

Efficiency of e cars in terms of greenhouse gas production compared to conventional units

Compared to the most efficient internal combustion engine vehicle, a typical electric car in Europe produces 29% less greenhouse gas emissions. If classic cars in Europe produce 260 (g / km) CO_2 and economical 180 units, the average of electric cars in Europe is 130 g / km CO_2. Among the most economical in Europe are Norwegians with 70 g / km CO_2, followed by the French with 80 g / km CO_2. While in Germany they produce about 180 g / km of CO_2 (ACEA, 2017).

Transformation of jobs to move to e-mobility (job loss)

The European car industry employs 2.6 million people directly, indirectly providing 14 million more jobs in other industries (Najdi si, 2019).

In Germany, the EU's largest employer of workers in the automotive industry (840,000), according to the Fraunhofer Institute of Engineering in 2018 (MMC RTV, 2018) due to the increasing "need" of electric cars there will be at risk among 75 and 100 thousand jobs in the "classic" car industry.

Firstly the "classic" automotive industry takes 30% more time to produce conventional gasoline and diesel vehicles than electric vehicles because the e cars have fewer mechanical parts and assemblies (only one-sixth of all compared to internal combustion engines). Therefore, the IG Metall union predicts that by 2030, e-mobility will directly or indirectly affect every second working job in the production of powertrains. Individual manufacturers in the automotive industry believe that the ratio of job losses to jobs created by e-mobility may be 1: 5 to the detriment of employees in the "classic" automotive industry.

Given that this is a low and medium skilled workforce (installers, mechanics, etc.) and if only one-fifth of the current workers are potentially made redundant the number of direct and indirect redundancies will be 2.8 million employers who must then find new jobs. Therefore it is also necessary to think about the retraining of redundant workers otherwise there will be additional social problems.

Exploitation of (human) resources in the production of base metals for batteries and the impact of multinationals on the exploitation of cheap labor

Almost 50 per cent of all cobalt which is important in the car batteries production is produced in the Democratic Republic of the Congo (DRC) where the minerals cobaltite (CoAsS), erythrite (Co_3 (AsO_4) 2 • 8 H_2O) and scooterudite ($CoAs_3$) are mined. Amnesty International has publicly exposed the exploitation of children who work in cobalt mines in the DRC where more than 40,000 children are expected to work for $ 2 a day without adequate protective equipment in inhumane conditions for more than 12 hours each day. The refined cobalt ore is shipped to China where it is processed into a suitable raw material for battery production. Many corporations exploit social and economical inequality of undeveloped countries for making profits.This exploitation leads to degraded or destroyed areas and even greater social inequality.

For example in Africa there are many resources owned by foreigners, most of all by Chinese companies, which in a very sophisticated way[5] get the necessary resources for their own industry. China invested about 125 billions of US dollars in to the Africa.

[5] Chinese companies provide loans that most of the impoverished countries are unable to repay. So in a different way than the USA (with wars-Irak) the Chinese are looking for an easy way to find the necessary resources.

Conclusion

Generally electric vehicles tend to have much lower life cycle greenhouse gas emissions than cars with conventional diesel gasoline units (in Europe) even taking in to account the fact that CO_2 emissions in the production of batteries are higher than in conventional units (diesel, gasoline batteries). The average electric vehicle in Europe produces 50% less greenhouse gas over the life cycle of the first 150,000 kilometers although the relative benefit ranges from 28% to 72% depending on local electricity production. The fundamental problem, or criticism, applies to all other segments of the automotive industry that do not meet the green standards of sustainable and environmentally orientated activities.

In the production of electricity for recharging batteries in e-cars the main focus is still on fossil fuels or energy from nuclear power plants which have been proven to be harmful to the environment and society. The first is due to the increasing consequences of their use in the environment, dust and particles in soil, generally because of air pollution, the second is due to nuclear waste for which we have not yet found suitable solutions.

There is also the concern that some minerals are extracted by children and workers without adequate protective equipment. They are also not adequately compensated for their work. This is a problem not only in mining activities but also chemical processes at extraction of metals which can cause additional devastated and contaminated areas.
All these processes, mining, chemical and logistical, have a negative impact on the environment and humans. The attitude of corporations the largest consumers of metal for the production of batteries is also inappropriate since they exploit the social crises of the mining countries and thus deepen not only the environmental but also the social and economical crisis. Corporations neglect the environmental and social consequences of exploitation in order to maximize profits. Most of the time, they are left with even greater environmental and social problems as are most who operate on the NIMBY[6] principle.

Solutions are possible only by reducing the use of resources, optimizing business, working and industrial processes and the reduction of personal consumption. Only with full consideration of all factors can we approach the fundamental purpose of green transformation, our survival on planet Earth. Modern technology together with IT technology, knowledge and human capabilities, today enables us to find the best-optimal solutions which without expressed political will cannot be implemented in life without change. The automotive industry is a segment where I wanted to show the positive and negative sides of "green technologies" that are often (un) intentionally overlooked.

[6] NIMBY is a synonym for Not In My Back Yard

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