Green Economics and Decent Work: A Viable Unified Framework

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www.ilo.org/weso-greening/documents/WESO_Greening_EN_web2.pdf

INTRODUCTION

The 2018 International Labour Organization (ILO) report *Greening with Jobs*, part of their World Employment and Social Outlook series, could not possibly be focused on a more critical issue.[1] This is because climate change literally represents an existential threat to life on earth as we know it. Within this context of extreme urgency, *Greening with Jobs* (henceforth the Report) provides a range of perspectives, findings and policy proposals which help define a viable path to global climate stabilization. The defining mission of the ILO is to promote *decent work* throughout the globe.[2] Given this mission, it follows that any version of what they would consider a viable climate stabilization path would also promote increasing mass living standards and expanding job opportunities for working people and the poor throughout the world.

[1] The primary listed authors for this study include Guillermo Monntt, Tahmina Karimova, Elizabeth Echevarria Manrique, Nicolas Maitre, Takaski Kizu, Tahmina Mahmud and Catherine Saget (p. v).
[2] The ILO defines decent work as: '[w]ork that is productive, delivers a fair income, offers security in the workplace and social protections for families, contributes to personal development and social integration, grants people the freedom to express their concerns, organize and participate in the decision that affect their lives, and ensures equality of opportunity and treatment for all women and men' https://www.ilo.org/global/topics/decent-work/lang--en/index.htm

The Report is largely successful in describing such a climate stabilization agenda. Its broad themes include the relationship between climate stabilization, economic growth and jobs; the quantity and quality of work opportunities that could be created through the stabilization project; and a range of ways, in the areas of labour market regulation and skills development, to promote decent work in all aspects of the project. In my view, there are also some significant problems at various points in the study, as I will discuss below.

CLIMATE STABILIZATION, JOB OPPORTUNITIES AND MASS LIVING STANDARDS

The *Special Report on Global Warming of 1.5°C* by the Intergovernmental Panel on Climate Change (IPCC, 2018), the most authoritative global organization advancing climate change research, presented an unequivocal case for urgent action. The report emphasized the necessity of limiting the increase in global mean temperatures to 1.5 degrees Celsius (1.5°C) above pre-industrial levels by 2100. This will substantially reduce the risks of heat extremes, heavy precipitation, droughts, sea level rise, biodiversity losses and corresponding impacts on health, livelihoods, food security, water supply and human security.

The IPCC concludes that to achieve the 1.5°C maximum global mean temperature increase target by 2100, global net carbon dioxide (CO_2) emissions will have to fall by about 45 per cent by 2030 and reach net zero emissions by 2050. The IPCC estimates that the rate of decline for all greenhouse gas (GHG) emissions can be modestly lower than for CO_2 alone. To be clear, CO_2 emissions from burning coal, oil and natural gas alone produce about 66 per cent of all global GHG emissions. Another 2 per cent is caused mainly by methane leakages during the natural gas extraction process. Nitrous oxide emissions resulting from energy production and consumption generate modest additional emissions. Agricultural production is the other major source of global GHG emissions, accounting for about 15 per cent in total, in about equal shares of methane and nitrous oxide.[3]

[3] These figures are derived from the World Bank's online Development Indicators database: https://data.worldbank.org/indicator

As the first priority project towards meeting both the IPCC's CO_2 and overall GHG emissions reduction targets, it is clear that the entire global energy infrastructure will have to undergo a total transformation in less than 30 years — that is, the entire global economy will have to stop burning oil, coal and natural gas to produce energy and to replace fossil fuels with clean renewable energy and high-efficiency energy systems. Other major projects must also be advanced in conjunction with the clean energy transformation, starting with global 'afforestation'. This involves increasing forest cover or density in previously non-forested or deforested areas, with 'reforestation' — the more commonly used term — as one component. Trees absorb CO_2 as a matter of course, which means that global afforestation is a proven negative emissions technology. Expanding the use of conservation-based and organic agricultural practices will also support global climate stabilization.

The approach advanced in the Report should be assessed within the context of long-standing intense debates over the extent to which trade-offs exist between, on the one hand, climate stabilization as well as other global greening projects, and, on the other hand, economic growth, expanding job opportunities and increasing mass living standards. Various commentators, from a range of perspectives, have long argued that such trade-offs are unavoidable and severe. That is, either we support jobs, living standards and economic growth and sacrifice the climate, come what may; or we advance a viable climate stabilization agenda, even though it means sacrificing jobs and growth. From this perspective, we can choose one option or the other, but not both.

Yet, for over a decade, a range of researchers have been arguing that this is, in fact, a false trade-off: that, in reality, there is no reason why a viable climate stabilization path must entail sacrificing job opportunities and increasing mass living standards or even, for that matter, economic growth in general. The Report's authors succeed in briefly synthesizing much of the literature on the compatibility of climate stabilization, expanding job opportunities and increasing mass living standards. They also build from the existing research to develop both new analytic results and concrete policy proposals to get us from here to there.

ECONOMIC GROWTH AND ABSOLUTE DECOUPLING

The first overarching issue that the Report tackles is how to think about economic growth within the context of climate stabilization. Proponents of the 'big trade-off' perspective are firm that there is no way to reconcile growth with climate stabilization. The version of this view coming from the political right opposes what they see as unnecessary limitations on burning fossil fuels, since this means demobilizing a gigantic, and highly profitable, global energy infrastructure. Restricting the fossil fuel energy supply will, in turn, drive up energy prices across the board and thereby stifle economic growth. A variant from the left argues that the root cause of climate change is economic growth itself, since growing economies utilize increasing amounts of fossil fuels and other non-renewable resources. Proponents of this view advance what they term 'de-growth', whereby policy interventions deliberately aim to ratchet downward the level of economic activity.[4] The aim here is stop creating huge strains on the earth's finite resources.

The Report addresses these matters carefully. The authors state upfront that economic growth can be, as they put it, 'a major driver for the attainment of decent work' (p. 9). Our current era of global neoliberalism, which has prevailed since the late 1970s, has been characterized by slow growth and rising inequality. Nevertheless, even under neoliberalism, the authors state that, as a result of the economic growth that did occur in 1999–2015, real monthly wages increased on average by 42 per cent across the world, and the share of employed people living in extreme poverty fell from more than 64 per cent to 38 per cent for low-income countries, from 41 to 15 per cent in middle income countries, and from 24 to 3.7 per cent in upper-middle-income countries. Child labour also fell, as did the gender gap between male and female labour force participation.

Given these patterns, it is irresponsible to dismiss economic growth outright as an engine for raising mass living standards. To my knowledge, no credible evidence exists demonstrating how mass living standards can rise significantly in the absence of growth. Of course, a transition from a neoliberal to an egalitarian growth framework would greatly expand the gains in well-being that would result from economic growth.

[4] See Pollin (2018) and follow-up responses in the *New Left Review*, as well as the debate between myself, Pollin (2019a, 2019b), and Schor and Jorgenson (2019a, 2019b) for alternative perspectives on de-growth vs a 'Green New Deal'.

At the same time, the ILO authors are also clear that, as they put it, 'economic growth has increased pressures on the environment *to an unsustainable degree*' (ibid., emphasis added). More specifically, they report that:

> In 2013, the latest year for which data are available, humanity used and produced 1.7 times as much resources and waste as the biosphere was able to regenerate and absorb. It now takes the Earth 18 months to regenerate what humanity uses in a year. Seen from another perspective, nine planetary boundaries define the Earth system's ability to remain stable. At least three of these boundaries have recently been crossed, which will produce irreversible and abrupt environmental change on a global scale: the addition of nitrogen and phosphorus into water and terrestrial systems, biodiversity loss and GHG emissions (p. 9).

In short, the authors portray sharply the tension between economic growth and environmental protection. But they also provide a solution to this dilemma. This is to *absolutely decouple* economic growth from, first and foremost, the consumption of fossil fuels, but also from the rising demands for other toxic and non-renewable resources. They write 'GHG emissions, and resource use in general, do not need to be linked to economic growth, or, in other words, economic growth can be decoupled from both emissions and material and resource use' (p. 13).

Thus, it is imperative that demand for fossil fuels falls steadily and dramatically if we are going to have any chance at stabilizing the climate. At the same time, while fossil fuel consumption falls steadily to zero, economies must still be able to rely on energy resources to meet their various needs — to light, heat and cool buildings; to power cars, buses, trains and planes; to operate computers and industrial machinery; among other uses. More generally, economies can still grow — and even grow rapidly, as with China and India — while also advancing a viable climate-stabilization project, as long as the growth process is absolutely decoupled from fossil-fuel consumption. The authors make clear that the more modest goal of *relative decoupling* — through which fossil fuel consumption and other non-renewable resource usages continue to increase, but at a slower rate than GDP growth — is not a solution.

The authors provide valuable evidence on the relationship between GDP growth and GHG emissions. They show that between 1994 — 2014, for most countries, economic growth has been positively correlated with GHG emissions. The same is true for material extraction as well as water and land use. At the same time, on a global scale, relative decoupling did occur to a modest degree. That is, 'between 1994 and 2015, the world became less dependent on emissions and resource use to generate each unit of GDP (i.e., the carbon intensity of world output has fallen, but total emissions continued to grow)' (p. 13). A few countries, including Germany and Denmark, experienced absolute decoupling, though not yet nearly to the extent necessary to reach a climate stabilization path. Absolute decoupling resulted in these countries through both raising energy efficiency standards and increasing the supply of renewable energy.

In my view, it is entirely realistic to allow that the German and Dutch absolute decoupling patterns can be replicated, and intensified, throughout the world. However, the authors do not emphasize this critical point sufficiently. The most basic reason that intensive absolute decoupling is a feasible project now is that transitioning to a clean energy infrastructure is already cost effective, with costs also continuing to decline further. Thus, the recent report of the International Renewable Energy Agency (IRENA) asserts that '[b]y 2020, all mainstream renewable power generation technologies can be expected to provide average costs at the lower end of the fossil-fuel cost range. In addition, several solar PV and wind power projects will provide some of the lowest cost electricity from any source' (IRENA, 2018: 5). Meanwhile, investments in energy efficiency lower costs by definition, because they entail using less energy to achieve the same, or even higher levels of energy services from the adoption of improved technologies and practices. Examples include insulating buildings more effectively to stabilize indoor temperatures; driving more fuel-efficient cars or, better yet, relying increasingly on well-functioning transportation systems; and reducing the amount of energy that is wasted both through generating and transmitting electricity and through operating industrial machinery.[5]

[5] As recognized initially in 1865 by Jevons, raising energy efficiency can also generate 'rebound effects' — i.e., energy consumption rising as a result of lower energy costs. But as discussed in Pollin (2015: 40–45), such rebound effects are likely to be modest within the current context of a global project focused on reducing CO2 emissions and stabilizing the climate. Among other factors, energy consumption levels in advanced economies are close to saturation points in the use of home appliances and lighting, and with auto transportation and heating/cooling, average rebound effects are likely in the range of 10–30 per cent. Average rebound effects are likely to be significant larger in developing economies. But it is critical that all energy efficiency gains will be accompanied by complimentary policies (as discussed below), including setting a price on carbon emissions to discourage fossil fuel consumption. Also, expanding the

EXPANDING DECENT JOB OPPORTUNITIES

What will be the impact on jobs if economic growth is decoupled absolutely from the consumption of fossil fuels and other non-renewable resources? It will be useful to consider the discussion in the Report within three broad categories: 1) jobs that will be created through green economy investments and lost through the fossil fuel industry contraction, as well as the net effects of both patterns; 2) the impact of both climate change and the green transition on working conditions; and 3) developing just transition policies for the workers whose jobs will be lost through the transition. A fourth major focus of the authors, on skills development for the green transition, cuts across these three other areas of concern.

Gross and Net Job Creation

The idea that building a green economy should be a source of job creation should be intuitive, even though it is frequently portrayed as a job killer. This is because building the green economy necessarily entails *building* — it means large-scale new investments to dramatically raise energy efficiency standards and equally dramatically expand the renewable energy supply. Spending money on virtually anything will create jobs. The only relevant question should then be *how many* jobs get created through building a green economy, and correspondingly, how many jobs will be lost through the contraction and eventual dissolution of the fossil fuel infrastructure.

On the first question, the authors conclude that progress toward creating a sustainable economy in the energy sector will create about 24 million jobs globally when compared to a 'business-as-usual' scenario. They write that this employment creation is driven by the spending

supply of clean renewable energy will allow for higher levels of energy consumption without leading to increases in CO2 emissions.

at all levels within the renewable energy value chain, to the extent that, by 2030, greenhouse gas emissions will have fallen by 41 per cent.[6]

Of course, calculating projections of this type is always fraught with pitfalls. We need to recognize that, at best, all such projections provide only a rough approximation of the reality one is hoping to describe. That said, the authors' estimate of 24 million jobs generated worldwide by 2030 to bring GHG emissions down by 41 per cent appears to be very low relative to the estimates my co-workers and I have generated for a range of country and regional settings. I would rather suggest that the extent of job creation would be closer, *as a low-end estimate*, to 160 million jobs — i.e. almost seven times higher than the ILO projection.

I describe how I derive this rough estimate in Appendix I. Of course, it would be valuable to understand exactly how the ILO authors generated their job creation estimate. However, as I discuss in more detail in Appendix I, there is no place in the study at which they explain their methodology down to the critical point — i.e. to the point at which they derive their final job-creation results. This is despite the fact that the study includes a dense 13-page appendix focused on exactly this question, titled, 'Using Multiregional Input–Output Tables to Estimate the Employment Effects in a Green Economy'.

Recognizing that we are dealing with rough approximations in all cases, it does still matter to our understanding of the opportunities ahead whether the extent of total job creation will be in the range of 160 million or above as opposed to 24 million. The ILO also estimates that 6 million jobs would be lost in the fossil fuel industry through the clean energy transition relative to the business-as-usual. This figure is probably accurate, as discussed in the Appendix. This is especially true once we assume, properly, that the contraction of the global fossil fuel employment closely follows the rate of fossil fuel consumption contraction that corresponds with the IPCC's emissions reduction goals.

Overall, by my calculations, the net employment effects of a clean energy investment project are much larger than what the ILO has projected — that is, in the range of 150 million

[6] The authors do not make clear what is the base year in this calculation, i.e. the year relative to which the 41 per cent emissions decline as of 2030 is being measured. The reference on the 41 per cent GHG emissions decline is on p. 42, with no reference to a base year. However, on p. 41, in a prior discussion, a parenthetical reference is made to 'a 59 percent increase in electricity produced from solar photovoltaic panels in 2030 compared to 2012'. Perhaps we can assume the 2012 base year also applies to the reference to the GHG emissions decline by 2030 mentioned on the next page.

jobs worldwide, amounting to about 3.5 per cent of the 2030 global labour force, as opposed to the ILO projection of 18 million jobs, equal to about 0.4 per cent of the global labour force. If it is true that the net employment impact is substantially larger than what the ILO has estimated, it then follows that the considerations on job quality emphasized by the ILO also carry much greater significance. We now turn to these issues.

DECENT WORK STANDARDS IN THE GREEN TRANSITION

The authors examine the relationship between the quality of employment, climate change and the green transition from a range of perspectives. For example, they compare how various countries perform with respect to both: 1) a set of decent work indicators; and 2) whether the countries have decoupled growth from GHG emissions, either relatively or absolutely. They consider these relationships over 1994–2014 for five decent work measures: the percentage of workers in poverty; the labour share of income; the female labour force participation rate; the employment to population ratio; and the share of self-employment. Through regression analysis, they conclude that the primary driver of changes in these indicators is the rate of economic growth itself, not whether they have decoupled growth from GHG emissions. That is, they find that faster-growing economies made relatively more progress in raising decent work levels in their respective countries. These results are not surprising, given that there is nothing about fossil fuel decoupling per se that would also necessarily yield improvements in working conditions.

They also examine the extent to which existing jobs throughout the global economy are interconnected with environmental conditions. Thus, employment in energy and mining are highly intensive in terms of GHG emissions and material extraction, but their shares of total employment are relatively small. The service sector contributes only modestly to GHG emissions on a per worker basis, but nevertheless, in absolute terms, is a large emitter because the sector itself is so large. Agriculture is still the largest source of employment in the global economy, with 1 billion people employed in the sector, equal to 30 per cent of the global workforce. Agricultural activity is also a major contributor to both GHG emissions and excessive material extraction. The transition to sustainability in agriculture will therefore significantly impact the

working lives of the largest proportion of the global workforce, requiring, as such, close attention on how best to expand decent work opportunities in the transition.

Considering still another perspective, the ILO estimates the degree to which a wide range of employment situations depend on the provision of ecosystem services. For example, dryland farming relies on rain for irrigation and farmers rely on forests to prevent floods. Coastal fishing relies on the biodiversity of the ocean and its capacity to renew fish stocks. The systems include the purification of air and water, the pollination of crops, the control of agricultural pests, the moderation of temperature extremes, protection against storms, floods and wind, and support for diverse human cultures and aesthetic beauty. The ILO estimates that 1.2 billion jobs — 40 per cent of global employment — depend on these services being provided adequately, even though the provision of these services is not adequately captured in GDP.

The extent of dependency on ecological services is most significant in Africa, where fully 59 per cent of employment is tied to having access to these services, and Asia/Pacific, in which the dependency rate is 47 per cent. The figures are lower in the Americas, Europe and the Middle East, but even in these regions, the ILO estimates the figures to be between 15 and 17 per cent of employment.

The critical point is that climate change and other forms of environmental degradation put these forms of employment at risk. Thus, the authors report that a rise in the mean global temperature above 2°C will, without adaptation, negatively impact maize, wheat, rice, cocoa, coffee and tea leaves in tropical and temperature regions. Rising temperatures to this degree will also have a significant impact on productivity and occupational safety. The authors cite figures of productivity losses due to heat stress to be especially high in agriculture, and therefore in regions with high proportions of agricultural employment. They estimate these losses to be as high as nearly 5 per cent of productive hours lost in Southern Asia and Western Africa. In short, the capacity to produce food and the capacity of people to work in agricultural are severely threatened by the prospect of rising global temperatures.

The study also offers detailed discussions on a range of policy measures that combine environmental and labour legislation. For example, they report on the extent to which labour concerns are included in climate change policies for a sample of 26 countries, from countries in all regions of the world. The news they report is mixed. That is, roughly half of the countries do include skills training and capacity building for adaptation as part of their package of climate

change policies, as well as job creation as one objective of these policies. But only about 15–20 per cent of the countries have incorporated other employment-focused considerations, such as decent work, just transition and occupational health and safety, into their overall climate programme. Making these issues more prominent clearly needs to be a concern moving forward.

The authors do not report how the various forms of regulations have actually impacted working conditions. Providing evidence on this would have been illuminating. For example, it would be valuable to know what has been the actual impact of including a decent work standard in climate change policies in the 20 per cent of countries that have included these measures relative to the 80 per cent of countries that have not.

JUST TRANSITION

It is only a modest exaggeration to say that the fate of the planet depends on whether we can put in place just transition policies for the workers and communities who will be negatively impacted by the decline and shuttering of the fossil fuel industry. Just transition policies are certainly justified according to any standard of fairness. But they are also a matter of strategic politics. Without such adjustment assistance programmes operating at a major scale, the workers and communities facing retrenchment from the clean energy investment project will, predictably and understandably, fight to defend their communities and livelihoods. This in turn will create unacceptable delays in proceeding with effective climate stabilization policies.

Greening with Jobs describes a range of initiatives that, in combination, can help deliver a just transition. These include income replacement, job placement, skills retraining and support for relocation. In terms of measures already in operation, the ILO gives emphasis to unemployment protection schemes. They also describe cash transfer programmes and public employment programmes focused on climate mitigation and adaptation, and payments for ecosystem services, such as companies paying farmers in the tropics to plant more trees and maintain forests.

These are valuable discussions. But there are also significant gaps in their coverage. To begin with, the discussion gives no indication as to the actual levels of support that will be needed for the affected workers to feel that they are being provided with more than what, in US

labour union circles, is commonly referred to as 'burial insurance'. Thus, with respect to unemployment insurance — a centrepiece of just transition policies — a reasonable first question is: what is the wage replacement rate for the displaced workers? Within the OECD countries, for example, wage replacement rates range over the first year of unemployment between 8 per cent in the US to 59 per cent in Germany. Sweden provides 61 per cent wage replacement over 2 years.[7] Obviously, where this figure would fall under a clean energy just transition programme will be critical.

One way in which the costs of a generous unemployment insurance rate can be minimized is to provide job guarantees to displaced fossil fuel industry workers as a complementary measure. This becomes a viable proposition if the employment guarantee is linked to the rapid expansion of the clean energy economy. Of course, there will be some skills mismatches in attempting to move workers from fossil fuel-related jobs into the clean energy industry. This problem can be mitigated through high-quality skills training programmes, as described by the ILO. In addition, a high percentage of jobs do match up well in terms of skill requirements between the fossil fuel and clean energy sectors, such as in administration, accounting, transportation, legal matters and office support.

A second major issue neglected in the ILO discussion is the treatment of pensions for fossil fuel industry workers. With the fossil fuel corporations facing persistent contraction, it follows that the solvency of the pension funds that they maintain for their employees will be threatened. It will certainly not be a priority for the declining companies to protect the funds they had set aside for their workers' pensions. Thus, legal protections for the pensions will need to be established. This is especially important because, once we recognize that the clean energy transition will proceed over a roughly 30-year time span, then in fact, most of the contraction in employment should be manageable through voluntary retirements as opposed to layoffs. As such, guaranteeing the pensions of the retiring workers will be central to the execution of the just transition.

Another area that needs to be included in just transition discussions is reinvestment and general support for communities that are, at present, heavily dependent on the fossil fuel industry. These communities will face formidable challenges adapting to the fossil fuel industry's decline. One obvious set of projects would be to clean up and reclaim the land

[7] See: https://stats.oecd.org/Index.aspx?DataSetCode=NRR

surrounding abandoned coal mines as well as oil and gas production sites. Another is land repurposing. A prominent case of successful repurposing has been the experience in Germany's Ruhr Valley, which has been the traditional home for its coal, steel and chemical industries. Since the 1990s, the region has advanced industrial policies to develop new clean energy industries. In his valuable survey of the Ruhr Valley experience, Galoczi (2014) writes:

> The Ruhr experience …shows that a complex process of restructuring from resource-intensive industrial base towards a green energy-efficient economy requires a comprehensive policy framework. Structural and reginal policies in the Ruhr included not only industrial regional development and urban recreation policies, but also education and laboour market policies, which were equally important. Moreover…land use and building regulation were also of key importance. A new concept for the utilization of land in the form of industrial and landscape parks gave a new impetus to regional development, (2014, p. 239).

As one important example of this repurposing project in the Ruhr region, RAG AG, a German coal-mining firm, is in the process of converting its Prosper-Haniel coal mine into 200 megawatt pumped-storage hydroelectric reservoir that acts like a giant battery. The capacity is enough to power more than 400,000 homes in North-Rhine Westphalia.[8]

CONCLUSION

Overall, the ILO's *Greening with Jobs* succeeds as an important contribution towards building a unified programme for achieving climate stabilization, expanding decent job opportunities and raising mass living standards for working people and the poor throughout the world. I conclude this while also recognizing what are, in my view, some weaknesses and significant gaps in the authors' analysis.

Over the past 1–2 years, the range and level of support for a viable global climate stabilization project equal to the magnitude of the crisis has grown exponentially. Thus, in

[8] See, for example, Chow (2017).

2018, the European Commission published a report titled 'A Clean Planet for All: A European Strategic Long-term Vision for a Prosperous, Modern, Competitive and Climate Neutral Economy'. The EU report recognizes that 'in order to limit temperature increase to 1.5°C, net-zero CO_2 emissions at a global level needs to be achieved around 2050 and for all other greenhouse gases somewhat later in the century' (2018: 5). The report concludes that the EU will need to 'achieve greenhouse gas emissions neutrality by 2050' (ibid.). In the United States, major Green New Deal initiatives have gathered strength in a several states, including California, New York, Washington and Colorado, representing nearly a quarter of the total US population.[9] This is despite the adamant climate change denialism of the Trump administration. It is especially notable that in New York, Washington and Colorado, these initiatives have been either led or strongly supported by the mainstream labour movement, working in coalitions with a range of environmental organizations. Similar substantial initiatives are advancing throughout other regions of the world, including sub-Saharan Africa.[10] Such detailed policy initiatives are all in addition to the heightened level of worldwide climate activism, as represented by the September 2019 Global Climate Strike.[11]

The challenge facing humanity with climate change is without precedent. Within the context of this urgent historical moment, the Report will serve as one valuable resource in enabling us to achieve a viable global climate stabilization path.

[9] Pollin et al. (2017a, 2017b, 2019) includes descriptions of these activities in New York, Washington and Colorado.

[10] See: www.afdb.org/en/topics-and-sectors/initiatives-partnerships/green-growth-initiative

[11] As reported in the *New York Times* (Sengupta, 9/20/19), "Anxious about their future on a hotter planet and angry at world leaders for failing to arrest the crisis, masses of young people poured into the streets on every continent on Friday for a day of global climate protests. Organizers estimated the turnout to be around four million in thousands of cities and towns worldwide. It was the first time that children and young people had demonstrated to demand climate action in so many places and in such numbers around the world,"

APPENDIX I

ESTIMATING EMPLOYMENT IMPACTS OF CLEAN ENERGY INVESTMENTS

1. In order to estimate a figure for job creation through any given clean energy investment project, we first need to specify how much money will be spent on clean energy investments to achieve the given emissions reduction target. In my reading of the Report, I could not find any reference to such a figure, either in the main text or in Appendix 2. By my own preliminary calculations, working from earlier detailed modelling exercizes, I roughly estimate that to reduce CO_2 emissions alone — that is, not including other sources of GHG emissions — by about 45 per cent by 2030 will require a level of clean energy investments at about 3 per cent of global GDP per year from 2021–30.[12] Working with the estimate of the International Energy Agency (IEA) that global GDP growth will average 3.4 per cent per year from 2021–30 (IEA 2018), that implies that global GDP will rise from its current level of about US$ 80 trillion to US$ 115 trillion in 2030. It follows, in turn, that clean energy investments in 2030 would need to be about US$ 3.5 trillion.
2. As a rough lower-end approximation, I estimate that job creation through clean energy investments will be 50 jobs per US$ 1 million in spending. I derive this figure based on the results from the previous modelling exercises noted above. Of course, these previous estimation exercises find that the figures on job creation through clean energy investments vary widely by country. But, again, as a rough approximation, let us allow our estimates for Brazil and South Africa respectively to serve as a rough median for a global figure on job creation per US$ 1 million in expenditures. That would imply a median global figure of roughly 50 jobs per US$ 1 million. This follows based on the figure we have estimated for Brazil at 37 jobs per US$ 1 million and for South Africa at 70 jobs per US$ 1 million.[13]

[12] These previous modelling exercises include Pollin et al. (2015a), Pollin et al. (2015b), Pollin and Chakraborty (2015), and Page-Hoongrajok et al. (2017). See also Chen (2019).
[13] Summary figures on job creation per US$ 1 million in clean energy investments are reported in Pollin (2015: 79).

3. Hence, if the global economy spends US$ 3.5 trillion in 2030 on clean energy investments and the jobs created through those investments are at roughly 50 jobs per US$ 1 million in spending, it follows that the total level of job creation through these investments in 2030 would be 175 million.
4. This estimate does not take account of gains in labour productivity between 2021 and 2030. If we assume that labour productivity in clean energy investment activities rises at a rate of 1 per cent per year between 2021 and 2030, then that would lower the job estimate to roughly 160 million jobs in 2030.
5. The 160 million figure for job creation in 2030 will be a lower-end figure if we allow that clean energy investments in China and India, along with other large economies in which labour intensity of clean energy investments are relatively high, are proportionate to their contributions to global GDP growth that year. The estimates my co-authors and I have generated are 133 jobs in China and 262 in India per US$ 1 million in spending — i.e. well above my rough approximation of a global median figure of 50 jobs per US$ 1 million in clean energy investment spending (see Pollin 2015, p. 81 for summary of country-specific figures).
6. Note that this estimate of 160 million jobs is broadly consistent with a rough approximation of the job estimate we would derive through scaling clean energy investments relative to the size of the global labour force as of 2030. At present, the global labour force is 3.4 billion people. If we assume the labour force grows by 2.5 per cent per year, we can expect the global labour force to have reached 4.4 billion people by 2030. Three per cent of this global labour force would therefore be around 130 million people. This would imply that the share of the labour force engaged in clean energy investments would be equal to the share of GDP being spent on clean energy investments that year. However, this 130 million figure for 2030 clean energy-based employment assumes that the labour intensity of clean energy investments would be approximately equal to the average labour intensity of all activities for the global economy overall. In fact, in general, clean energy investments are relatively more labour intensive than the average for all global economic activity. As such, a figure of 160 million jobs would be broadly consistent with our approximate figures for: 1) the share of clean energy investments relative to global GDP; 2) the size of the labour force by 2030; and 3) the

expansion of relatively labour intensive activities in the global economy through clean energy investments. This general result would still follow even if we allow for an official rate of global unemployment in the range of 7 per cent.

7. Overall then, the ILO estimate of global employment generated by clean energy investments by 2030 as ranging from 0.3–0.4 per cent over a business-as-usual scenario appears inconsistent with what we would expect for the size of the 2030 labour force and the magnitude of clean energy investments required to reduce emissions in the range of 45 percent by 2030. As noted in the main text, at no point in the study do the authors provide the necessary relevant detail that explains how they derived their result. This is despite the fact that Appendix 2, 'Using Multiregional Input–Output Tables to Estimate the Employment Effects in a Green Economy', begins with the following statement:

> This appendix provides methodological details on the procedure used to estimate the number of jobs created and destroyed, as well as the change related to wages, emissions and skills, and gender composition of the economy under certain scenarios associated with a low-carbon and resource-efficient economy (p. 162).

Appendix 2 further explains its primary data source as being Exiobase. It explains that Exiobase 'is a multiregional input–output and supply-and-use table (MRIO) and reports the interlinkages between final consumption, the flow of intermediate and final goods and factor inputs into production' (p. 162).

Their description of Exiobase notwithstanding, the authors still do not report the most salient underlying results that establish the foundation for estimating job impacts of a green economy transition. The first set of critical data are the employment/output ratios that one derives within the input/output tables for the range of clean energy and other green economy investment activities. The second set of critical data are the equivalent employment/output ratios for activities that will be phased out under a green transition, starting with fossil fuel production.

The authors also do not provide estimates as to the level of spending that will be required to achieve the green transition at the scale and at the pace that is warranted. That is, there is no point in the study at which the authors present something like figures equivalent to those I have reported above — i.e. that the required level of global

investment for a clean energy transition will be in the range of US$ 3.5 trillion as of 2030 and that a rough approximation as to the aggregate employment/output ratio associated with this spending level will be 50 jobs per US$ 1 million in spending.

8. I am not aware of a definitive figure for total employment in the global fossil fuel industry. I did not find such a figure reported in the Report. For the US, total employment in the coal, oil and natural gas industries as well as major ancillary industries is roughly 800,000.[14] Total US-based fossil fuel production accounts for a bit less than 20 per cent of total production. If we assume that average labour intensity for global fossil fuel production is roughly triple than for the US, that would imply that global employment in the fossil fuel and ancillary industries to be roughly 12 million. If we then assume that this total 12 million person labour force contracts at a steady rate to zero as of 2050, that would imply a rate of contraction of about 400,000 jobs per year. Therefore, over the 10-year period 2021–30, total job contractions in the fossil fuel industry would amount to 4 million. This figure is fairly close to the ILO figure of 6 million job losses as of 2030.

[14] See Pollin and Callaci (2018).

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