

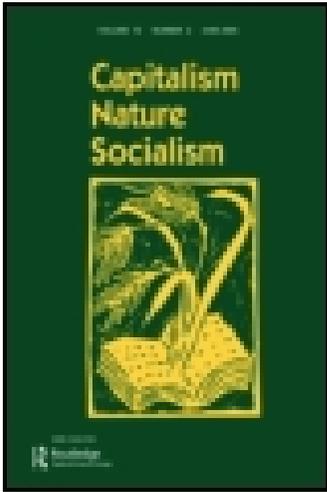
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On: 14 August 2015, At: 11:19

Publisher: Routledge

Informa Ltd Registered in England and Wales Registered Number: 1072954

Registered office: 5 Howick Place, London, SW1P 1WG



Capitalism Nature Socialism

Publication details, including instructions for authors and subscription information:

<http://www.tandfonline.com/loi/rcns20>

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Published online: 14 Aug 2015.



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To cite this article: David Schwartzman & Quincy Saul (2015): An Ecosocialist Horizon for Venezuela: A Solar Communist Horizon for the World, *Capitalism Nature Socialism*, DOI: [10.1080/10455752.2015.1069867](https://doi.org/10.1080/10455752.2015.1069867)

To link to this article: <http://dx.doi.org/10.1080/10455752.2015.1069867>

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An Ecosocialist Horizon for Venezuela: A Solar Communist Horizon for the World[‡]

David Schwartzman* and Quincy Saul[†]

We humbly propose to the people of Venezuela the outline of a plan by which Venezuela could lead a wind/solar power transition in Latin America using a small fraction of her liquid petroleum reserves, while still gaining revenue from oil exports as well as contributing to the same energy transition globally. Implementing this approach would be a critical component of Venezuela's self-identified path of ecosocialist development.

Part I. Introduction: The World on the Brink of Doom; Great Bifurcation

Humanity and existing biodiversity are facing a huge challenge in the first half of the 21st century. Shall civilization emerge in a new mode, with the end of what Marx called our prehistory, the rule of capital on our planet? Or shall we plunge into a deep abyss of climate hell, climate catastrophe, for the few who survive? This is the great bifurcation ahead, and the outcome is not possible to predict. Only transnational class that struggle on a scale not witnessed in human history has any chance of avoiding the abyss (Schwartzman 2013a, 2013b).

There are two threats of unprecedented magnitude. The first is that of nuclear war, which would be deadly even if localized, because of resulting climatic impact on agriculture. The second threat is catastrophic climate change (C3). C3 is very likely inevitable if carbon emissions to the atmosphere are not rapidly and radically reduced and if the already unsafe atmospheric level of carbon dioxide is not reduced by sequestration technologies to a safe level.

Paradoxically, however, we are also privileged to confront this challenge, since the process of removing these threats raises the possibility of ending the rule of capital on our planet.

[‡]Note: Sections I, IV, and V were written by David Schwartzman; sections II, III, and the Conclusion by Quincy Saul, with both authors reviewing the whole paper. Supplementary material for this paper, including an update on "How much energy does humanity need?", can be found at: <http://ecosocialisthorizons.com>. This article is an updated version of a paper given at "Moving Beyond Capitalism" Conference, July 29–August 5, 2014, Center for Global Justice, San Miguel de Allende, Mexico.

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The Increasing Threat of Climate Catastrophe and the Requirement of a Prevention Program

Our global climate is nearing tipping points to irreversible shifts:

Changes are beginning to appear, and there is a potential for explosive changes with effects that would be irreversible—if we do not rapidly slow fossil fuel emissions over the next few decades. Tipping points are fed by amplifying feedbacks. As Arctic sea ice melts, the darker ocean absorbs more sunlight and speeds melting. As tundra melts, methane, a strong greenhouse gas, is released, causing more warming. As species are pressured and exterminated by shifting climate zones, ecosystems can collapse, destroying more species. (Hansen 2009)

Increased climate extremes are now confirmed as driven by global warming (Hansen et al. 2012, 2013), with flooding, extreme droughts, forest fires, and greater storm damage all expected to increase with dangerous climate change. Ocean acidification from rising atmospheric carbon dioxide is already observed, with potential for widespread marine ecosystem collapse (Hansen et al. 2008). Arctic sea ice is shrinking to record-low levels, with some predicting final collapse within four years (Vidal 2012).

Meanwhile, the level of carbon dioxide in the atmosphere is already above a safe limit (it reached 400 ppm in 2013, with a safe level being no more than 350 ppm, assuming methane, ozone, and black soot decrease (Hansen et al. 2008, 2013)). Only the thermal inertia of the ocean responding to the greenhouse forcing of the atmosphere still gives a brief window of time to initiate an effective C3 prevention program. Hansen et al. (2013) contend that the International Energy Agency (IEA) and Intergovernmental Panel on Climate Change (IPCC) recommended 2°C ceiling is not based on science, but rather on a political assessment of the potential of leading carbon-emitting countries to radically reduce carbon emissions in the near future. They wrote:

Increased climate extremes, already apparent at 0.8°C warming, would be more severe. Coral reefs and associated species, already stressed with current conditions, would be decimated by increased acidification, temperature and sea level rise. More generally, humanity and nature, the modern world as we know it, is adapted to the Holocene climate that has existed more than 10,000 years. (2013)

Further,

distinctions between pathways aimed at ~1°C and 2°C warming are much greater and more fundamental than the numbers 1°C and 2°C themselves might suggest. These fundamental distinctions make scenarios with 2°C or more global warming far more dangerous; so dangerous, we suggest, that aiming for the 2°C pathway would be foolhardy. (2013)

The material requirements for a prevention program with any chance of avoiding C3 must include the radical and rapid reduction in carbon emissions to the atmosphere

(especially carbon dioxide, methane, and soot), coupled with aggressive energy conservation and build-up of global wind/solar power, sufficient to sequester carbon from the atmosphere below the “safe” carbon dioxide limit of 350 ppm. Two technologies to achieve this objective are agroecologies increasing soil carbon and solar-powered industrial C-sequestration (Schwartzman and Schwartzman 2013). Of course, adaptation to already occurring and projected impacts of global warming must be aggressively implemented, but mitigation, that is, action to prevent even more dangerous climate change, is imperative, coupled, if possible, with adaptation. For example, substituting agroecologies for conventional agriculture potentially combines mitigation (reduction of fossil fuel use) with adaptation (shift to more local and resilient food production).

But it is increasingly clear that only with a radical shift to a global regime of peace and cooperation will it be possible to implement an effective C3 prevention program. The threats of C3 and nuclear war pose an unprecedented opportunity to end the rule of capital, because the main obstacle to elimination of these threats is the Military Industrial Complex (MIC) (fossil fuel, nuclear, state terror, and surveillance) at the core of real existing capitalism (Schwartzman 2009). Thus, the challenge to dissolve the MIC puts an ecosocialist transition on the agenda for humanity—an ecosocialist transition out of prehistory and into a new global civilization, solar communism in the 21st century.

How Much Energy Does Humanity Need?

A rough minimum of 3–3.5 kilowatt/person is now required for state-of-the-science life expectancy levels, that is, highest achievable (e.g., see graph posted on www.solarutopia.org, Schwartzman and Schwartzman 2013; Schwartzman 2014a, 2014b; see also the supplementary discussion posted at <http://ecosocialisthorizons.com>).

Part II. Venezuela in the World System

It is in the context of this worldwide upheaval and reversal, known throughout indigenous South America as “the Pachakuti,” that we turn to the nation of Venezuela. In many ways Venezuela seems a very unlikely candidate to play a progressive role in the resolution of our global ecological crisis. The Saudi Arabia of Latin America, Venezuela, is one of the world’s largest oil producers, and home to Petróleos de Venezuela S.A. (PDVSA), the largest corporation in the world. Venezuelans can fill up their gas tanks with pocket change. And yet it is in this nation, comparatively skipped over by the revolutionary wave which swept over most of the continent in the 1960s, and home to a large rentier aristocracy and an oil-fueled culture of consumption, that in the last decade a revolutionary process has emerged and taken hold, which may be one of the last best hopes for people and the planet. As Bertold Brecht said, “in the contradiction is the hope.”

In the early 1900s, an oil boom turned what was a cash crop colony into a bustling metropolis, with skyscrapers and superhighways, stock tickers, and supermarkets.

Unlike other Latin American nations, whose economies and governments the US and European empires (past and present) could afford to bait and switch with impunity, imposing colonial and neocolonial relations via trade agreements and occasional coups, Venezuela's position as an oil producer make it a different animal, a player on the world stage of geopolitics. OPEC (Organization of Petroleum Exporting Countries) was born in Venezuela.

For almost a century, US transnationals ran the Venezuelan oil fields, extracting more oil wealth from Lake Maracaibo, according to Galeano (1973), than all the silver wealth extracted by the Spanish from the mountain of Potosi in Peru. This was the gas that fueled the birth of the military industrial complex and greased the way for the USA to take over the world, picking up where the Europeans had left off in building its global hegemony of "full spectrum dominance."

In 1994, when the Zapatista uprising shook the world with the slogan that resonated around the world, "ya basta!" ("enough already"), calling for an end to the last 500 years of conquest, a group of revolutionary-minded soldiers inside the Venezuelan military were planning a coup. Led by Hugo Chavez among others, they were outraged and repulsed by the Venezuelan elite, the corrupt two-party system, and the extreme brutality routinely unleashed on the Venezuelan people. They found inspiration and courage in the revolutionary figures of the anti-colonial struggle in Latin America, and indigenous, African and European, who were united in fighting against the Spanish: Simon Bolivar, Guaicaipuro, Jose Leonardo Chirinos, Ezequiel Zamora, Jose Carlos Mariategui, Jose Marti, and many more. A decade later Hugo Chavez was democratically elected president of Venezuela, the entire nation mobilized to rewrite the constitution, and hundreds of social reforms were initiated, including the full nationalization of the oil industry.

When the Chavez government, with the new constitution as its mandate, implemented a full nationalization of the oil fields and began to put oil money toward social programs for health and education, the Venezuelan elite responded with a coup attempt and an oil strike. These circumstances radicalized Chavez and his supporters still further, leading Chavez in 2006 to call for socialism and to begin to frame the social programs more and more explicitly in the context of anti-imperialist, anti-capitalist revolution.

No longer under the thumb of the USA, Venezuela continues to flaunt the colonial legacy of the Munroe Doctrine, routinely engaging in diplomatic and trade relations with countries such as Iran and China. Now, in the first decade of the 21st century, China has replaced the USA as the main recipient of Venezuelan oil. In the space-time of a couple decades, five centuries of colonial economic and political relations have been severely shaken, if not completely turned upside down. In the space-time spearheaded by Venezuela's revolutionary process, other nations have followed the lead, with Bolivia, Ecuador, and Uruguay, and to lesser but significant extents Brazil and Argentina, throwing out agents of US imperial domination, from diplomats to corporations.

Throughout Latin America the revolutionary process is uneven and embattled, as mixed up paradigms of development clash in a dialectic between movements and governments. We have no desire, as many have had, to romanticize all the so-called progressive regimes of Latin America, which in many cases amount to little more than green-washed state capitalist governments. Nonetheless, we cannot allow the contradictions of a revolutionary process to confuse or distract us from our primary obligation, which is to defend the gains of the revolutionary process from its enemies. Today in Venezuela the opposition is trying yet again to spark a counter-revolution, to unseat President Maduro, and to reverse the dynamics which the revolutionary process has unleashed. It is our contention that the contradiction and complexity of the revolutionary process are not an indication of its weakness, but precisely the opposite. The situation in Venezuela is so complex and embattled precisely because in so many ways it is the place in the world where the revolutionary process is most advanced and globally significant. With the recent discovery of the Faja del Orinoco, one of the largest untapped oil reserves in the world, Venezuela's role as a key player in geopolitics will only increase, as peak oil sets in throughout the world. For all the more reason, then, it devolves upon us all to study the internal dynamics of this place and its people, to discern the vital thread that connects the struggle against catastrophic climate change, to its radical anti-capitalist and ecosocialist alternatives all over the world.

Part III. Venezuela Ecosocialista! A Pending Revolution

Few would have guessed that Venezuela would be the first country in the world to make ecosocialism an official government policy. Fewer still are even aware that this has taken place! But this historic fact, the result of decades of activism and advocacy by a wide diversity of sectors all concerned about environmental degradation, is a kernel in the kettle of the revolutionary process which, if allowed to fully develop, could change the world. It is already changing Venezuela.

The Plan Patria, the five-year plan upon which Chavez ran for his last election, was developed through a constituent process of investigation and research which many Venezuelans have compared to the constituent process convoked to rewrite the constitution. In its fifth and final historic goal, it points toward a legacy and a mission of profound significance in the face of catastrophic climate change, one whose audacity puts to shame the other governments of the world, who have clothed fear, cruelty, and indecision in endless jargon. The fifth historic goal of the Plan Patria, understood as Chavez's legacy, epitaph, and last will, is simple: "Contribute to the preservation of life on the planet and the salvation of the human species." How?

Build and promote the eco-socialist and productive economic model, based on a harmonious relationship between man and nature that guarantees the rational, sustainable and optimal use of natural resources while preserving the processes and cycles of nature.

This plan, which calls for an end to the commodification of nature, which calls for the creation and amplification of a global movement to fight catastrophic climate change, and outlines real policies of mitigation and adaptation, is historic in its audacity and its vision. Unlike most government documents which are written and read only by politicians and lawyers, the Plan Patria is being distributed, read, and debated at all levels of society. From forums in universities to urban land reclamations, to farmers in the interior to indigenous and Afro-descendant communities, to seed savers in the mountains, to the National Assembly, the Plan Patria and the meaning of ecosocialism in particular are being debated.

Already numerous articles and polemics have appeared calling attention to the obvious contradiction expressed in a government whose main source of revenue is oil production advocating ecosocialism. Others have called attention to the plight of indigenous peoples in Venezuela, who deserve more recognition for their ecosocialist praxis than a government document. To the extent that these critiques and commentaries further our understanding of the blind spots in the revolutionary process and delineate possibilities and strategies for rectification, these critiques are to be welcomed and encouraged. Unfortunately, a more facile approach is the trend. Instead of celebrating the Plan Patria and the call for ecosocialism, many understand the contradictions as dark secrets that undermine the legitimacy of the revolutionary project.

It is true that all of the tremendous gains in education and health, gains which in fact are unprecedented in scale and speed in human history, have depended on oil money. It is true that Venezuela has the highest per capita deforestation rate of Latin America. It is also true that tens of thousands of Venezuelan are taking Chavez's mandate of ecosocialism very seriously, and are training cadre in agroecology, bioremediation, sustainable land and water management, seed saving, urban agriculture, and more. "In formal logic, a contradiction is the sign of defeat," wrote philosopher and historian of science Alfred North Whitehead. "But in the evolution of real knowledge, it marks the first step toward victory."

Venezuela has very large reserves of conventional liquid oil, but even larger deposits of extra-heavy oil in the Faja del Orinoco basin approximating the global total of conventional oil reserves (https://en.wikipedia.org/wiki/Orinoco_Belt). The environmental/ecological/climatic impact of extracting this heavy oil is comparable to that of tars sands oil in Canada. The Orinoco region is dominated by a dry savannah ecosystem. Very significant loss of carbon stored in the soil to the atmosphere is the very probable outcome of extraction of the heavy oil occurring in the underlying sedimentary rock. Thus, *if any of the historic goals of the Plan Patria are to be fulfilled over the long term, then the international political significance of the Faja del Orinoco must change from "oil for everyone" to "oil for no one," and become an example to the world (similar to the struggle for the Yasuni in Ecuador) of "leaving the oil in the soil." (not taking this literally of course, the oil being in sedimentary rocks in the underlying crust)*. Given the totally sufficient amount of conventional oil in the global reserve, any proposal to use the Orinoco heavy oil as a global resource for renewable transition is completely unnecessary and unwelcome.

In 2010, Miguel Angel Nunez, director of the Latin American School of Agroecology, published a book titled “Ecosocialist Venezuela: A Pending Debate.” Today the debate is no longer pending but underway, from the corridors of government to the streets of Caracas, to the mountains of Yaracuy and the llanos of Barinas. Now it is the ecosocialist revolution that is pending, gestating in the hearts and minds of all the protagonists of the Bolivarian process, in Venezuela and beyond, who recognize the urgency of catastrophic climate change, who see the hope in the contradictions, and who believe the words of Simon Bolivar, quoted at the opening of the Plan Patria: “What you have done so far is only a prelude of what you can do in the future. Prepare for combat, and count on victory.”

This was the sentiment and the hope at the IV Congress of Biological Diversity, where the contradictions between ecosocialism and the oil economy were hotly debated. In the final declaration of the congress, painstakingly compiled and synthesized from a week of forums, lectures, classes, and debates, and then collectively revised and rewritten by hundreds in an assembly which lasted nearly six hours, we call attention to the following paragraph:

We believe that a basic element of any ecosocialist transition is the change in the mode of production and consumption that should be accompanied by a matrix of alternative energy to guarantee sustainability and promote the sovereignty of all peoples.

This sentence emerged from a debate in the assembly of how to include the question of alternative energy. Against those who called simplistically to include a mention of renewable energy as part of ecosocialism, many successfully argued that to call simply for renewable energy was not enough. The real issue and demand is for a change in the mode of production and consumption, which must be accompanied by renewable energy, and grounded in the sovereignty and independence of the people. Absent this distinction, as we have witnessed in other parts of the world, “green energy” can act as a Trojan Horse to further the privatization of the environment, the creation of massive development projects such as hydroelectric dams, and the creation of intellectual property rights on technologies which do not solve but exacerbate our ecological and social crisis. With this ideological understanding in mind, the declaration went on to say:

We believe that the current unsustainable rentier petroleum model of our country, upon which we are dependent, is a transitory passageway that should serve to transcend the capitalist mode, toward the construction of the Ecosocialist Communal State. This transformation implies settling the historic social and ecological debt of the State with its peoples and guaranteeing regional integration.

It is on exactly this note that we wish to proceed. *How* can Venezuela use its oil wealth to seed the creation of an ecosocialist mode of production? How can oil be used

in such a way as to eventually leave the oil in the soil, as peoples movements are demanding from the Amazon River to the Niger Delta? How can we navigate and guide this transitory passageway in such a way as to open up not only an ecosocialist horizon for Venezuela, but also a solar communist horizon for the world? We believe that all this is not only necessary, but possible and within the range of current technological capacity. It is within our reason and technique to use fossil fuels to transition toward a solar economy, while at the same time remaining committed to the obligations of the revolutionary government to alleviate poverty. With this courage and conviction, with the audacity and the vision of ecosocialism which is Hugo Chavez's legacy to the world, that we propose the creation of a new Gran Mision to accompany the other Gran Misiones of the Bolivarian process, a transversal mission within which all others are understood and directed, to immediately begin the transformation of a solar energy infrastructure which alone could satisfy the highest aspirations of the Bolivarian revolution and the communal state.

Part IV. Solar Transition Is Possible: A Concrete Proposal for a New Transversal Gran Mision in Venezuela, with Regional and Global Implications

A Solar Transition is Possible!

Does the technology now exist for robust solar energy transition accompanied by a rapid and radical reduction of carbon emissions? Existing solar technologies can now be the basis of a high-efficiency infrastructure capable of replacing the present unsustainable fossil fuels/nuclear power/big hydropower energy/biofuels system, especially combined with greater energy efficiencies. These solar technologies include:

- (1) Wind power
- (2) Solar thermal power (CSP)
- (3) Photovoltaics, including near future thin film high-efficiency technology

Expansion of nuclear energy, specifically a reincarnation of fission-powered reactors with new technology, will not significantly mitigate global warming, nor will it plausibly avoid the well-known negative environmental and health impacts of this energy source. A global mix of these three solar technologies, coupled with a sophisticated grid and energy storage capacity, can replace the current unsustainable energy infrastructure if sufficient transnational political power can be generated to make this transition possible in a time frame sufficient to prevent C3.

A C3 prevention program with any chance of success must include the rapid replacement of fossil fuels (starting with phase-out of coal and non-conventional petroleum such as fracked gas and tar sands) by global wind and solar energy power sufficient for:

- (1) Carbon sequestration from the atmosphere to bring atmospheric level of CO₂ below 350 ppm (it is now 400 ppm)
- (2) Termination of energy poverty now afflicting the great majority of humanity.

We modeled global solar transition with computer simulations that assumed values for the energy return over energy invested for state-of-the-science wind/solar technologies, 'Energy Returned On Energy Invested (EROEI),' that is, how much energy does the technology such as a photovoltaic array or wind turbine generate in its usable lifetime divided by the energy needed to construct and maintain it (Schwartzman and Schwartzman 2011). As far as we know, this was the first study which computed the necessary non-renewable energy (mainly fossil fuel) needed to create the renewable capacity in a solar transition scenario. The critical factor that leads to exponential growth of this renewable energy supply is the feedback of energy from the growing renewable capacity back into the physical economy to create more of itself. Here is the critical modeling result: assuming present wind/solar technological capacities, and using 1–2% of current annual consumption of energy (85% derived from fossil fuels) for wind/solar power creation per year will result in a global-scale transition in no more than 30 years, ending with zero anthropogenic carbon emissions, providing the rough minimum of 3.5 kilowatt/person energy consumption for all.

How Much Petroleum Is Needed for a Global Solar Transition?

Conventional Petroleum (liquid oil) is the preferred energy source for transition to a fully wind/solar global energy supply because of its lower carbon footprint with respect to global warming compared to coal or non-conventional hydrocarbons (tar sands, oil shale, fracked natural gas). Even the consumption of natural gas currently extracted without fracking technology apparently has a carbon footprint equal to or greater than coal, because of leakage of methane directly to the atmosphere (Howarth 2014). We estimate that a maximum of 30% of the estimated global conventional proven petroleum reserves are needed for a full solar transition in 25 years (Schwartzman and Schwartzman 2013, update at www.solarutopia.org). New wind and solar technologies with higher EROEI values will make this solar transition faster, requiring even less conventional petroleum.

Post-extractivism?

Hollender (2015) has brilliantly outlined the alternatives to real existing extractivism, with the worst being "predatory." Following her terminology, we advocate a transition to an initial "sensible extractivism" followed by an "indispensable extractivism" phase. The characteristics of sensible extractivism include deliberate selecting of extractive projects that meet strong environmental and social criteria, such as those outlined in national and international legislation. For example, extractive

projects that risk irreversible environmental damage or species lost should be immediately halted. During this phase a country would implement additional macroeconomic reforms such as price correction for primary materials, tax and royalty reforms, subsidy reductions, etc. The transition to an indispensable phase of extractivism involves eliminating all extractive activities that cannot be directly linked to human needs and quality of life improvements. Each policy phase would require complementary socio-cultural measures to facilitate the long transformation of consumption patterns and “materialistic values.” Critical components of this transition include implementing “Buen Vivir” (food security and sovereignty; autonomy in education, governance, and justice; and “making Mother Earth a subject with rights”) and the solidarity economy (Hollender 2015, 86–88).

In the final phase of ecosocialist transition we envision indispensable extractivism fading away as solar power capacity increases, that is, more solar, more recycling, less mining (Schwartzman 2014a, 2014b). Finally, mining on Earth may cease entirely as mining on the Moon becomes feasible, although Quincy Saul is not keen on this prospect. It should be noted that many rare metals (e.g. neodymium) used in high technologies are recycled at rates lower than 1% (Reck and Graedel 2012).

If they had their way, extreme anti-extractionists such as Jensen (2012) would immediately shut down all oil wells (taking “keep the oil in the ground” literally), thereby blocking a solar transition with the capacity to eliminate energy poverty now affecting most of humanity and simultaneously bringing on inevitable climate catastrophe, since the clean energy infrastructure needed for climate adaptation and the sequestering of carbon from the atmosphere into the crust would be not be created.

A Concrete Proposal for a New Transversal Gran Mision in Venezuela, with Regional and Global Implications

We propose the following objectives can be achieved, drawing on the conventional petroleum reserves of Venezuela and other Mercosur members, supplemented by electricity supplied by current hydropower:

- (1) Provide the minimum energy consumption per person level consistent with state-of-the-science life expectancy levels (3.5 kilowatt/person) for the Mercosur¹ group (plus Bolivia and Ecuador).
- (2) Provide this required energy with a growing component of wind and solar power, phasing out fossil fuel consumption over a 20–30-year time frame.

¹The Mercosur Group includes the following member states: Venezuela, Brazil, Argentina, Paraguay, Uruguay. Their total population (including Bolivia and Ecuador) is now 308 million (http://en.wikipedia.org/wiki/List_of_countries_by_population).

Table 1. Energy use in Mercosur nations.

	Population (million)	kg of oil equivalent per capita	Energy consumption (million MWh/year)	kilowatt per capita
Venezuela	28.9	2380	800	3.16
Brazil	201	1371	3205	1.82
Argentina	42.7	1967	977	2.61
Paraguay	6.8	739	58.4	0.98
Uruguay	3.3	1309	50.2	1.74
Bolivia	10	746	86.8	0.99
Ecuador	15.7	849	155	1.13
Total	308.4		5332	1.97
For comparison:				
USA	316	6793	24,965	9.01
Cuba	11.2	992	129	1.32

Note: Energy use refers to the use of primary energy before transformation to other end-use fuels, which is equal to indigenous production plus imports and stock changes, minus exports and fuels supplied to ships and aircraft engaged in international transport. IEA Statistics © OECD/IEA (<http://www.iea.org/stats/index.asp>). Catalog Sources World Development Indicators (source of energy use data in kg of oil equivalent: <http://data.worldbank.org/indicator/EG.USE.PCAP.KG.OE>; 2011, unless specified). One kilogram of oil equivalent energy = 11.63 kWh.

Current Status of Mercosur Member Countries

The total energy consumption of Mercosur nations in 2011 was 5332 million MWh/year, equal to 17.31 MWh per capita, and assuming 308 million people this is equivalent to 1.97 kilowatt/person (Table 1). To reach 3.5 kilowatt/person at the current population level would require 1.78 times the present energy consumption level, equal to 9470 million MWh/year. For a population of 400 million, this level would correspond to 12,300 million MWh/year. Note that by the end of 2013 the total energy supplied from wind power in the Mercosur nations was roughly 8 million MWh/year, or less than 0.2% of the total.

Current Plans and Potential for Renewable Energy Development in Mercosur

Brazil is now the leader in wind power development in Mercosur, and could potentially be the main producer in this transition, with a significantly larger growth than by reliance on the market with its projected wind power capacity of 25,000 MW by 2020 (<http://www.brazilwindpower.org/en/#>). With an assumed capacity factor of 40% this translates into an energy delivery of 78 million MWh/year by 2020. Venezuela² just announced its goal of wind-generating capacity of

²Note that, of the Mercosur members, Venezuela is closest to the 3.5 kilowatt/person level, while now ranking 73 in the world with respect to life expectancy, with Uruguay ranking the highest at 49; note that Cuba is 38 and U.S. 35; Life expectancy at birth (years), World Health Income inequality and the legacy of poverty are still significant, likely accounting for Venezuela's life expectancy statistic.

10,000 MW over the next 15 years (<http://www.laht.com/article.asp?ArticleId=355174&CategoryId=10717>). The overall potential for wind energy in Brazil has been estimated to be between 300 and 350 GW (New Report on Wind Power in Brazil by GlobalData, Posted on November 22, 2012 [OffshoreWIND.biz] states: “Wind Power in Brazil, Market Outlook to 2025 – Capacity, Generation, Market Share, Levelized Cost of Energy (LCOE), Investment Trends, Regulations and Company Profiles”). Noting that very recent estimates give an average capacity factor of 35% for already functioning Brazilian wind power (<http://www.rechargenews.com/wind/americas/article1356796.ece>), assuming a capacity factor of 40% for 300 GW would deliver the equivalent of 0.12 TW, or approximately 10% of the energy consumption for 400 million people at 3.5 kilowatt/person. Considering both offshore and on-land development, the wind and solar potential of all Mercosur-participating nations would plausibly generate the goal of 1.4 TW delivery for 400 million people. Of course serious research is needed to decide exactly where such renewable energy infrastructure would be sited, taking into account the imperative of a strong regime for environmental, ecological, and health protection for both the workers and communities affected. This transition will of course require the full participation and bottom-up social governance of the people of Mercosur.

A Projected Transition to 100% Wind and Solar Energy for Mercosur

The modeling of a full transition to wind and solar energy supplies presented in Schwartzman and Schwartzman (2011) was converted to a Solar Calculator, accessible at <http://solarutopia.org/solar-calculator>. This Solar Calculator was used to determine the amount of time it will take to implement a full wind and solar energy for Mercosur member states. The notation R^* , L , M , f , and f_{FF} are those used in Schwartzman and Schwartzman (2011).

The computed values (R^*) are multiples of the present energy consumption level for any assumed country, region, and of course the world. Hence, in this case they are multiples of the Mercosur group energy level, estimated to be currently 5322 million MWh/year.

The lifetime of the wind/solar technology, “ L ,” is assumed to be 25 years, the fraction of the wind/solar power in place at any time used to make more of itself, “ f ,” is assumed to be equal to 0.1, and the fraction of the present power capacity used to make new wind/solar power “ f_{FF} ” is assumed to equal 0.01 and 0.1, noting that roughly 90% the present capacity for Mercosur is now being supplied by fossil fuels, mostly petroleum.

Note that Venezuela has the largest by far proven oil reserves of Mercosur countries, with its conventional petroleum reserves (excluding heavy oil) corresponding to 298 billion barrels, which would provide 300 years of production at current levels of roughly 1 billion barrels/year (<http://www.eia.gov/countries/country-data.cfm?fips=VE>). Further, the total energy consumption level of 5332 million MWh/

year for Mercosur is equivalent to the energy generated by burning about 3 billion barrels of oil/year.

The current perspective of Venezuelan specialists in wind power research should be noted. According to a very recent study (Marulanda et al. 2014),

The increased use of diesel for electricity generation, mostly in western country has meant an increase in domestic consumption of fuel and a reduction in exports to international markets. This situation, coupled with the rising cost of oil and fuels, derived country high opportunity cost regarding the thermoelectric generation. For this reason, the trend in the use of fossil fuels for electricity generation should be reversed. Government plans and policies in the electricity sector are focused on harnessing wind on the northern coast of the country, with the aforementioned projects.

We urge these specialists and the Venezuelan government to consider a somewhat different approach, namely that a fraction of their domestic petroleum production be used as an energy source to robustly create a wind/solar power infrastructure, in cooperation with other Mercosur nations.

With this in mind, let us now consider the modeling results shown in Table 2. For example, let us assume an EROEI of wind/solar technology of 25, with the fraction of the present power capacity being used to make new wind/solar power (f_{FF}) of 0.1 or roughly equal to 0.3 billion barrels of oil/year. Assuming a population size of 400 million, R^* equal to 2.31 is required to supply 3.5 kilowatt/person. This level is achieved in a time frame of less than 15, but greater than 10 years (Table 2). For the same assumed EROEI ratio of 25, an assumed f_{FF} of 0.04, equal to 0.12 billion barrels of oil/year, will generate R^* equal to 2.6 in 20 years. Higher assumed EROEI ratios result in even faster replacement of fossil fuels by wind/solar. It should be noted that offshore wind now reaches estimated EROEI ratios of 40–50 (Schwartzman and Schwartzman 2013). Hence, using a relatively small fraction of oil production per year to create a growing wind/solar energy capacity will make

Table 2. Model results.

	Column 1		Column 2		Column 2	
	25		30		40	
Assumed EROEI (same as M)= Assumed f_{FF}	0.01	0.1	0.01	0.1	0.01	0.1
t (years from present)	Wind/solar energy capacity created as multiples of present supply (R^*)					
5	0.1	0.6	0.1	0.8	0.1	1.2
10	0.2	1.7	0.2	2.3	0.4	4
15	0.3	3.5	0.5	5	1	10
20	0.6	6.4	1	10	2.4	23.5

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possible a full transition to clean energy in a couple of decades, while continuing to allow export of most of the petroleum produced, thereby deriving revenue for societal needs, as well as potentially promoting solarization in the rest of the world.

Given current and anticipated values of EROEI for wind and photovoltaics, it should be possible to use a relatively small fraction of current petroleum-derived energy to create a renewable capacity to replace all fossil fuel use as well as provide the 3.5 kilowatt/person level for all living in Mercosur countries in a time frame of no more than a couple of decades. A commitment of Venezuela and Mercosur to such a transformation would surely promote the consideration of parallel solar transitions in the rest of Latin America, indeed throughout the globe. This global transition, coupled with a very timely phase-out of high carbon footprint fuels, is imperative for humanity to have a plausible chance to avoid C3.

Oil-rich countries in the Mid-East and South America (e.g. Venezuela) will be valuable partners in a regional and global solar transition by providing the needed petroleum. But a global regime of equity and cooperation is required, the termination of attempts to impose imperial hegemony. This global transition will require a radical reduction of the global military budget along with such measures as a tax on global financial transactions, thereby freeing up vast resources and human power now being diverted into preparation for war and ever-growing wealth inequality.

Part V. Ecosocialism as the Transition to Solar Communism

An ecosocialist horizon is imperative to prevent and prefigure activity embodied in multidimensional class struggle in our world dominated by the rule of capital; to prevent C3 and along the way demilitarize, solarize, and transform agriculture with agroecologies; to prefigure the future in the present by expanding the commons, virtual and material, moving toward the ecosocialist horizon, reaching it and moving toward the solar communist horizon.

In her audacious book “The Communist Horizon,” Dean (2012) reasserts the vision of radical materialist utopia that has been buried, reburied, but never extinguished.

But the communist horizon in the 21st century will be *Solar Communist*. Solar should be added to the conception of communism because:

- (1) This energy source is by far the most abundant and the technologies to harness it are already available, with very low negative health and ecological impact if there is a robust social management process during its lifecycle.
- (2) A global transition to solar is still achievable in a time frame to avoid C3.

- (3) In the prehistory stage of capitalist reproduction, solar is the energy source most compatible with decentralized, democratic management and control, relatively free of the dictates of the MIC compared to fossil fuels and nuclear power.
- (4) A solar “clean energy” transition is a critical component of the Global Green New Deal and an ecosocialist path out of capitalism. (Schwartzman 2013b, 483)

To simply say capitalism must be replaced by socialism is not a strategy, only a conclusion. To claim that capitalism must be first replaced by socialism to prevent C3 is a cowardly rejection of responsibility to living and future generations. On the other hand, to simply rely on green capitalism to implement C3 prevention with the usual market-driven mechanism is a recipe for disaster, since global carbon emissions continue to climb as renewable energy supplies still grow too slowly to replace fossil fuels.

The struggle to prevent C3 is ongoing and must be made deep and transnational to have any chance of success. Multidimensional class struggle on every scale, from the neighborhood to the global, at every intersection of the oppressed and the exploited, “race,” gender, sexual orientation, ethnicity, citizenship status, (a)religion, age, degree of able-bodiedness, with only this has the capacity *to reach* the ecosocialist horizon but also create the material basis for a global civilization realizing Marx’s aphoristic definition of communism for the 21st century: “from each according to her ability, to each according to her needs,” “her” referring to both humans and nature (ecosystems) (Schwartzman 1992, 1996). Then humanity will leave its prehistory, emerging in a planetary civilization.

Conclusion

The ecosocialist horizon is embedded in the revolution within the revolution currently taking place inside Venezuela, at all levels, from the grassroots to the National Assembly, debating the meaning of ecosocialism. Certain forces will attempt to empty the word ecosocialism of technical, political, and philosophical content, presenting an ecosocialism which is little more than socialism painted green. While there are many reasons for this, the most persuasive of the arguments against a fully embodied ecosocialism will come from those who correctly allege that if Venezuela ceases to export oil, or even slows its production, it will be invaded militarily by the US empire and/or others. It will be further argued that oil production is the one thing currently supporting and safeguarding all of the social programs which have made such historic achievements over the decade, and that to speak of abandoning oil is to speak of abandoning the revolution.

There is virtually no chance that Venezuela will cease to export oil, apart from an imperialist-driven shutdown in direct intervention. In a cooperative world regime for solar transition she will continue to export over a few decades. If Venezuela leads a solar

transition in Mercosur as outlined in this paper, she could even boost exports, given the relatively small fraction of present production required for such a transition, and her reserves of conventional oil.

In response, we remind our readers that the mandate of the Venezuelan constitution and of the Plan Patria is to work toward and guarantee supreme social felicity, and that this will not be possible in a world in the gauntlet of mass extinction and C3. Of course if Venezuela exports and burns all of the oil in the Faja del Orinoco, then this would certainly contribute to a future of mass extinction and C3. Therefore, the commitment to ecosocialism which appears in the Plan Patria is the only way in which the Venezuelan government can fulfill its obligation and mandate, not only to those currently living today but also to future generations. Thus, ecological integrity and human liberation are only in apparent contradiction, to those who cannot see beyond the immediate horizon, and on the terrain of both technology-engineering and ideology-cosmovision. Together with revolutionary musician Leonor Fuguet, who said as much at the IV Congress of Biological Diversity, we say that it is ideologically incoherent to advocate for the liberation of people and the murder of their mother. Ecosocialism is the philosophical synthesis between Marxist/communist ideology and indigenous cosmovision, the key to the riddle holding our collective consciousness hostage, the path to repair the sacred hoop which once held all the peoples of the world in fundamental unity.

To paraphrase Simon Bolivar, the unity of our peoples in harmony with nature is not just a capricious idea of man, but the inexorable decree of destiny. In order to give this dream its concrete material expression, we must fulfill the directive of Cabral (1973), that is, return to the source. This must occur in a triple sense: to Mother Earth, the Pachamama (and the mater in historical materialism); to our indigenous roots as a species-being who has lived in relative harmony on this planet for far longer than we have been destroying it; and finally, to the sun, the source of all life on earth, and the source to which we must head for all our energy needs if we are to fulfill the dream of a dying man and a people newly born onto the stage of world history, to contribute to the preservation of life on the planet and the salvation of the human species.

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