

# The Green Energy Transition and Energy Security in Mexico, 1980–2016 Expansion and Intensification of Extractivism<sup>1,2</sup>

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## Abstract

This essay shows the difficulties and contradictory processes to achieve energy security by transitioning towards a new and secure energy system with a lower share of fossil fuels with far-reaching political, economic, and effects not sufficiently analyzed. The energy transition entails privatizing wind, sun, water, and land to transform them into electricity; additionally, it implies the consumption of minerals, which will expand extractivism. The paper points out Mexico's slow progress in green energy with two purposely designed energy indices: Energy Diversification Index EDI and the Energy Transition Index ETI. It points out the structural limits of the energy transition in this oil-rich country and, in general, for most resource-rich countries. Finally, it presents some policy options for reducing the effects of energy extractivism and the transition to environmentally and socially secure and equitable energy.

**Keywords:** *Mexico, energy transition, energy security, extractivism*

**Jel Codes:** *P18, P48, Q47*

## Meksika'da Yeşil Ekonomi Dönüşümü ve Enerji Güvenliği 1980-2016: Ekstraktivizmin Yoğunlaşması ve Genişlemesi

### Öz

Bu çalışma, etkileri yeterli şekilde analiz edilmemiş ve iktisadi ve politik etki alanı geniş olan, daha düşük fosil yakıt içeren güvenli ve yeni bir enerji sistemine direkt olarak geçişte enerji güvenliğine erişmenin zorlu ve çelişkili sürecini sunuyor. Enerji dönüşümü kavramı, rüzgâr, güneş, su ve toprağın elektrığe dönüştürülmesi için özelleştirilmesi anlamına gelir; ek olarak, ekstraktivizmi genişletecek mineral tüketimini kasteder. Makale, kasti olarak tasarlanmış iki enerji politikası Enerji Çeşitlendirme Endeksi (EDI) ve Enerji Geçiş Endeksi'ni (ETI) kullanarak Meksika'nın yeşil enerjideki yavaş ilerleyişine dikkat çekiyor. Petrol zengini Meksika ve genel olarak kaynak zengini ülkelerdeki enerji dönüşümünün yapısal sınırlarına işaret ediyor. Son olarak, enerji ekstraktivizminin etkilerini azaltacak ve sosyal ve çevresel olarak daha güvenli ve eşit enerjiye dönüşümü sağlayacak çeşitli politika önerileri sunuyor.

**Anahtar Kelimeler:** *Meksika, enerji dönüşümü, enerji güvenliği, ekstraktivizm*

**Jel Kodları:** *P18, P48, Q47*

- 1 This essay is based and expands Puyana and Rodríguez (2022 under peer review) "The Green Energy Transition. Expansion and Intensification of Extractivism".
- 2 The authors thank the very important comments and suggestions of two anonymous reviewers. The errors are the exclusive responsibility of the authors.

## 1. Introduction

Energy transition and energy security mark the passage from energies based on fossil resources, coal, oil and, gas, to hydroelectric, wind, solar, and nuclear energies. Both involve intense extraction and use of natural resources, leading to environmental damage and complex social effects, which current energy security policies ignore, hide or silently accept

In effect, energy security and energy transition policies expand extractivism by transforming natural resources such as sun, wind, water and land into “natural capital” to commodify them into electricity to reap rents from their sale on domestic and foreign markets. On top of that, low-emission technologies will multiply the demand for the required critical minerals and metals. So, commodification of natural resources and the ecosystem and opening them to the financial capital is the newest form of the expropriation and privatization of nature, a process legitimized as the only way to combat climate change and preserve life on earth (Foster, 2022). As predicated today, energy security and energy transition policies constitute the only alternative to curb climate change and avoid a global catastrophe. Therefore, the commodification of nature constitutes an imperative of obligatory character. It is a new form of capital accumulation worth four thousand trillions dollars, according to the *Intrinsic Exchange Group* (cited by Foster op cit.)

When, in 1974, energy security became a global concern, oil was the most important source of energy, the reason why the 20th century was known as the oil civilization (Lord, D. 2010). Reducing the burden of crude oil in the economy involved a wide range of internationally adopted policies to be translated into a full range of slow to come to fruition and difficult to assess, national plans, programs and measures. I involved a long and complex process of negotiation and implementation of the agreements, affecting multiple spheres of a country's economy and the livelihoods and interests of its inhabitants. Continuous and unpredictable technological transformation and concerns about climate change add further snags and reasons to conceptualize energy security more holistically and question the positive and negative effects of green energies, and ponder how green the green energy really are.

No less complex is extractivism itself, which evolves with technological change, economic growth, productive social structures, and intermediate and final levels of demand. In this paper, extractivism means the exhaustive exploitation and intensive use of raw materials, aiming to extract profits from the intensive use of that resource, either for export with little or no transformation, or for consumption in the domestic market. As such, the use of the air, sun, or water for power generation and as an input in the entire domestic or foreign production chain is considered extractive activity which includes tourism, agricultural plantations of coffee, sugar cane, tea, forestry, among others (Puyana, 2017; Myint, 1958;).

The energy transition, as the route to energy security, creates new bases of natural resource rents by privatizing public goods the sun, the air, the water, and areas of land that are public goods, not created by human agency, to convert them into electricity for the domestic electricity market. The resulting profits are captured by the owners of the capital, which itself is highly concentrated. The concentration of capital in a profit-seeking activity implies the same concentration of income and raises social inequality (Melville H. et al., 1963). The new energies are as, or more, intensive than the traditional ones in terms of technology and foreign investments, from which they earn profits that absorb practically all the produced rents. In the case of fossil fuels and hydroelectricity, profits are captured by the governments of the producing countries and the oil multinationals, whereas in the case of new energies, the private sector, domestic and foreign, captures the main share of rents. The close connection between the economic cycles of countries specializing in raw materials and energy and these prices leads to economic instability and political conflicts over the distribution of the benefits and costs of the transition.

Despite the push towards Energy Transition, by the 2050s, oil and hydrocarbons are still expected to contribute a majority proportion of the energy mix, due to their lower relative costs and higher energy content compared to green energies. This is why they continue to outperform hydroelectric, wind, solar, nuclear, and plant-based energy, despite the significant reduction in production costs achieved by the latter in the past two decades. Another aspect to consider is the political character of energy security and the energy transition, as shown by the turnaround in President Obama's environmental policies, President Trump's denial of climate change, and Biden's reassertion of the US commitment to the Kyoto protocol, swings that occur when the party in power is replaced. Biden's campaign and early government decisions were put by the inflation pressures resulting from the economic recovery and the economic sanctions against Russia for the Crimean war (Davenport, C, 2022). Indeed, since 1974 the incentives to substitute oil suggest that domestic, partisan and personal interests set the tone for the energy policy of the United States and, in general, of any country, as may be deduced from the environmentalist and productive policy of President Biden (Puyana and Romero, 2022). Energy security involves growing tensions between domestic and international interest groups, involving hegemony and geopolitics, which are not always made explicit in negotiations or debates. The ongoing Ukrainian conflict puts oil and gas's strategic, and geopolitical relevance. It reveals also how fast energy and climate change concerns are replaced by national security and political hegemony

strategies, with calls to immediately increase oil and gas production and to invest in oil and gas, exploration and development activities.

Energy security and energy transition policies, adopted in February 1974, mandated: 1) to diversify the oil markets with new suppliers, domestic and foreign, to limit imports from OPEC; 2) to promote other sources of energy: coal, gas, and nuclear energy; 3) to reduce energy consumption and the energy intensity of the national economy; 4) to promote renewable energies: mainly wind, solar, and hydroelectric. This step was added in the 1990 decade. The effects of this strategy are multiple. It reduces the production and sale of oil, the income of the oil companies and of the governments whose treasuries depend on them to a greater or lesser extent. It creates macro and micro economic imbalances that require mediating policies to reduce spending, raise taxes, or create new sources of revenue. While governments offer incentives for new energies, subsidies for consumers, and restructure spending and income policies, multinationals are attempting strategic changes. For example, Aramco, the Saudi Arabian oil company, has begun a discreet strategy of diversifying its energy supply with external sales of electricity, building solar parks, while British Petroleum and Shell venture into biomass and wind power and several others announce targets of zero carbon emissions by 2050. Latin American oil companies, focused on improving oil production technology, are making little progress in the energy transition.

After this introduction, the paper is organized as follows. The first section deals with the relationship between energy security and the energy transition in the current context. It identifies different transitions, all of them complex and challenging to solve. This section also explores the characteristics of extractivism and suggests that the energy transition opens up new sites of extractivism and sources of extractive rents. The second section explores the trajectory of energy security and the energy transition in Mexico from 1980 to 2019. The analysis of the evolution of these two indicators is carried out through the formulation of two indexes purpose-designed for this paper. The third section presents the conclusions.

### **1.1. Energy security, energy transition and extractivism, resource rents and the slow pace of energy change.**

The first energy security and energy transition policies, adopted in February 1974, mandated the following: 1) diversify the oil markets with new suppliers, domestic and foreign, to limit imports from OPEC; 2) promote other sources of energy: coal, gas and nuclear energy; 3) reduce energy consumption and the energy intensity of the national economy; 4) beginning in the 1990s, promoting renewable energies: mainly wind, solar, and hydroelectric.

The connection of oil, energy security and energy transition with extractivism emerges from the exploitation of natural resources such as coal, gas, oil, water, sun, wind, and land, which are the resource base of transition energy foundations. These natural resources are privatized and transformed into fuels and electricity for sale in foreign and domestic

markets. Converting corn and other agricultural products into ethane implies switching agricultural production from food to fuel, a transformation of questionable ethics since it pits the population in competition with cars at a time when two billion people worldwide suffer from acute and severe malnutrition. These extractions (Gudynas, 2013) involve the sometimes violent appropriation of natural resources owned by the nation and deny the rights of whole populations and generations and of nature, in low, medium or high-intensity exploitation, destined for the local, national or foreign markets (Gudynas, 2013). In general, these types of activities refuse to recognize that the earth is the basic sustenance of human life, which is why the constitutions of Ecuador and Bolivia enshrine these rights, integrating them with human rights. Article 71 of the Ecuadorian Charter of 2008, establishes that nature (Pacha Mama) allows the “...realization and reproduction of life and has the right to full respect for its existence and the maintenance and regeneration of its vital cycles, structure, functions and evolutionary processes” (Bagni, 2018: 3).

Wind, solar, hydroelectric, and plant-based power generation have very close political, economic, and social effects as mining and fossil fuel extractivism: price instability; deindustrialization and de-agriculturalization; high technological intensity, boundless concentration of both capital and discriminatory distribution of income; they are *focal points* for social and political conflicts, land dispossession and violation of the human rights of indigenous and peasant communities (Puyana, 2015; Svampa M., 2019; Gudynas 2007; Pineault, E. 2020). The exploitation of land, a good not produced by human agency, generates rents that grow *pari passu* with the population, food demand, economic development, and changes in consumption patterns due to higher GDP per capita. The interest in maintaining this rent induces economy’s dependence of the on price cycles and perpetuates the pattern of development and the rent-seeking structures of the state and society. (Karl, 1999). Oil rent revenues are high due to the diversity of oil wells, in terms of both size and qualities of crude oil, the concentration of reserves and production, and the strategic nature of crude oil, resulting in a non-competitive international market.<sup>3</sup> Agricultural land is less concentrated than oil, but not so agricultural technology, or productive and commercial capital, which leads to similar patterns in production and the distribution and appropriation of rent, creating costly barriers to entry. On the other hand, the land differs in physical and chemical qualities and yields, giving rise to agricultural rents. In short, the link between great income from raw materials and the economies of exporting countries is direct and mediated by various political and social factors (Puyana and Rodríguez 2021; Puyana, 2015; Karl, 1997).

Economic shocks due to price surges of raw materials and the concomitant increases of income of the owners of these resources, are one of the well-known effects of extractivism, leading to premature decline in agriculture and manufacturing in terms of GDP and employment; slow growth in labor productivity; increased precariousness of jobs and

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3 Even if the quality and production costs of oil from Cantarell in Mexico and from Cusiana and Cupigagua, in Colombia, were identical, the transportation costs vary greatly: While Cantarell is adjacent to a port, the Colombian fields are more than 4,000 kilometers away, through mountainous terrain.

remuneration and increasing income concentration, (Prebisch, 1948; Furtado, 1973; (Puyana, 2017). Out of this distributive path emerges on the one hand elites who benefit from the dynamism of the booming energy sector, and on the other masses of underemployed, unskilled workers (Svampa, M., 2019). It is possible that the dependence of the exporting countries on agricultural raw materials is less than that of the oil producers, and that their economies, foreign investment flows and inflation are less exposed to price variations, but the effects indicated do occur (Karl, 1997). (Puyana 2015; Furtado, 1982)

While the impact of fossil fuels on global warming is clear, the path to de-fossilization of economies is hazy, with no consensus on whether the correct path is to reduce emissions or leave fossil fuels in the ground, whether to slow down economies and whether or not gas counts as transition energy for the short or long term or as a green energy. According with Breton, the French Commissioner to the European Union, ...gas is not the best way to achieve our goals (reducing emissions and preventing global warming) because it generates CO<sub>2</sub>, but as transition energy it is better than coal... It is necessary to have the financial resources to decarbonize the economy and a more scientific taxonomy of energy sources, including nuclear (Khan, 2022). Clear disqualification of the European Union, classifies gas as a green energy (European Union, 2022).<sup>4</sup> Breton's strategy would impose high costs on the global and North American energy system, which is dependent on oil and gas (see Tables No. 1 and 2). On the other hand, by 2050 one-third of the amount of fossil fuels will be consumed compared to 2019.

Over the years elapsed from 1974 to 2020 and the international agreements put in place, few achievements have been recorded in the energy transition, with hydrocarbons still contributing 80.7% of the world's primary energy. This represents a decrease of 13.4 percentage points over 50 years, and a further decrease of 11 points is expected by 2050, with oil providing about 30% of the world's primary energy at that point (see Table 1). The transformation of the energy mix is far from the goals suggested by the most recent report of the Intergovernmental Panel on Climate Change (IPCC), which states that only one of the five feasible strategies would succeed in containing global warming below 1.5 degrees Celsius (IPCC, 2021). This route implies abandoning the growth model based on fossil fuels, the intensive use of raw materials, and extractivism. Latin America is far from taking this route, as explained later on.

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4 Taxonomy refers to the classification of economic activities according to environmental sustainability criteria to guide investments, according to the European Green Deal, see European Union (2022).

**Table 1.** Global demand for primary energy. 1949-2050. Percent share

Source	1950	1970	1980	1990	2010	2020	2030	2040	2050	1950-2020
Oil	38.5	47.01	45.1	38.5	33.7	30.3	30.6	29.1	28.1	-0.2
Gas	17.2	16.96	18.4	21.2	22.6	24.5	23.6	22.4	21.8	0.4
Carbon	35.7	30.1	26.9	27.1	29.9	25.9	22.1	21.2	19.9	-0.3
<b>TOTAL FOSSILS</b>	<b>91.4</b>	<b>94.07</b>	<b>90.4</b>	<b>86.8</b>	<b>86.2</b>	<b>80.7</b>	<b>76.3</b>	<b>72.7</b>	<b>69.8</b>	<b>-0.1</b>
Nuclear	0	0.36	2.5	5.8	5.2	4.6	4.5	4.2	3.7	4.6
Other renewables	8.6	5.54	7.1	7.4	8.6	14.7	19.2	23.1	26.5	0.7
<b>TOTAL RENEWABLES</b>	<b>8.6</b>	<b>5.9</b>	<b>9.6</b>	<b>13.2</b>	<b>13.8</b>	<b>19.3</b>	<b>23.7</b>	<b>27.3</b>	<b>30.2</b>	<b>1.2</b>
<b>GRAND TOTAL</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	

**Source:** Prepared by the author, based on: IEA (2021a y 2021b)

The relatively limited decrease in the share of fossil fuels in the energy mix arises from offsetting this reduction with greater consumption of gas, fossil fuel, and significant emitter of CO<sub>2</sub>. The slow growth of renewable energies, in the face of a high expansion in demand, opens up spaces for fossil fuels, whose lower production costs and higher energy content per unit of weight are substantial competitive advantages. This factor has led to the search for technologies to reduce CO<sub>2</sub> emissions from coal, oil, and gas, such as carbon capture, the carbon credit market, or electric cars, microchips and other intermediate and final goods, the production of which, in the scenario that the IEA calls sustainable, would raise the demand for various metals, minerals and rare earths by up to 2.8 times. All of these are non-renewable resources, whose reserves are either equally or more concentrated than oil, and whose environmental, climatic or sociopolitical effects are not yet known (IEA, 2021c). The growth in demand summarized in Table 2 is conceived for the Sustainable Development Scenario (SDS) of the Paris Agreement, to keep the increase in global temperature below 1.5°C by 2050, improve air quality and guarantee universal access to energy, objectives 3.9 and 7 of the Sustainable Development Goals (IEA, 2021c). This scenario, together with that Net Zero Emissions by 2050 (NZE), assumes solid political support, extensive international cooperation, and increased investment. It is based on a series of assumptions about cross-cutting policies and policies about the energy sector, the construction sector, the transport sector, and the industrial sector.<sup>5</sup> This scenario sheds light on the extractivism inherent in the energy transition as the path toward energy security, showing that new energies and new technologies will almost triple the demand for natural resources by 2020, a year of great contraction in economic activity due to the pandemic. In short, the SDS presupposes increasing demand for critical minerals to achieve its objectives. Keeping the global temperature around 1.5°C above pre-industrial levels, intensifies and perpetuates extractivism by establishing the dichotomy of either extractivism or climate change, since some important facts have not crystalized. Despite the fast grow of wind and solar energy, the decarbonization of transport is still an ongoing task and the share of hybrid and electric cars is practically negligible.

<sup>5</sup> The IEA presents four development scenarios for the energy sector by 2025, two normative: Net Zero Emissions by 2050 (NZE) and Sustainable Development Scenario (SDS), and two exploratory: Announced Pledges Scenario (APS), and Stated Policies Scenario (STEPS). (IEA, 2021b)



Table 2 depicts the structure of the new demand for minerals and rare earth induced by the transition to a lower CO2 economy and illustrates how the transport sector is a central pillar for reaching the objectives of climate change control. One relevant point is how the increase of the costs of raw materials demanded for the new technologies compensates or even surpass the reduction of solar and wind energy. The price of EV battery cells and packs is expected to rise this year for the first time in decades, as demand for electric vehicles runs ahead of the industry’s ability to secure adequate supplies of critical raw materials such as cobalt, nickel, and lithium, and manufacturers scramble to secure future supplies. Effectively, renewable energies, central to reducing CO2 emissions, require the extraction of non-renewable minerals, which are concentrated in a few countries, although not so much as oil resources. Solar electricity and transport are the activities with the most significant increases in rare earth minerals demand, the reserves of which are concentrated mainly in China, at least up to today.

**Table 2.** Critical mineral demand projections for clean energy technologies sustainable development scenario - 2020-2040

	Power generation: solar			Power generation: wind			Electric vehicles and battery storages			Electrical network (transmission, distribution and transformation)			Rate Growth			
	2020	2040	The demand is multiplied by...	2020	2040	The demand is multiplied by...	2020	2040	The demand is multiplied by...	2020	2040	The demand is multiplied by...	2017	2018	2019	2020
Aluminum										0,104	444,444	1.5				
Argon	0.1	0.2	10										5.5	5.4	1.5	5.4
Cobalt							21	455	21				-3.5	-4.9	6.8	-5.1
Copper	246	509	2.5	217	610	2.8	118	3,530	28	4,272	444,444	1.0	5.0	14.2	21.1	2.5
Chromium				74	75	1.0							-3.1	3.1	-0.3	0.5
Tin	0.6	1.8	3.0										10.0	3.0	3.8	24.8
Gallium	0.004	7.6	672										5.3	3.4	-7.1	-5.9
Graphite							152.7	3,649	23				55.4	5.2	15.8	-2.7
Lithium							77	904	12				-18.5	15.7	11.0	-7.3
Manganese				49	117	2.5	26	428	16				24.0	22.3	-4.7	-3.8
Neodymium				3.43	1.6	0.46							28.0	5.7	8.6	20.6
Nickel				21	53	2.5	61	3,544	58				8.4	-5.4	7.6	7.3
Silver	2.0	2.3	1.15										10.5	11.0	13.4	-8.0
Lead	0.6	1.7	2.8										-4.2	2.9	0.2	-5.5
Silicon	4711	848	0.18				11.4	6.2	0.54				-7.4	-1.4	6.7	-4.9
Zinc	3.2	6	1.8	321	822	2.6										
Vanadium							0.1	239	2102				-4.0	2.9	7.2	-5.7
Uranium				10.4	10.7	1.03										
Neodymium				2.1	2.0	0.95	1.8	28	1.6				7.0	35.7	11.3	7.4
Praseodym				0.9	0.8	0.89										
Total	342	3,673	1.5	814	1,114	1.4	426	16,376	38	3,179	28,144	1.8				

**Source:** Authors own elaboration based of (EIA, 2021c)

These forecasts make it possible to suggest strategies to combat climate change by reducing CO2 emissions, intensify, and perpetuate extractivism as they consecrate the new sources of extractivism as the only way to control climate change. A dichotomy is created that synthesizes the function proposed by Leonardi (2015):

Climatic stability = fall in CO2 emissions = carbon trading = sustainable economic growth



If it is so, neither Mexico, Latin America and many other countries cannot escape extractivism. There are several policy measures and actions to take temper the effects extractive growth: Most of them involve preventing the revaluation of the national currencies, reorienting fiscal policies to ameliorate concentration of income, stimulating tradable sectors, agriculture and manufactures intensive in domestic factors and premature terciarización of the economy, without annulling those that stimulate the energy transition. The remaining margin of action is to control and mitigate its social and political effects.

## **2. Mexico: the slow energy transition towards an environmentally and socially sustainable energy system**

### **2.1. Some general remarks.**

In order to ponder how far has Mexico advanced the transition to a new structure of primary energy supply, it is essential to have present some factors that distinguish the Mexican economy: its relative wealth in oil and other energy sources, second the integration of its economy, and oil resources with those of the United States and Canada (Puyana y Rodríguez, 2020), the third Mexican economy is neither oil economy no extractive, due to the comparatively lower weight of oil and other commodities in total GDP, employment or exports (Puyana y Rodríguez, 2020). Mexico has developed its economic potential according to its perception of the value of its oil resources in the frame of the economic model implemented in different periods and the strong trade relations with the United States. Energy policies have been a key issue for the advance of the import substitution industrialization prevalent from circa 1950 to the beginning of the 1980s and in the liberal export-oriented model instrumented in mid 1980s and prevalent until now. In both periods, but specially in the second, the integration of Mexican economy has been a strong influencer due, amongst other things, to the signature of the North American Free Trade Agreement- NAFTA, in 1994 and the United States, Mexican Canada Agreement UMSCA (Puyana, 2015, 2006 and 2020).<sup>6</sup>

In the context of the economically integrated North American region, it is worth mentioning large disparities in energy resources, total and per capita energy consumption and CO<sub>2</sub> emissions, as indicated in Table 3.

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6 Regional commercial integration in agricultural and manufacturing goods and in trade flows is similarly significant and asymmetric (Puyana, 2015)

**Table 3.** México, Canada and United States: Production and consumption of fossil energy and CO2 emissions 2000-2050

		2000				2010				2020				2050*				2050*			
		USA	CAN	MEX	100%	USA	CAN	MEX	100%	USA	CAN	MEX	100%	USA	CAN	MEX	100%	USA	CAN	MEX	100%
OIL	Reserves	47.1	13.7	50.6	100%	48.0	25.9	4.2	100%	28.0	68.2	2.5	100%	8.5	N/A	-	N/A	N/A	-	-	-
	Production	47.1	13.6	50.6	100%	48.0	25.9	24.9	100%	23.3	21.3	8.4	100%	21.2	20.4	10.0	100%	20.7	20.7	100%	100%
	Consumption	6.0	2.7	0.4	100%	16.5	16.5	5.0	100%	62.7	1.0	6.1	100%	81.0	1.0	10.0	100%	81.0	1.0	100%	100%
GAS	Production	6.7	2.9	1.7	100%	7.9	7.9	1.3	100%	63.3	17.1	1.7	100%	86.0	N/A	-	N/A	N/A	-	-	-
	Production	71.1	27.2	7.6	100%	74.1	25.3	6.6	100%	62.7	15.9	2.7	100%	73.7	21.2	2.7	100%	73.7	21.2	100%	100%
	Consumption	10.6	22.8	7.6	100%	16.4	21.1	8.6	100%	82.7	12.9	8.6	100%	88.0	20.6	12.0	100%	77.0	12.0	100%	100%
COAL	Reserves	N/A	N/A	N/A	-	N/A	2.7	6.0	100%	57.3	2.9	2.7	100%	N/A	N/A	-	N/A	N/A	-	-	-
	Production	N/A	N/A	N/A	-	N/A	5.2	3.0	100%	6.4	7.9	4.0	100%	6.6	7.9	4.0	100%	6.6	7.9	4.0	100%
	Consumption	N/A	N/A	N/A	-	N/A	1.1	1.1	100%	82.7	1.1	1.1	100%	82.7	1.1	1.1	100%	82.7	1.1	1.1	100%
TOTAL	Production	26.34	4.02	23.12	100%	25.34	28.19	24.75	100%	21.23	91.21	24.04	100%	8.5	N/A	-	N/A	N/A	-	-	-
	Consumption	26.34	4.02	23.12	100%	25.34	28.19	24.75	100%	21.23	91.21	24.04	100%	8.5	N/A	-	N/A	N/A	-	-	-

**Sources:** prepared by the author, based on BP, *Statistical Energy Review*, July 2021; EIA at [eia.gov/international/data/coal/](https://www.eia.gov/international/data/coal/); \* BP's business-as-usual scenario. The "fast" scenario projects lower production and consumption of fossil sources. \* "net-zero": accelerated reductions

Mexico went from having oil reserves higher than the United States and being an important net exporter, selling over 50% of its production, to restricting foreign sales due to the depletion of the gigantic oil field Cantarell. The United States is the largest producer and consumer of fossil fuels in the region, representing 70% of the former and 80% of the latter in 2020. It emits less CO2 per person and in GDP terms than Canada, but more than Mexico, and in 2020, it represented 83%, 82%, and 93% of the demand for oil, gas and coal, respectively. United States produce 5 times more CO2 per capita than Mexico and 1.1 times more than Canada.

Although it is the humanity's responsibility to act on the causes of climate change, this responsibility is not distributed equally among all the countries of the world, or according to the population and the economy of each one. Accountability is more significant in developed countries that were pioneers in industrialization, a critical factor in CO2 emissions and other contaminants, and the main for producing and consuming fossil fuels. Even if they did not have reserves until 1973, they had advantageous concessions with taxes lower than 8% of the extracted value. Their responsibility dates back to the beginning of the 20th century. It covers the entire period since oil replaced coal as the main fuel, the period of integration of the national and international markets, and industrialization, particularly after World War II, when the so-called oil civilization was consolidated, due to its role in practically the entire economic structure: production, transportation, and services. Indeed, the United States, Canada, Europe, Israel, Australia, and Japan are responsible for 92% of excess emissions to prevent the temperature from exceeding 1.5 degrees over the pre-industrial period; hence, the majority of the population of developing countries are responsible for hardly any of the climate crisis (Hickel, J. 2022). The per capita consumption of raw materials in developed countries is four times greater than in the Global South (ibid.). The consumerism of the most developed countries coexists with the low consumption levels of developing countries. This equity issue has not been fully explored, while equity within countries is emphasized, leaving out the disparity between countries in terms of consumption and CO2 emissions. The success of energy security and energy transition policies depends on the extent to which they respond to national contexts and how, based

on these, responsibilities are taken to remedy the environmental damage and the effects of both current energy extractivism and those arising from strategies for energy security and the energy transition.

## 2.2 How far has Mexico gone in Energy Security?

To measure the trajectory of energy security, assembled according to the rules described above, the Energy Diversification Index EDI and the Energy Transition Index ETI were constructed based on two axes: availability and sustainability, the first associated with the availability of reserves and the second with the volume of production and imports of fossil fuels. Reserves and production have a positive relation to energy security and imports have a negative one. Since the energy transition aims to reduce the share of fossil fuels in the primary energy supply by replacing them with non-fossil fuels that are supposed to be less CO<sub>2</sub> intensive, any increase in their participation represents progress in energy transition, which deepens extractivism, as argued in the second section above, which holds that the production of electricity, wind, solar, nuclear, and hydroelectric energies should be added to the category of extractive activities, in line with Puyana and Rodríguez (2020). The value of the indexes oscillates between zero and one; values closer to one indicate improvements in the indicator, while values approaching zero indicate the opposite. Next, the construction of the indexes is described, and the results are discussed.

The impact of extractivism are the Dutch Disease effects which are present Mexican economy: long periods of overvaluation of the Mexican peso, the premature retreat agriculture and manufactures in total GDP and total employment and the terciarizacion of the economy<sup>7</sup>. All together slow down labor productivity and work remunerations growth. So, at the time of changing the energy mix different anti extractivism actions have to be taken to avoid overvaluation of the currency and to stimulate production, exports and employment in agriculture and manufacture sectors; accelerating total economy labour productivity and wages.

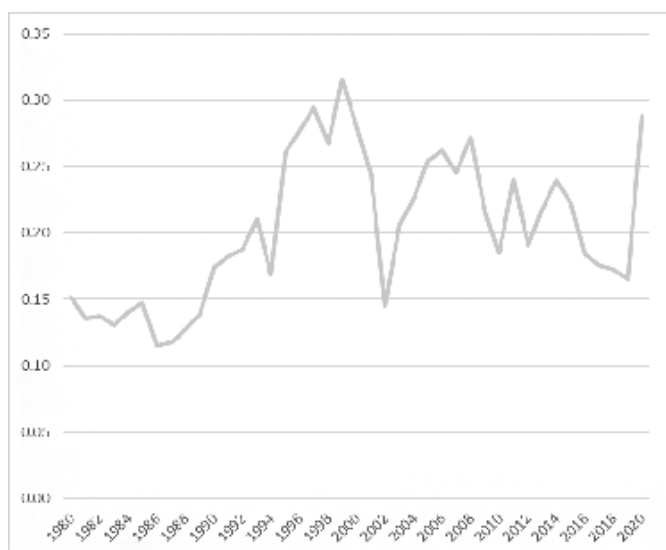
**Energy Diversification Index (EDI).** This index contains two variables: 1) the consumption ratio between the production of crude oil, gas, and coal, where the value is more significant than one, it indicates losses in energy security because consumption of gas and carbon would be guaranteed through imports, which are linked to dependence, there for losses in energy security; 2) the consumption of nuclear and hydroelectric energy and the total consumption of renewables. For the calculation of the index, oil and coal are marked with a negative sign to indicate the negative relationship with diversification and, consequently, energy security is negatively affected. On the other hand, gas, together with renewables, enters with a positive value since they are considered lower emitters of CO<sub>2</sub>, a factor central to the energy transition (EU 2022; Aguilera and Aguilera, 2020; Puyana and Rodríguez, 2020).

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<sup>7</sup> For a detailed analysis of the Dutch Disease effects of extractivism and oil production in Mexico and other countries see Puyana (2015).

It is worth noting the particularity of the EDI in terms of extractivism, arising from the emphasis given in energy security policies to the diversification of renewable energy sources, without sufficiently weighing aspects such as social conflicts due to sometimes violent dispossession of land, changes in land use (Hickel, J. 2022; Oxfam 2018), weakening of pollination caused by wind turbines and greater consumption of non-renewable mining resources for their operation. Therefore, any increase in the share of new energies is positive in terms of energy security because diversification increases and, depending on the case of each country, dependence on fossil fuels is reduced while simultaneously expanding the extractivist logic of the intensive use of natural resources. From the foregoing, it follows that guaranteeing energy security and energy transition, through a greater share of gas or renewable energies, deepens and broadens extractivism. Paradoxically, gas, identified as transition energy, is a fossil fuel, and its exploitation is extractive. Therefore, its higher electricity consumption increases energy security and extractivism.

**Graph 4.** Mexico. Energy Diversification Index EDI. Evolution in 1990-2020



**Source:** prepared by the author with data from BP (2021)

In the last decade, the supply of renewable energies grew. However, its share of total consumption is still low, and the reduction in the consumption of coal and oil is slow, since in the generation of electricity, these are replaced with gas. It is worth asking whether gas deserves to be classified as alternative energy, ignoring the fact that it is a source of greenhouse gases. Table 4 provides information to exemplify the arguments. When considering gas as a fossil resource, participation by fossil fuels dominated the mix in 2020 and will continue to do so until 2050. In each of the three countries and the region it will predominate despite the implementation of the energy transition. It contrasts, while renewable

energies remain a low proportion of total consumption and hydro and nuclear energy are a stable proportion. The table points out the relevance of regional patterns of energy change and the low fading out of fossil fuels in the primary energy supply due to the strong energy regional economic relations, the relative abundance of fossil resources, and the market-oriented economic model.

**Table 4.** Demand for primary energy in Mexico 1975-2020 (percent share)

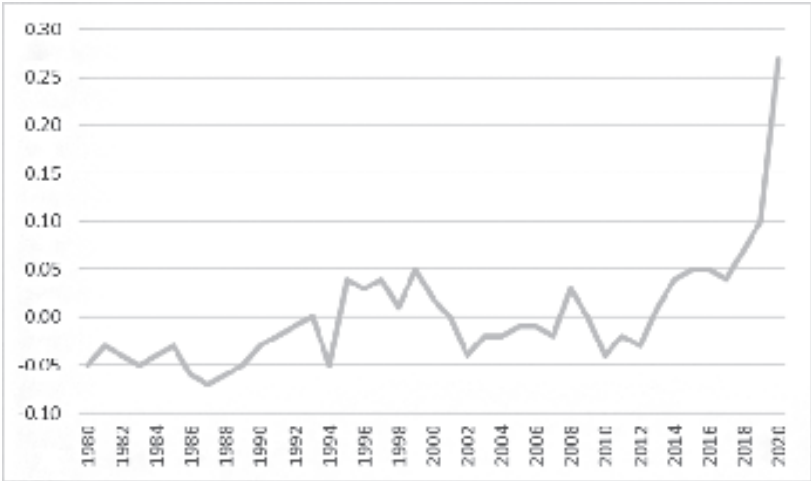
	MEXICO				
	Oil	Gas	Coal	Nuclear	Renovab.
1975	66.5	22.2	4.0	0.0	7.4
1980	66.8	24.7	3.0	0.0	5.5
1985	65.1	24.4	3.1	0.0	7.4
1990	68.6	21.2	3.1	0.6	6.5
1995	65.5	21.9	4.2	1.7	6.7
2000	65.1	22.0	4.7	1.4	6.8
2005	58.1	28.1	7.1	1.5	5.2
2010	53.5	32.5	7.3	0.8	5.9
2015	48.2	37.8	6.9	1.4	5.7
2020	38.1	48.0	3.2	1.6	9.2

**Source:** Own elaboration, based on BP 2021

The increase in the share of renewable energies indicated in the table implies that they grew at rates higher than total energy production and fossil fuels. Mexico is substantially lagging. As of 1974, the international oil market forces are seen as the culprit of climate change, yet, in a logical inconsistency, reversing this phenomenon is left to the market. Several reasons could be offered in this regard. One is that energy security gave rise to the “...historic process of fetishizing CO2 emissions (carbon fetishizing), that is, reorienting capital and its relations with the nature and environment towards the elimination of CO2, a process accepted even by progressive forces, as a reformist agenda, in what Peter Newell and Matthew Paterson call ‘climate capitalism’” (Merrick, 2021: 2). If the real purpose is to contain climate change and energy inequality, it is essential to question the logic behind the mercantile strategy of energy security and carbon fetishism, which imply privatizing and commodifying natural resources and transforming the natural world into a capital stock for a few, as suggested by Böhm S et al. (2009)

**Energy Transition Index (ETI).** The ETI includes, with a negative sign, the value of the total consumption of fossil fuels and the generation of CO2 and with a positive sign gas, and renewable energies. As in the previous index, improvements in energy security are based on an increase in the consumption of gas and renewable energies and a decrease in CO2 emissions.

**Graph 5:** Mexico. Energy Transition Index (ETI). Evolution in 1990-2020



**Source:** *BP stat review (2021).*

Both indexes indicate a lower weight of fossil fuels and a greater weight of new energies. This change in the structure of primary energy supply and consumption is based on the exploitation of other natural resources, some renewables, such as wind, water, and land, and others non-renewable such as uranium, lithium, various metals, minerals and rare earths. The impact will be the intensification of the Mexican relatively small mining sector shown in Table 5. Therefore, it is feasible to argue that Mexico has to design a sound strategy to satisfy the increase in the demand for mineral and rare earths that will be generated if real progress towards energy diversification and climate control are seriously taken. It is well known that the country already suffers the impact of territorial, political and social conflicts caused by the increase in mining activities spurred by the previous three governments.

**Table 5.** Mexico: production of several minerals and rare earths. 2010-2021. Billions Mexican Pesos

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	TOTAL BY MINERAL
Previous metals	65,241	110,642	122,497	104,163	91,510	112,443	126,888	114,034	101,545	84,357	102,236	114,646	1,472,406
Gold	26,280	32,223	48,202	56,756	53,211	72,845	87,221	77,115	71,721	63,163	87,941	95,001	827,281
Silver	28,333	36,422	51,335	47,566	38,479	33,659	42,236	41,122	35,894	36,681	54,383	57,658	559,834
Non-ferrous industrial metals													
Copper	46,241	61,166	69,051	57,948	64,842	84,824	96,720	88,042	74,400	61,823	103,231	121,517	948,834
Zinc	4,239	5,400	5,711	5,583	5,481	6,006	5,571	7,102	5,544	5,752	7,046	8,450	72,285
Aluminum	22,296	32,645	45,346	30,440	43,219	42,450	44,235	33,513	29,372	26,153	66,236	32,908	687,354
Iron	14,170	12,151	12,817	10,080	12,104	13,862	15,281	21,052	21,500	16,067	10,166	24,543	204,844
Stannum	215	187	230	188	297	135	31	101	61	21	-	-	1,841
Calcium	72	51	39	26	36	31	31	38	57	47	40	42	538
Tungsten	-	-	-	-	-	-	-	-	-	-	-	-	-
Antimony	4,716	4,428	4,174	3,624	4,236	2,583	3,154	4,022	7,275	6,682	10,449	10,232	89,474
Metals and non-metallic minerals													
Coal	22,324	34,546	24,197	24,194	26,801	32,445	19,190	18,833	24,572	25,138	19,108	18,084	359,838
Gas	5,651	7,028	4,716	3,024	5,479	3,888	4,527	4,102	4,538	3,264	2,113	2,658	52,595
Crude oil	8,875	8,990	11,180	13,370	10,484	8,541	8,541	7,18	8,746	5,972	4,438	2,757	93,540
Non-fossil fuels	7,046	8,006	8,705	8,710	10,254	9,848	9,154	7,715	11,465	10,113	17,145	10,605	112,108
Manganese	731	513	538	642	814	488	721	1,052	1,273	1,002	942	988	5,823
Non-metallic minerals													
Sulfur	1,218	2,182	1,876	1,778	1,227	1,884	889	1,29	771	684	817	428	15,883
Asbestos	202	158	185	164	312	582	245	234	242	943	1,122	1,181	6,421
Gypsum	16	18	14	14	26	23	1	8	25	82	9	11	388
Silica	131	244	274	344	466	1,154	1,184	944	1,214	1,154	1,444	2,114	14,444
Fluorapatite	2,126	2,524	4,895	1,616	2,616	1,416	2,126	2,145	4,891	3,416	2,948	2,616	22,694
Silica sand	1,817	1,222	1,201	1,224	1,253	855	1,041	1,513	443	1,248	1,521	1,624	14,817
Crystalline	348	454	479	524	614	814	414	445	423	462	421	1,024	4,888
Phosphates	1,272	1,108	1,214	1,146	1,416	1,816	2,146	2,145	825	812	827	508	12,234
Ammonia	98	61	124	141	154	184	424	141	424	427	342	442	2,422
Cellulose	18	23	31	46	46	67	31	42	35	42	44	58	453
Carbon	222	202	207	662	827	222	226	225	404	413	724	664	2,822
Asbestos	204	218	224	47	84	84	36	54	54	242	226	417	1,446
Salt	2,225	1,547	2,280	1,240	2,230	2,782	3,424	2,443	2,583	3,042	2,154	2,055	31,248
Ammonia	245	257	276	256	210	232	330	249	330	325	322	258	4,223
Sodium sulfate	847	1,224	1,844	1,244	1,847	1,814	2,151	2,064	2,151	2,215	2,221	2,148	25,487
Magnesium sulfate	37	111	114	125	114	115	120	125	177	232	227	223	1,894
TOTAL	244,541	324,485	324,806	208,046	207,054	211,678	234,888	242,727	241,834	221,258	281,516	321,168	2,729,897
	24,884.07	32,448.6	32,480.68	20,804.61	20,705.48	21,167.8	23,488.87	24,272.7	24,183.4	22,125.8	28,151.6	32,116.8	

**Source:** Authors elaboration based on INEGI (2022)

Policies to mitigate the effects of the New Extractivism are based on what has been set out in this paper and in many other findings, on the effects of the exploitation of oil and other raw materials, within the framework of the theories of Dutch disease, the curse of natural resources and on neo-extractivism.

Defining extractivism by its effects on the structures of a country, and not by the characteristics of the products, their production, and sale, has led to a focus on the backward and forward linkages of the exploitation of resources, those of demand and those of income and emphasizing the instability of prices, technological intensity, the concentration of capital and production, the predominance of foreign investments that transfer part of the income abroad, aspects that generate economic crises, displacement and backwardness of other productive sectors and concentration of income from the production and exports of labor-intensive goods and national inputs and derived from the above, deterioration of employment and intensification of inequality. (Hirschmann 1970; Puyana 2015 and 2017; Karl 1997; Furtado, 1973). Solving these problems requires adjusting the role of the state, which has generally sponsored extractivism, with a view to capturing rent and securing



fiscal resources with little or no budgetary, providing it with a large margin of discretionary public spending. The state is primarily responsible for extractive activities benefiting the public interest, the national economy, and the majority of the population that does not bow to the demands or lobbying of vested interests, and eliminate measures and incentives adapted to the interests of capital.

The foregoing entails the government actions to designing:

a) *New tax rules* aim, on the one hand, to socialize private income generated by the commodification of the sun, the wind, the tide, and land. These taxes will ensure that most of this income is captured by the public sector and channels its monetization towards labor-intensive and low energy intensity and income distribution policies. This socialization of income would make it possible to couple the restructuring of the economy with the generation of formal employment, wage growth, and internal demand.

b) *Production policies* stimulate activities with the most significant and dynamic backward and forward linkages and the most labor-intensive activities with low and medium technologies, low CO<sub>2</sub> intensity, and lower demand for scarce non-renewable natural resources.

c) *Redistributive measures* to reduce the effects of the capital concentration, the preeminence of foreign investment, and the high capital intensity of new energy sources and electricity production. A large part of the profits and income go abroad, and are not reinvested in the same activity or in the domestic and local economy. Due to the high level of imported technology and the concentration of production, the distribution of income that remains in the country and that of domestic capital deepens the widespread inequality. The socialization of income and the productive policies mentioned can mitigate these two concentrating tendencies. As a result, it is appropriate, as Gunton (2020) suggests, to limit and regulate foreign investment and strengthen national property in extractivist activities.

d) *Distributive actions and training* to level up labor income, preventing the displacement of fossil fuels by new energy resources from creating new sectors of the working population that are impoverished and excluded from the labor market. As with any technological change, it is necessary to invest in the training of the outgoing workforce in new technologies or those used in other activities, as well as to prepare the new generations for the economic conditions and new technologies to come.

### 3. Conclusions

The journey through the themes proposed as exploratory topics of this essay shows the difficulties and contradictory processes to achieving energy security by transiting towards a new and secure energy system with a lower share of fossil fuels. The energy mix transformation is urgent but needs a deep analysis before being put in motion. The urgency is even more vital for the greater complexity because that is transiting to an energy security system

expands and extends the extractive features of the economies of countries, such as Mexico and the majority of Latin American Countries are rich in commodities.

Yet, replacing fossil fuel energy with solar, wind, hydraulic, and nuclear ones might reduce CO<sub>2</sub> emissions but create new and not sufficiently explored problems and contradictions that must analyze. To privatize and commodify wind, ocean waves, water, and land, to transform them into electricity requires that it is necessary to treat them as another merchandise open to the grab of large capital owners. For that grab to take place, the appropriate conditions have to be created to guarantee the maximum profitability of investments from exploiting assets not produced by human agency. This transformation is inherent in all proposals on energy security and transition while often staying silent on the enormous costs of such policy advice. Mexico's experiences in energy transition show how hard it is to part from oil and the hurls for moving towards economies that emit less CO<sub>2</sub> and methane gas, with a secure supply based on clean energy. Even if achieving a complete transition, it will be insurmountable to overcome extractivism. Concerning the analysis in Mexico, the values obtained for the indexes of energy diversification and energy transition show the relatively meager progress made in energy security and the energy transition since 1974 and identify which of the variables that make up each of the two indexes present the most negligible satisfactory results and therefore the most significant tasks to be carried out. All the indexes show the contradictions of the strategies since the gains in energy security imply adverse effects by increasing extractivism, forming a balance that is still pending urgent quantification. The positive balance in energy security can decrease and even turn negative when adding the high growth of the exploitation of minerals and rare earth, which demand energy substitution and the new technologies involved, enhancing extractivism and even perpetuating it.

The insistence on market efficiency and cost-benefit criteria for energy transition is another hurdle to reaping energy security. Oil and gas continue to be the lower costs source of energy despite the formidable reduction of the costs of renewable sources. Political factors impose restrictions on energy transition and give excuses for renewing oil exploration and production. In Mexico, the global energy crisis, the explosion of energy prices, and inflation pressures offer arguments in favor of constitutional reforms of the electricity, energy, and mining sectors proposed by Morena.

Mexico and other natural resources rich countries have to solve the double edge problem of changing the energy matrix and managing the resulting intensification of extractivism. Some policies can be implemented such as preventing the revaluation of the national currencies, reorienting fiscal policies to ameliorate concentration of income, stimulating tradable sectors, agriculture and manufactures activities intensive in domestic factors and avoiding premature terciarization of the economy, without annulling those that stimulate the energy transition. The remaining margin of action is to control and mitigate its social and political effects. Stimulating the activities for the production of new energies and training displaced workers in the technologies these will demand,

## Bibliography

- Aguilera, R.F., Aguilera, R. (2020). Revisiting the role of natural gas as a transition fuel. *Miner Econ* 33, 73–80 <https://doi.org/10.1007/s13563-019-00192-5>
- Bagni, S. (2018). Los derechos de la naturaleza en la jurisprudencia Colombiana e Indiana, *Revista Jurídica de Derecho*, 7(9), p. 33–53.
- Böhm, S. (2009). *Upsetting the offset: the political economy of carbon markets*. London: MayFlyBooks, 2009.
- British Petroleum, BP (2021). *Statistica Review of World Energy*, available at: <https://www.bp.com/en/global/corporate/energy-economics/statistical-review-of-world-energy.html>
- Capellán-Pérez, I., De Castro, C., & González, L. J. M. (2019). Dynamic Energy Return on Energy Investment (EROI) and material requirements in scenarios of global transition to renewable energies. *Energy Strategy Reviews*, 26, 100399.
- Davenport, C. (2022). Biden Plans to Open More Public Land to Drilling, *The New York Times*, April 16th, 2022. <https://www.nytimes.com/2022/04/15/climate/biden-drilling-oil-leases.html>.
- EIA, (2021). U.S. Energy Information Administration. International Energy Outlook 2021, EIA <https://www.eia.gov/international/data/world/total-energy/total-energy-consumption>.
- European Union (2022). *EU taxonomy for sustainable activities*, Available at: <https://ec.europa.eu/info/business-economy-euro/banking-and-finance/sustainable-finance/eu-taxonomy-sustainable-activities>
- Foster, B. (2022). Nature as a Mode of Accumulation: Capitalism and the Financialization of the Earth, *Monthly Review*, 73(10), <https://doi.org/10.14452/MR-073-10-2022-03>.
- Furtado, C. (1982) *Desarrollo y Subdesarrollo*. Buenos Aires: Editorial Universitaria de Argentina.
- Grupo Intergubernamental de Expertos sobre el Cambio Climático IGCC (2012), recatable en: <https://www.ipcc.ch/languages-2/spanish/>
- Gudynas, E., (2013). Extracciones, extractivismos y extrahecciones. *Observatorio del Desarrollo*, 18, pp. 1–18.
- Gunton, T. (2020). Staple Theory and the New Staple Boom, Stanford, J. The Staple Theory at 50. *Canadian Centre for Policy Alternatives*.
- Hickel, J. (2022) “De-growth is about global justice, *European Green Journal*, available at: <https://www.greeneuropeanjournal.eu/degrowth-is-about-global-justice/>
- Hirschman, A. O. (1970). *The strategy of economic development*, Yale University Press.
- IEA (2021a). *International energy outlook 2021*, EIA. Available in: <https://www.eia.gov/international/data/world/total-energy/total-energy-consumption>
- IEA, (2021b). *Energy Models*, Available in: <https://www.iea.org/reports/world-energy-model/policies#sustainable-development-scenario-assumptions>.
- IEA, (2021c). *The role of critical minerals in clean energy transitions. world energy outlook special report*. Available in <https://www.iea.org/reports/the-role-of-critical-minerals-in-clean-energy-transitions>
- INEGI (2022). *Estadística Mensual de la Industria Minero metalúrgica y Cuentas Nacionales*, available at: <https://www.inegi.org.mx/rnm/index.php/catalog/580>
- IPCC (2021), *Sixth Assessment Report, Climate Change 2021: The Physical Science Basis*, Available at: <https://www.ipcc.ch/report/sixth-assessment-report-working-group-i/>
- Karl, T.L. (1999). The Perils of the Petro-State: Reflections on the Paradox of Plenty. *Journal of International Affairs*, 53, 31.

- Puyana, M. A. & Rodríguez, P. I. (2022). The green energy transition and energy security in Mexico, 1980–2016: Expansion and intensification of extractivism. *Efil Journal of Economic Research*, 5(2), 10-28.
- Karl, T. L. (1997). *The paradox of plenty: oil booms and petro-states*, USA: University of California Press.
- Khan, M. (2022). Brussels proposes green label for nuclear and natural gas, *The Financial Times*, Jan. 4. Available at: <https://www.ft.com/content/7872a05f-9e38-4740-9b1b-4efc69ca316c>.
- Leonardi, E. (2015). *For a critique of carbon trading dogma*, Available at: <https://undisciplinedenvironments.org/2015/12/14/for-a-critique-of-carbon-trading-dogma/>
- Lewinsohn, J. L. (2021). *Estado del arte de las estadísticas mineras del uso de agua y energía en los países andinos: intercambio metodológico entre Chile y el Perú en el marco de la cooperación Sur-Sur*, Santiago: Publicación de las Naciones Unidas.
- Lord, D. (2010). Playing with oil: Putting performativity at the center of oil civilization, in Denzin, N.K. (Ed.) *Studies in Symbolic Interaction*, 34, pp. 285-293. Available at: [https://doi.org/10.1108/S0163-2396\(2010\)0000034019](https://doi.org/10.1108/S0163-2396(2010)0000034019).
- Melville H. Watkins A. (1963). Staple Theory of Economic Growth, *The Canadian Journal of Economics and Political Science*, 29(2), pp. 141-158 [Chttps://www.jstor.org/stable/139461](https://www.jstor.org/stable/139461)
- Merrick, J. (2021). *The paris climate talks and other events of carbon fetishism*, Verso, Available at: <https://www.versobooks.com/blogs/2372-steffen-bohm-the-paris-climate-talks-and-other-events-of-carbon-fetishism>
- OWD, (2021). Our World in Data. Available at: <https://ourworldindata.org/energy-mix>, accedido el 12 octubre 2021.
- OXFAM (2018) Minería y privilegios, *Captura política y desigualdad en el acceso a los Bienes Comunes Naturales en México*, Available at: <https://www.oxfamMexico.org/>
- Parshley, J. (2022). Predictions Favored Solar Over Wind Power. What Happened?, *The New York Times*, Jan 21.
- Pineault, E. (2020). The Panacea: Panax Quinquefolius in Denzin, N.K. (Ed.) *Studies in Symbolic Interaction*, 34, pp. 285-293. Available at: [https://doi.org/10.1108/S0163-2396\(2010\)0000034019](https://doi.org/10.1108/S0163-2396(2010)0000034019).
- Prebisch, R. (1948). *El desarrollo económico de la América Latina y algunos de sus principales problemas*, Repositorio CEPAL 2012, en: <https://repositorio.cepal.org/handle/11362/40010>
- Puyana, A & Rodríguez I. (2022). The green energy transition and energy security. Expansion and intensification of Extractivism. Mexico, the US and Canada, 1980–2016.
- Puyana, A. (2006). Mexican Oil Policy and Energy Security within NAFTA, *Journal of Political Economy*, 35(2), pp. 82-111.
- Puyana, A. (2015). *La economía petrolera en un mercado politizado y global: México y Colombia*, FLASCO.
- Puyana, A. (2017). El retorno al extractivismo en América Latina. Ruptura o profundización del modelo de economía liberal y por qué ahora?, en *Espiral*, 24 (69).
- Puyana, A. (2019). “El retorno al extractivismo en América Latina. Su impacto en la desigualdad y el trabajo” in Alicia Puyana Mutis, Mariano Rojas (Editores, 2019): *Desigualdad y deterioro de las condiciones laborales Un círculo vicioso en América Latina Flasco*, México.
- Puyana, A. & Rodríguez, I. (2020). Seguridad energética en México, Estados Unidos y Canadá de 1980 al 2016: centralidad del petróleo y la incorporación de temas ambientales. *Norte-américa*, 15(2), pp. 9-37.
- Puyana A. & Romero, J. (2022). Does the Mexican-United States-Canada, Agreement Facilitates the Integration of the North American Region?, *International Development Economics Associates*, Feb. 2022, [https://www.networkideas.org/wp-content/uploads/2022/02/Mexico\\_US\\_Economic\\_Integration.pdf](https://www.networkideas.org/wp-content/uploads/2022/02/Mexico_US_Economic_Integration.pdf),
- Svampa, M. (2012 ). Consenso de los commodities, giro ecoterritorial y pensamiento crítico en América Latina. <http://biblioteca.clacso.edu.ar/clacso/osal/20120927103642/OSAL32.pdf>