

Background Paper

Bouncing Forward Sustainably: Pathways to a post-COVID World Sustainable Energy

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Abstract

The global lockdown due to COVID-19 has reduced industrial activities, construction, tourism, material demand, and mobility. This has impacted many sectors of the global economy including the energy sector which has witnessed movements both towards and away from sustainability. Key trends observed include a reduced demand for both energy and energy services, zero to negative oil prices, disruptions in the supply chain of energy technologies and materials – specially for renewable energy, and a decline in investments. This has led to welcome reductions in greenhouse gas emissions and air pollution, revealed opportunities for new and digitalized business models and responsible lifestyle choices, but all these will be short lived if we go back to business as usual.

Such behavioral and societal changes have revealed the potential for structural change and transitions in demand for energy services towards sustainability. An interesting revelation is that the positive fallouts for sustainable development are all related to what are commonly perceived to be difficult-to-overcome barriers such as lifestyle choices, behavior, and business models. Whereas the negative fallouts for sustainable development are the relatively easier to address issues of reinstating supply chains and kick-starting/accelerating investments in sustainable energy. As the world looks to recover from the economic and jobs related consequences of the pandemic, all stakeholders have a responsibility to ensure that we create a system of incentives to reward sustainable behavior while penalizing those actions that would take us back to the path of unsustainability. For the energy sector, this would translate not only to the choices that influence the supply of energy, including evaluating the balance of centralized and decentralized energy options, but also the choices that would impact the demand for energy itself! Re-examining these business models from the point of view of contributions to economic growth and jobs, while building on heightened awareness and a desire for green growth is the imperative.

The way forward:

The economic downtime due to COVID-19 and resultant budgetary constraints have raised concerns on the long-term impact of the pandemic on Sustainable Development Goals (SDGs) and climate efforts. Stimulus packages are being implemented to recover economic growth and jobs – these may not necessarily coexist with combatting climate change or building resilient societies unless a “new normal” will be embedded in the design and implementation of such stimulus packages.

Ensuring that we recover in a more sustainable manner, building on hard-earned insights into transformative change potential and opportunities for alternative development pathways from the COVID-19 response will require us to:

- i. Further expound on new and innovative job-creating, economic opportunities that are compatible with sustainable energy goals, as for example the provision of mobility services or meeting demands for shared workspaces and shared vehicles
- ii. Build confidence in the ability and agility of a re-designed energy system to respond to evolving and dynamic demand patterns

- iii. Empower society at large to meet their socio-economic obligations and consumption needs with minimum carbon and environmental footprint

Team Members

This is the first draft of the Background Note of the theme “Sustainable Energy” of the ISC-IIASA Consultative Science Platform. The team of “Sustainable Energy” is composed of the following. IIASA Co-lead: Luis Gomez Echeverri; IIASA Senior Advisor to the team: Keywan Riahi; Alternate Lead at IIASA: Behnam Zakeri; and Co-lead at ISC: Katsia Paulavets. Other members of the team include, Leonardo Barreto and Shruti Athavale (Austrian Energy Agency), Dolf Gielen (IRENA), Joeri Rogelj (Imperial College London and IIASA), Christian Ellermann (African Development Bank), and Rana Ghoneim (UNIDO).

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Introduction: COVID-19 and Energy

COVID-19, first reported in China in end-December 2019, took the world by storm. Even after a few weeks of experience with the virus, until then largely restricted to China, the rest of the world did not see the virus as a risk – leave alone an existential threat to many! Within a matter of the next 3-4 weeks, the wheels of the world economy screeched to a halt. To curb the international transmission of COVID-19, country after country closed its borders to international air travel. This was soon followed by the closing of regional and domestic air travel too. This was invariably followed by a lockdown with nearly half the world under lockdown by the end of March 2020. Slowly, these measures are being relaxed. However, what is certain is the enormous economic impact of the shutdowns – the world is already said to be in a recession worse than that experienced in 2009 as per IMF. The long-term impacts of the pandemic on human well-being, the economy and the energy sector are however uncertain, raising questions and concerns on how the post-COVID-19 recovery will contribute to or frustrate efforts for reaching the (SDGs) and climate stabilization.

The economic and social aftermath of the pandemic will strain countries, private business and households and this is likely to affect the energy transition in the immediate future. Reduced industrial activities, global travel and tourism, reduced consumption of consumer goods, and lower mobility has impacted many sectors of the global economy including the energy sector in short term. However, there have been some immediate benefits. The reduced demand for transportation fuels has led to a dramatic improvement in the air quality of cities around the world. How low will demand fall and how long will this demand suppression lasts is anybody's guess just now, but there is an increasing recognition that full economic recovery could take several years¹. It needs to be borne in mind that both the energy producing sectors and the intensive energy consuming sectors employ large numbers of people who are facing a very uncertain and volatile future.

The COVID-19 crisis has clearly shown the urgent need to act swiftly and decisively once the scientific facts for an imminent global crisis have been established. The climate crisis is similar and requires us to dramatically accelerate the pace of the transition towards resilient and environmentally compatible energy systems. Apart from the forced brakes applied on mobility, several choice barriers on conducting businesses and on consumption patterns are also being broken – possibly irreversibly – leading to a continued depression in demand for energy. In the business world, work-from-home was largely practiced by the millennials in the technology sectors. At a private level, millions of consumers have been introduced to the convenience of online shopping, overcoming any entry barriers that they may have faced. A whole new industry – at least in terms of scale and efficiency – is emerging with unprecedented innovation and job opportunities. This points in the direction of the need to have recovery packages that are vital to get economies going and put them on a clean path.

Green stimulus responses to the COVID-19 crisis can contribute to, and accelerate the pace of, this transition. In this sense, the COVID-19 crisis, as devastating as it may be, represents both a challenge and an opportunity

¹ World Bank, The Global Economic Outlook During the COVID-19 Pandemic: A Changed World, Feature story, June 8. World Bank, Washington, D.C.

to put the necessary instruments in place to lead the world towards a climate-resilient, low-carbon and environmentally benign global energy system while leaving no one behind.

Overarching questions:

- How should COVID-19 and related recovery packages be directed to create the maximum impact on the transition to sustainable and resilient energy systems?
- How can a decarbonized, decentralized, and digitalized energy systems make all of our society more resilient?

Energy and Sustainability

Modern energy consumption by all is acknowledged to be an essential driver for achieving the sustainable development goals. But, the consumption of fossil energy forms has, and is, contributing to nearly 70% of the emissions of greenhouse gases in the world. Coal, followed by oil and gas, has the highest emission rate of carbon dioxide. Both the Paris Climate Agreement and SDG 7 (Energy) of Agenda 2030 call for 3 critical actions to ensure that the world moves towards a sustainable energy pathway. The call is for moving aggressively towards renewable energy; managing energy demands and doubling the rate of energy efficiency improvements; and, ensuring access to modern energy for all. While the world had already made huge strides in promoting renewable energy, it is established that we are not on track to achieve SDG 7 by 2030² on all three sub-goals – with energy access lagging the most.

To keep the world on track to limit temperature increase to 1.5 degrees Celsius over pre-industrial levels, the IPCC has estimated³ that coal consumption should decline by 97% and that oil consumption should decline by 87% by the year 2050, over 2010 levels, in a limited or no overshoot scenario. The same IPCC report estimates that final energy demand in 2050 relative to 2010 needs to reduce by a third while the share of renewable energy in total electricity needs to go up to 77%!

More importantly, several studies have estimated that “declining carbon emissions after 2020 is a necessity for meeting the Paris Agreement temperature goal of “well below 2 degrees”⁴. This would mean that fossil energy consumption should start significantly declining from 2020 onwards.

COVID-19 and Sustainable Energy

Today, the COVID-19 pandemic has the oil industry staring at an existential crisis – the drastic and rapid fall in demand has not only taken oil prices to the lowest levels seen in decades but, coming on the back of a glut, have seriously dented the viability of new investments as well as existing assets. The reductions in demand for

² <https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2019/May/2019-Tracking-SDG7-Report.pdf>

³ https://www.ipcc.ch/site/assets/uploads/sites/2/2019/05/SR15_SPM_version_report_LR.pdf

⁴ <http://www.realclimate.org/index.php/archives/2017/06/why-global-emissions-must-peak-by-2020/>

electricity are impacting coal based generation – a great employment generator at least in the developing world – most adversely too as compared to gas and nuclear power generation⁵. In this scenario, to urge countries to use their policy frameworks and fiscal stimuli to support a more sustainable energy industry seems heartless – however, it is also totally irrational to continue to support these industries when they are clearly in their sunset phase. Even today, the fossil fuel industry enjoys a subsidy of 370 billion \$ per year, as against \$ 100 billion for renewable energy⁶! It is the energy economy of the past few decades that has brought the planet to the brink from a sustainability perspective – we cannot go back and support the same! And if we continue to support the fossil fuels sector, we are at great risk to take the world to other tipping points and extreme events as identified in the Fifth Assessment Report of the IPCC.

But to be realistic, it is well understood that we cannot continue in a state of lockdown forever. It is also a given that the post-COVID-19 recovery will need energy to drive the economy and society. So, how can this recovery be designed such that the energy economy of the future would align with the call of SDG 7 and such that the awareness created, and the behavioral willingness to change forced by this pandemic, are not lost.

The post-COVID impacts span both energy demand and supply with strong implications for the environment and the economy. Here, we review how COVID-19 impacts and offers opportunities for a more sustainable path in the future:

- Energy demand, considering behavioural and lifestyle impacts, as well as impacts on the industry and transport sectors
- Energy supply, including both renewable and non-renewable sources
- Energy policy and cooperation, both at national and international level and in support of energy access

Energy Demand: How to maximize energy demand reduction opportunities

On the energy demand side, the pandemic has forced several rapid innovations in the way that the world goes about its business and life. As a result of the global lockdown and containment measures, mobility has declined to an unprecedented level. Road transport in regions implementing lockdowns has fallen between 50% and 75% compared to corresponding period in 2019, with global average road transport dropping by 50%⁶. Educational institutions have risen to the challenge and placed a record number of their courses online and are engaged in online teaching at all levels. Offices and non-customers facing businesses have encouraged work-from-home and are increasingly becoming confident of their ability to maintain efficiency and productivity using this means of business handling. Where residential circumstances make work-from-home difficult, area based shared workspace arrangements can provide a good proxy and still result in significant energy savings. Conferences and workshops with fairly large number of participants have shifted to the use of online platforms and have been conducted successfully across the globe. On the flip side, the willingness of populations to travel in crowded public transport modes is likely to decline leading to a larger share of vehicle ownership or individual vehicle use based on a shared principle.

The widespread efforts on financial inclusion and e-banking, e-finance transactions have facilitated e-commerce at an unprecedented level. Even the business and leisure related travel industry is now innovating to see how they could provide a range of alternate services to best use their assets. Where manufacturing cannot be

⁵ International Energy Agency, Global Energy Review 2020, the impacts of the COVID-19 crisis on global energy demand and CO2 emissions, IEA, Paris, April, 2020.

⁶ <https://www.iisd.org/gsi/news-events/reforming-subsidies-could-help-pay-clean-energy-revolution-report>

substituted by services, the management of product consumption needs through the maximization of shared services can result in a more material/resource efficient meeting of service demands.

The key learning that COVID-19 has provided us is that businesses and people can be fairly adept at innovating and adapting to change. However, they may need to move from the current temporary-fix solutions to more customized and efficient solutions for the longer-term sustainability of such solutions. This is where governments need to ensure that the policy/regulatory environment would need to adapt quickly to align incentives with desirable outcomes. One key impetus that needs to be provided is for the *strengthening of an inclusive and reliable digital economy* adequately supported by entrepreneurial initiatives and human capacities. The other key policy impetus needs to go to the functioning of a *sharing economy* – from mobility services, to online delivery systems to workspaces and more.

The lockdown measures reduced demand for electricity by up to 20% in 2020⁷⁸⁹¹⁰ with the largest impacts in those economies implementing strict containment measures with the service sector making up a large segment of the economy. On the positive side, these reductions in energy demand, mobility and industrial activity have led to beneficial short-term effects on air quality and greenhouse gas emissions.

From an equality and energy poverty perspective, the availability of modern energy services is important during and after the pandemic. Lacking access to affordable modern energy services results in large inequalities in the way population groups are impacted by COVID-19 containment measures or by COVID-19 itself. Electricity access is crucial for access to information, option for social interaction, remote working, home-schooling during the lockdown, and operating of health facilities to provide health services. Access to digital technologies that rely on electricity are needed for remote working and home-schooling, for example. Thermal comfort and well-being can be compromised in self-isolation if affordable energy (heating/cooling) is a burden for householders. The impact of clean cooking on health (respiratory disease) and how one could be impacted by COVID-19 is a particular concern for vulnerable and low-income families.

While the short-term impact of COVID-19 was reduction in mobility and energy demand in general, the long-term effect of the pandemic on energy demand remains uncertain. The way businesses and offices will function after the pandemic, with possible increased in digitalization and remote working will lead to lower commuting and business travels. The international tourism, travelling, and trade may experience a longer recession compared to other sectors with major impacts on tourism-based economies and the aviation and hospitality industry. This may trigger new structural shifts in the economy and rethinking of some activities and services with implications for the energy sector. For example, road and rail transport may replace the aviation in intra-continental travels while using private or shared car services and bikes may reduce the use of public transport in cities and densely populated urban areas. This has been an opportunity for some cities taking to extend the bike lanes, while some countries are introducing packages for in-country summer vacations.

If economic downtime persists after the lockdown period, energy prices will continue to be lower than expected. This reduction in final energy prices will put policies for improving energy efficiency and its role in achieving SDG7 at risk as consumers find it economically less attractive to invest in such measures. At the same time, energy efficiency can contribute to economic recovery in the long term and it is important that stimulus packages carry energy efficiency incentives to help a green recovery. There is also an important role for consumers in

⁷ Le Quéré, et al, 2020. Temporary reduction in daily global CO2 emissions during the COVID-19 forced confinement. Nature Climate Change. <https://doi.org/10.1038/s41558-020-0797-x>
Based on the following sources:

⁸ <https://posoco.in/reports/daily-reports/>

⁹ https://www.eia.gov/realtime_grid/-/status?end=20200608T07

¹⁰ <https://transparency.entsoe.eu/>

changing the market and both individual and collective actions of energy consumers can have a substantial impact on the energy transition.

The overarching questions can be divided to the following points related to energy demand and services:

Demand for energy in a post-COVID-19 world:

- How can demand shifts away from high energy and material intensity be effected? (Avoidance)
- How can work, business and lifestyle choices be nudged towards low energy demand scenarios? (Reduction)
- Can consumer choices be steered towards renewable energy? (Clean energy)

Energy Supply: The renewable energy sector is ready for a major take-off

Where demand reduction/management and shared services prove inadequate, the role of renewable energy needs to be aggressively stepped up. The renewable energy sector has witnessed an impressive growth in the last few years with prices of solar and wind energy continuing to drop. As per the IEA "The share of renewables in world electricity generation reached 25% last year while remaining at 10% in heat and below 4% in transport demand"¹¹.

Clearly the transport sector and the provision of mobility services needs careful systemic attention. The incentivization of shared services, supporting attractive public transport options where available, as opposed to unsustainable ownership of vehicles can also serve to reduce the spread of charging infrastructure that needs to be set up for electric vehicles. Reduced support infrastructure costs can improve the attractiveness of e-vehicles used for commercial purposes. E-vehicles, powered by renewable energy, would help us stay away from fossil fuels and can be supported by both regulatory and fiscal measures.

Utility scale renewable energy sources, especially based on solar and wind energy, are increasingly price competitive at a grid level. A lot of this has been, and is expected to be, led by growth in the solar industry. The challenge posed to the renewable energy sector to fill in the gap likely to be created by a reduction in fossil demand is that most of the supplies of solar panels and equipment comes from China and the sense of vulnerability from supply disruptions is acute. Additionally, is the continuing concern around stability of old-fashioned grid infrastructures.

The landscape for progress in renewable energy and clean energy investment may be more uncertain than fossil fuels. Renewable energy showed an increasing share in electricity generation in some regions like Europe, mainly due to lower electricity demand during the COVID-19 outbreak and the aftermath lockdown. This conveyed the message that local renewable energy industry is more resilient than fossil fuel as renewable energy supply, (i) is independent of inter-continental fuel shipping that could be impacted by the containment measures during the pandemic, (ii) unlike fossil fuels is not tied with limited suppliers vulnerable to geopolitical uncertainty, and (iii) is not priced through complex international markets with significant price volatility.

However, the short-term implications of COVID-19 for the renewable energy sector are marked lower manufacturing and disruptions in supply chains of green technologies, such as solar panels and batteries in major manufacturing countries like China as mentioned before, and delayed construction projects due to the lockdown measures and limited international trade. The disruptions in the global supply chains of clean technologies and limited availability of workforce can increase the capital investment of such projects. In

¹¹ <https://iea.blob.core.windows.net/assets/cf477276-f5a5-4130-9395-138035363668/Renewables-2019-Launch-Presentation.pdf>

addition, the investment capacity of utility companies is declining due to lower electricity prices, delayed payment of bills by some consumers supported by the government, and political/economic uncertainty, showing a decline of 10-15% in new investments in Europe for example¹². While the final impact of COVID-19 on renewable energy projects depends on the length of the lockdown, wind energy installations in 2020 show a decline in Europe compared to previous industry forecasts¹³. Planning and decisions in the energy sector are currently being driven by the emergency response of governments and markets but resilience of supply is gaining in importance¹⁴.

Renewables together with energy efficiency can be at the centre of a green recovery strategy. Energy security and sustainable, resilient energy systems are indispensable and energy efficiency and renewable energy offer competitive solutions in terms of economic development and job creation while also reducing emissions and fostering technology innovation¹⁵. These innovations could include more decentralized renewable energy options in the supply mix. Such options could be examined in the context not only of enhancing energy independence but also for their contribution to economic recovery and job creation.

The bigger concern is, however, the clash in the economy and possible long-term recessions that may tighten public expenditures in climate-friendly solutions and clean energy investments in different countries around the globe.

In response to the overarching questions, the following notes can be highlighted with respect to energy supply:

COVID and energy supply:

- What would be a desirable mix between large scale vs decentralized renewable energy options? What are the implications for the economy and jobs?
- Is localized energy independence the way forward? To what extent?
- How can a transition to a sustainable energy future be managed at a time of economic and political stress?

Energy Policy and Cooperation: Meeting climate and economic recovery targets, or failing both?

The temporary emission reductions in the near term do not make a significant difference for climate stabilization. The more persistent, long-term impacts of COVID-19 on energy transitions, the environment, climate change, and more broadly on SDGs largely depend on the measures being adopted to recover the economy as well as long-term changes in lifestyle, i.e. behavioural changes due to the pandemic experience. Many services and industries may revise their operations and reduce the risk or vulnerability to potential future lockdowns by increasing digitalization and changes in their day-to-day operations like introducing more virtual working environments, while individuals may seek for new ways of mobility and travelling in general.

Government-driven investment decisions will be critical to economic recovery. The government will design and implement recovery packages in the coming months, after the lockdown. The reductions in greenhouse gas emissions and air pollution that resulted from the COVID-19 lockdown measures will be short lived unless green

¹² <https://www.eurelectric.org/news/covid-19/>

¹³ <https://windeurope.org/newsroom/covid19/>

¹⁴ <https://www.atlanticcouncil.org/blogs/new-atlanticist/the-implications-of-the-coronavirus-crisis-on-the-global-energy-sector-and-the-environment/>

¹⁵ <https://www.iea.org/events/ministerial-roundtable-on-economic-recovery-through-investments-in-clean-energy>

stimulus packages are adopted, aligned with climate goals. These measures and possible support for different sectors of the economy will have a significant impact on whether nationally determined contributions (NDCs) of the Paris Agreement and globally agreed climate goals will be met. These measures can accelerate transitions to more sustainable climate and energy pathways or lock nations furthermore into a fossil-based economy. There are two important aspects in this regard. First, the need for mechanisms that could assess the socio-economic impacts of such recovery policies not to repeat failures after similar cases like 2008 stimulus effects. Second, we need to develop recipes that not only help us go through the post-COVID crisis but also serve in future crises. The role of scientific advice is critical here.

Governments will be able to intervene decisively after the short-term emergency is over to stabilize the climate, by directing systems towards cleaner modes of production and consumptions. These regulatory and policy measures require the public support. It is believed that the recent decisive measures by governments to support the health system – e.g., by executing lockdown and containment measures that could prevent the overwhelming pressure on the health system saving many lives – can act as an impetus to raise the public support for other measures such as tackling climate change¹⁶. The COVID-19 fiscal recovery packages will have a significant impact on whether global climate goals will be met in the long run or not, if avoiding wrong decisions. It is also crucial to design efficient and comprehensive packages across energy, health, digitalization etc. This is an opportunity to examine the immense fuel subsidy schemes around the world and see how these could be redirected to support investments in renewable energy.

As part of the recovery packages, integrated approaches to capacity building are necessary, which cover different actors from governments to entrepreneurs, technical professionals, and civil society, and address different segments of the value chain to foster networked entrepreneurial ecosystems.

Solid governance is fundamental for the implementation of low-carbon energy systems and must integrate various policy areas (e.g. energy efficiency, renewable energy, climate change), break silos, promote sector integration and multi-level energy and climate dialogue and regional cooperation to ensure policy implementation.

An integrated, energy systems approach must be taken to planning, implementing and reporting policy measures to take account of the interlinked nature of objectives and measures (the same measure can contribute to GHG, RES and EE targets or to targets in other sectors). Regional and international cooperation can facilitate better energy and climate policy coordination, support to implementation to cross-border projects and knowledge transfer and it is, in this sense, a fundamental element of a global green recovery strategy. Regional activities facilitate the adoption of policies and incentive mechanisms on national levels, benefiting from best practice examples, regional knowledge exchange, capacity building and large-scale awareness raising activities. In doing so, existing national approaches can be integrated while defining a common denominator acceptable to all participating countries and integrating lessons learned.

Today, the poor and marginalized sections of a country's population can be helped to leap-frog to the most sophisticated sustainable energy forms – both by exploiting the decentralized renewable energy markets being made viable in urban settings as well as by leveraging the energy service market opportunities for energy entrepreneurs. Barriers in terms of volume of demand, affordability, technological viability etc. can be addressed through the design of dynamic, viability gap frameworks and payment mechanisms supported by the digital economy.

¹⁶ Hepburn, C., O'Callaghan, B., Stern, N., Stiglitz, J., and Zenghelis, D. (2020), 'Will COVID-19 fiscal recovery packages accelerate or retard progress on climate change?', Smith School Working Paper 20-02

COVID-19 and energy policy:

- How can global energy subsidies be most effectively and rapidly redirected towards sustainable energy?
- How can global renewable energy markets be made more secure and resilient?
- How can the growing energy access challenge be addressed