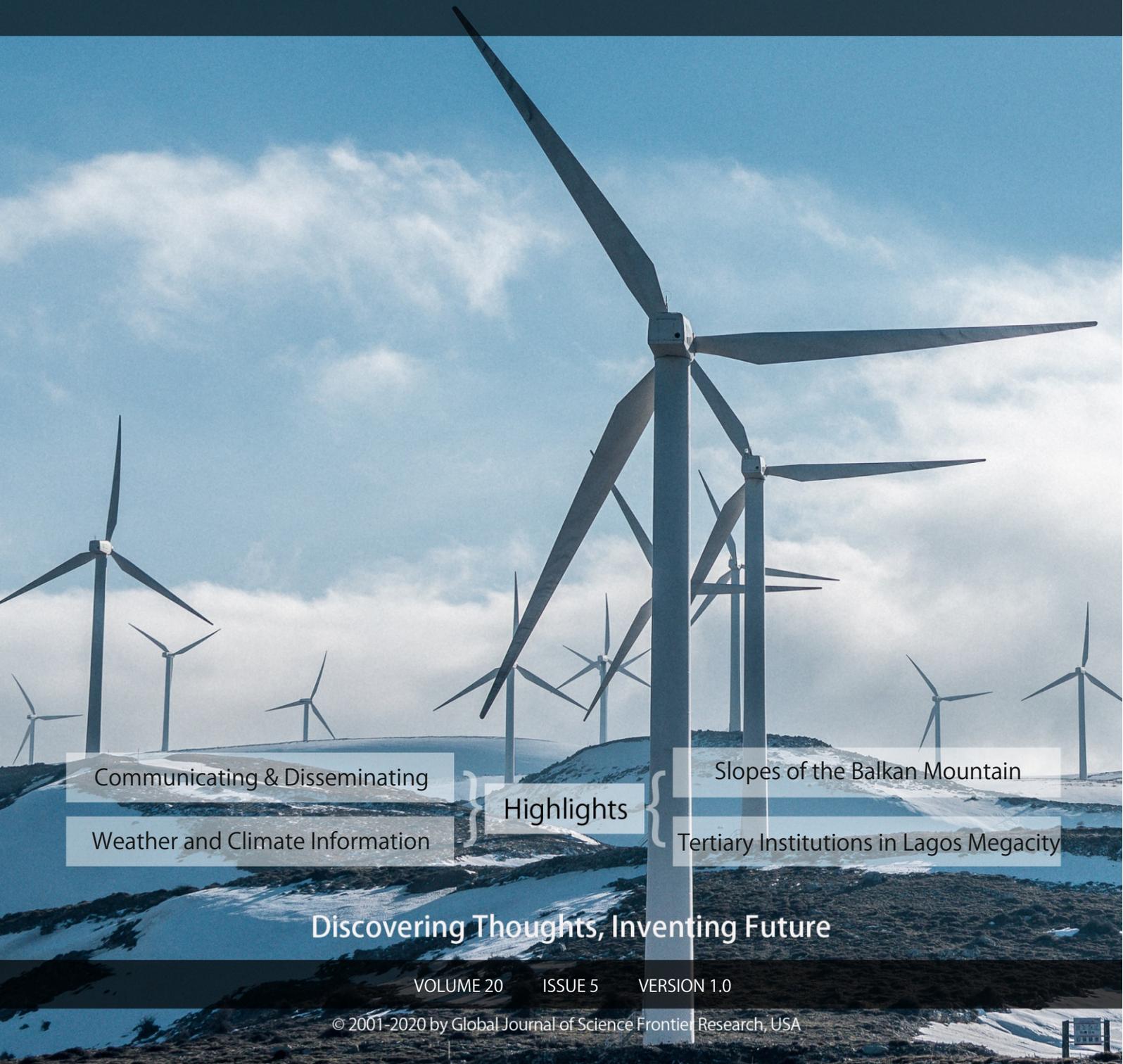


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Slopes of the Balkan Mountain

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Discovering Thoughts, Inventing Future

VOLUME 20

ISSUE 5

VERSION 1.0



GLOBAL JOURNAL OF SCIENCE FRONTIER RESEARCH: H
ENVIRONMENT & EARTH SCIENCE
Volume 20 Issue 5 Version 1.0 Year 2020
Type: Double Blind Peer Reviewed International Research Journal
Publisher: Global Journals
Online ISSN: 2249-4626 & Print ISSN: 0975-5896

Tackling Climate Change in a Changing World

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A change of this magnitude requires an overhaul of historic proportions for energy policies, and investment of the order of \$16.5 trillion. Such outlays will require profound transformation in production and transportation practices, and spending on renewables and efficiency, as well as carbon capture and storage through 2030.

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GJSFR-H Classification: FOR Code: 040104



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A change of this magnitude requires an overhaul of historic proportions for energy policies, and investment of the order of \$16.5 trillion. Such outlays will require profound transformation in production and transportation practices, and spending on renewables and efficiency, as well as carbon capture and storage through 2030.

With over 25 years since the original UN Convention, there is little tangible evidence of progress in the climate change agenda. Greater focus will be needed on policy and institutional dimensions to achieve tangible results, particularly in the power sector, which absorbs more primary energy than any other sector, and which accounts for over a third of carbon emissions.

This article is based on benchmark work to assess experiences worldwide to design policy and institutional framework for energy and environmental policies. It highlights the need for sharper attention to macroeconomic and sector policies on efficiency and effectiveness concerns, and their reconciliation with development and economic management concerns for growth and development. In the end, these have been the main stumbling blocks for progress on the subject, and capacity to adapt flexibly to emerging and changing societal demands.

Keywords: *adjustments, climate change, economic development, efficiency, emissions, energy, renewables, paris agreement.*

I. INTRODUCTION: SPRINTING IN A TREADMILL'

"Madness is doing the same thing over and over again hoping to get different results". Albert Einstein.

"However beautiful the strategy, you should occasionally look at the results". Winston Churchill.

For over 25 years, since the establishment of the UN Framework Convention on Climate Change, annual summits of the parties of the Convention (known as COP meetings) have been arranged to

establish binding obligations to track and ultimately reduce greenhouse gas emissions.

Yet, despite such massive and recurring efforts, public debates, agreements, myriads of strategy statements, and a multitude of institutions and special initiatives, there is little tangible evidence of progress in the climate change agenda¹.

In a way, the regular summitry and elaborate pageantry, has tended to shape public discourse and politics focused on local audiences perceptions of people back home – rather than serious efforts to understand the underlying issues that explain the situation as it is involving, and thus how to reverse past trends.

The time has thus come to reassess the effectiveness, orientation of such efforts, their policy and institutional shortcomings to achieve better results. This paper is to point out some key aspects that this agenda is missing, and thus areas that require urgent attention and recasting^{2,3}.

The fervent string of statements and public discourse oftentimes create a wall of distancing noise and headlines but not any visible progress to diagnose and understand the underlying issues -- and ultimately corrective actions and policies to "move the needle" for investors to address environmental issues on the ground. Accusations of lack of political will, vested interests and the like, while flamboyant and attention grabbing, are decidedly unhelpful to guide action for effective results.

This paper accordingly focuses on the "reachable" – i.e. getting the maximum reasonable results with the minimum actions and efforts as practical. This requires an empirical approach to diagnose the issues standing in the way of effective action, and a strategic approach to implementation and mainstreaming environmental concerns into broader policy-making. The operative aim is to achieve tangible progress – not the final word on the issue -- by emphasizing policies and institutions that help align interests and focus on economic incentives that facilitate initiatives to generate solutions without excessive bureaucracy.

This should give the necessary breathing room to work on more fundamental structural shifting solutions for longer term and sustained responses to megatrends facing the world.

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II. HOLD ON AND TAKE A DEEP BREATH

"Ponder and deliberate before you make a move". Sun Tzu

"One must be slow in deliberation and quick in execution". Napoleon

Much of the economic and social development over the last centuries, and associated improvements in standards of living, have been propelled by massive growth of energy demand, powered by hydrocarbons that brought about increases in CO₂ emissions.

Such development generated unprecedented progress, overcoming recurrent and widespread famines, extending life expectancy, increasing incomes in large swaths of the world. In recent centuries, this has been underpinned by productivity gains in agriculture, industry, advances in communications, transport and energy, never experienced in recorded history before.

Much of this has been propelled by technological changes leading to the industrial revolution, particularly the development of the internal combustion engine, which powered much of the productive progress since then. However, this has brought with it increases in CO₂ emissions, whose full implications are as yet somewhat unpredictable and not fully understood.

In the past decade alone, disruptions propelled transformations in where and in the way people lived – from how we move, drive, invest, to how we generate and consume energy, how we take care of ourselves. Every single facet in our lives have been challenged or reimagined.

On the other hand, human progress is outpacing the capacity of the resource environment to keep pace with the need for a balanced development.

Whether it is economic expansion (at the expense of known resource bases, such as mining and raw materials, forests), and consequent increased emissions; institutional and policy constraints to cope with ever increasing economies; growing and widening societal demands and so many other developments are testing the limits of human knowledge to develop and settle increasingly complex and emerging discontinuities.

Admittedly, there is some controversy about the underlying science claiming the connection of such developments with climate change, particularly the impact of solar radiation and other cosmological phenomena affecting global temperatures, and thus the capacity of human beings of influencing climatic conditions⁴. Several studies reconstructing temperature changes over the last 5,000 years, essentially point to large climatic changes over the millennia, related largely to changes in sun radiation rather than other phenomena^{5, 6, 7}.

That said, there is an increasing consensus that CO₂ emissions generated by human activity need to be curbed to prevent further global temperature increases, and constrain global average temperature increases to less than 2 degrees Celsius above pre-industrial (18th and 19th centuries) levels, and to pursue efforts to limit temperature increase even further to 1.5 degrees Celsius. This is in essence what has been set out in the 2016 Agreement reached by the 195 countries in climate talks in Paris.

However, all too often, the economic implications of the above-mentioned initiatives have tended to overlook, if not underrate -- and with it, the consequent resistance to the quest to constrain energy production and associated carbon emissions⁸.

The world's climate challenge has many aspects. The most important driver of climate change is the atmospheric buildup of carbon dioxide released by fossil fuel combustion, as well as methane released from the production, distribution and use of natural gas and by agricultural activities.

The social and economic damage that will be caused by climate change are byproducts of the buildup of carbon dioxide, methane, and other greenhouse gases. This includes rising sea levels that threaten coastal and low-lying regions, increased incidence of certain weather hazards, and declining crop yields due to changes in growing seasons, diminished water supplies, and proliferation of insect pests.

Other effects include climate-induced human migrations, accelerated spread of infectious diseases, and hardship resulting from the direct effects of climate change and the economic and political disruptions that follow.

III. AND WHAT DOES IT TAKE TO CHART A NEW COURSE?

"He who wishes to fight, must first count the cost" Ts'ao Kung

"When making plans, it is as well to take into account those of the enemy" Winston Churchill

Achieving the CO₂ emission and temperature goals described above requires, however, an overhaul of historic proportions for energy policies, and investment of the order of \$16.5 trillion, as estimated by the International Energy Agency. Such outlays will require profound changes in production and transportation practices, and spending on renewables and efficiency, as well as carbon capture and storage through 2030.

This is no small challenge, particularly when seen the issue in the context of competing claims on scarce resource surpluses. This is the case particularly in emerging economies whose development needs remain challenging and heavily dependent on hydrocarbons to fuel their economies – particularly in an

uncertain, if not fragile, international economic environment, to fuel production of energy-intensive primary commodities, which are the mainstay of exports and fiscal revenues for many emerging nations⁹.

Admittedly, in the last decade, accelerating gains in energy efficiency have muted growth in energy demand; mounting expansion in renewable energy combined with successive falls in global coal consumption, have led to improvements in fuel mix.

Some progress has taken place through natural gas becoming the largest source of energy growth,

boosted by a massive programme of coal-to-gas switching in industrial and residential sectors in China¹⁰.

But much more progress is needed to “move the needle” in a tangible manner, particularly in the power sector, which absorbs more primary energy than any other sector.

Adding all up, it accounts for over a third of carbon emissions, and despite the push away from coal and rapid expansion towards renewables, progress has been negligible over the last 20 years, with hardly any changes in CO₂ emissions as evidenced below:

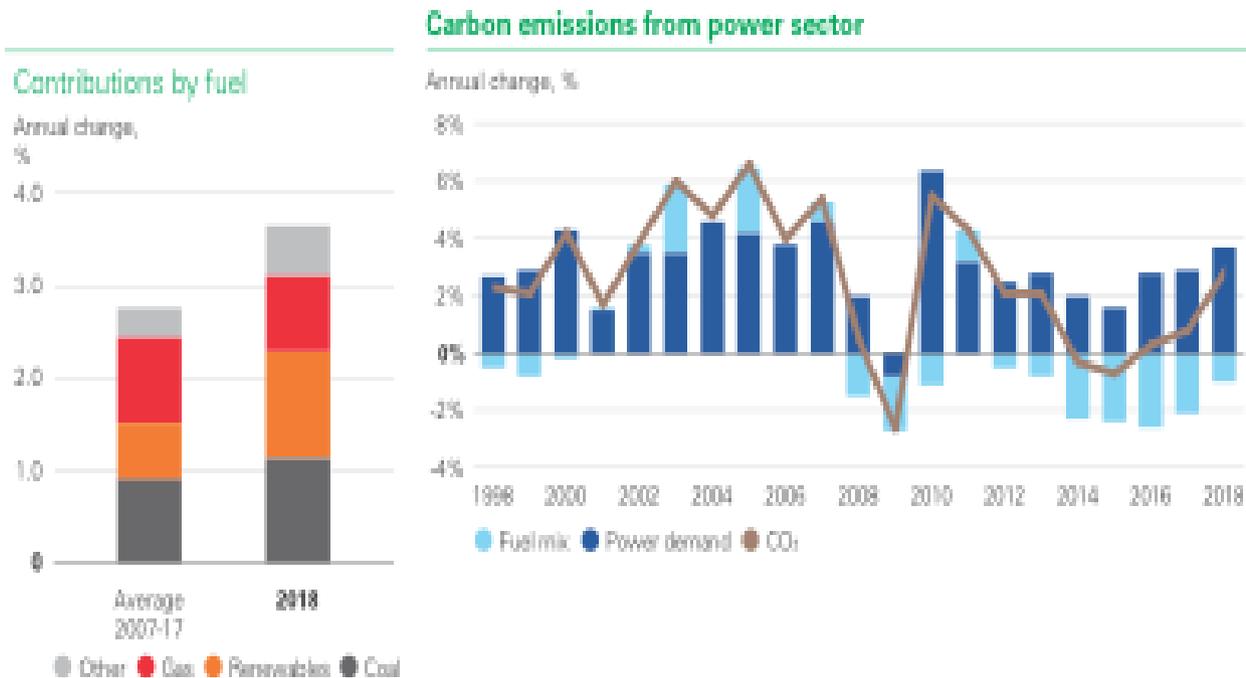


Fig. 1: British Petroleum Statistical Review of World Energy 2019: British Petroleum

Renewable energy sources, including transitional hydrocarbons such as natural gas, must become a growing part of a carbon free energy development, since they tend to have lower CO₂ emissions than traditional sources¹¹.

For the time being, though, such sources are still more expensive, particularly when subsidies are discontinued, thereby constituting in many cases situation-specific solutions, depending on local conditions (such as wind regimes or solar radiation levels), and appropriate for limited load factor requirements.

The need to move towards a decarbonized economy, provide the conditions for enhanced R&D to develop such technologies to further reduce costs and level the playing field vis-à-vis traditional energy sources.

Some “green” technologies are closing the cost gap, and are bound to become more attractive when considering CO₂ emissions.

In all, though, what the record strongly suggests is that none of the large-scale changes needed will take place in a significant manner or be politically, economically and technically easy in the near future.

Henceforth, emphasis must focus more sharply in a manner that does not affect negatively economic development – a burning concern of most, if not all emerging economies, with consequent limited incentives to make significant progress and get results in the climate change agenda¹².

IV. POISING TOWARDS THE FUTURE – THE POLICY OPTION

“Forecasting is difficult, particularly towards the future”. Popular proverb

“Forecasts may well tell you a lot about forecasters; they tell you nothing about the future”. Warren Buffet

countries. As things stand, they are likely to be the fastest growing portion of the region's energy balance as the continent's modernization unfolds¹⁴.

In all though, key at least for a good many developing countries, is the need be vigilant to avoid developing institutionally-intensive arrangements in institutionally-weak conditions, since "institution-building" mentioned in the Paris Agreement is a long and difficult road.

A policy framework must enable economic actors and civil society to interact organically, without constraints and avoid moving to a complicated regulatory system (where duplication, offsetting incentives, etc. are all too common).

The rule should be minimize the rules, use pricing where at all possible, and allow any legitimate additional costs of externalities and of compliance to environmental standards to be recouped through output

prices — thereby avoiding energy development paths that become costly and complicated.

V. CHANGING COURSE -- THE TECHNOLOGY OPTION

"Energy cannot be created or destroyed, it can only be changed from one form to another". Albert Einstein

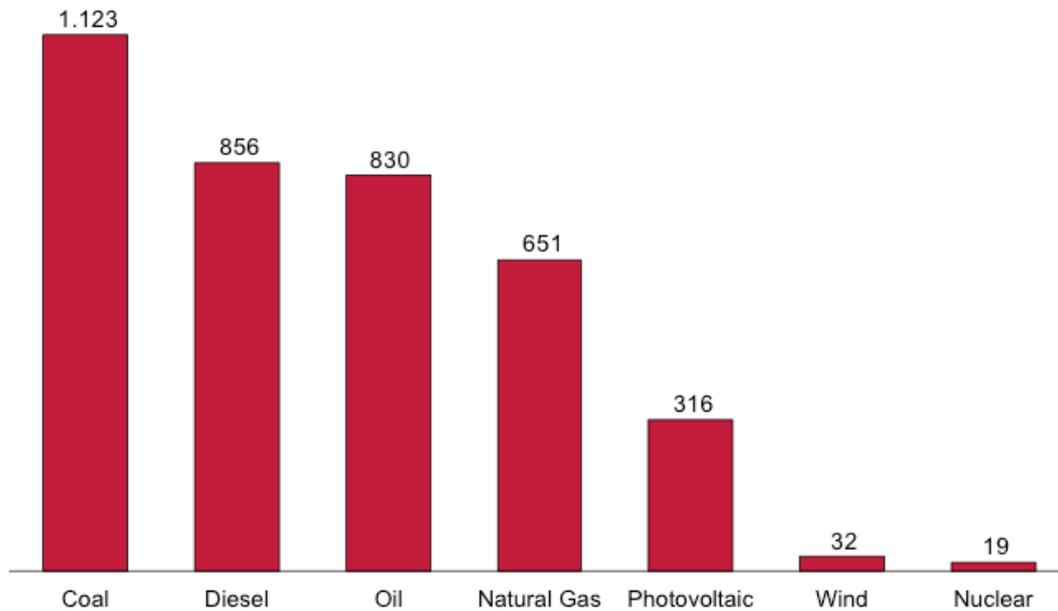
"A positive thinker sees the invisible, feels the intangible, and achieves the impossible". Winston Churchill

Renewable energy sources, including transitional hydrocarbon sources such as natural gas, must become a growing part of a carbon free energy development, since they tend to have lower CO2 emissions than traditional sources, as illustrated below:

Environment: Emissions & Local Ecosystems

There are large differences in emissions by energy source

CO2 Emissions by energy type (kg carbon equivalent/ TEP)



Sources: CNE (Chile Energy Commission): "Current Situation & Perspective"; M.Schloss et al "Cambio Climático y Energía", 2019; Inter-American Association of Energy Regulatory Agencies; M. Schloss et al "Design of an Energy Strategy for Chile: Context and International Lessons"

Fig. 3

For the time being, though, such sources are still more expensive, and thus constitute in many cases situation-specific solutions, depending on local conditions (such as wind regimes or solar radiation levels), and appropriate for limited load factor requirements (i.e. not appropriate for industrial or mining sector activities that require reliable energy supply 24

hours a day, irrespective of seasonality's, with sufficient reserve capacity).

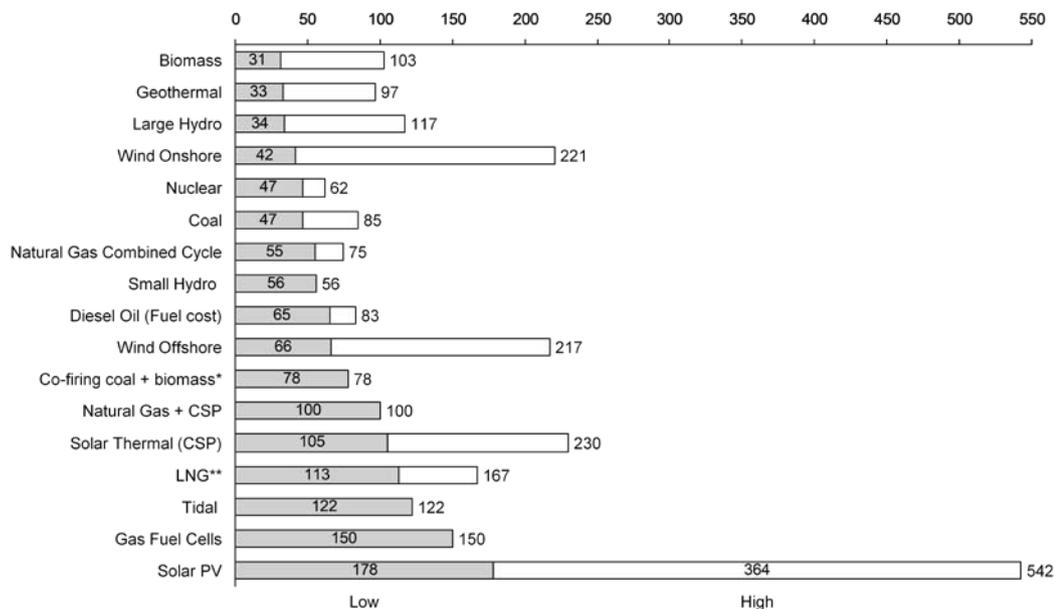
The need to move towards a decarbonized economy thus requires conditions for enhanced R&D (and associated resource mobilization in advanced economies) to develop such technologies to further reduce costs, enhance reliability and level the playing field vis-à-vis traditional energy sources.

Some “green” technologies are closing the cost gap, and are bound to become more attractive when considering CO2 emissions as can be observed below:

Security of Supply in Power Generation

...AND become even more attractive when considering CO2 emissions

“Green” Cost Comparison, Production Costs (USD/MWh & CO2 Emissions in Tons/MWh at 25 USD/ton)



Sources: IEA Energy Technology Perspectives; Ormat Technologies, Inc.

Fig. 4

In the meantime, a long-term energy strategy must rely on technological substitution of the current capital stock of non-liquid fossil fuels towards a greater mix of LNG based plant, geothermal and hydro electricity (particularly low head and run-of-river facilities). In such evolution, renewables can play a niche role, and eventually mainstream option in the energy mix.

In all, though, the world lacks the solutions that will be needed to achieve genuine global net-zero carbon emissions called by international agreements at reasonable economic and social cost. Nor are the solutions in hand to adapt equitably and efficiently to the climate-related risks that will occur even if mitigation goals are met.

Much can and must be achieved with existing technologies and policy approaches, but without game-changing advances in multiple fields of science, technology, and policy, the world's efforts to address the climate challenge may not succeed in the long haul.

Beyond that, the scientific foundations and implications of climate change remediation via solar radiation management (“geoengineering”) and even wind-based technologies will need further development to become genuinely competitive at grid levels.

Unsolved problems include cost-competitive long-term energy storage systems (advanced batteries,

fuel cells, thermal storage, and clean hydrogen systems) to enable 24-hour energy supply from renewables at competitive costs.

Similarly, technical work is needed to develop scalable low-carbon firm electricity generating technologies (e.g., advanced nuclear); low-carbon manufacturing processes for cement and steel; viable alternatives to these materials; long-distance low-carbon transportation by land and sea; low-carbon aviation; and carbon-capture, storage, and utilization.

VI. REFRAMING THE COURSE – THE PROCESS OPTION

“Everything must be made as simple as possible. But not simpler”. Albert Einstein

“Dream in a pragmatic way”. Aldous Huxley

Much more progress is needed to advance in a tangible manner, particularly in the power sector, which absorbs more primary energy than any other sector. And yet, neither the policy nor the technology options referred to above, provide a clear and straightforward direction that can assure visible results. Seeing the bigger picture, a more rigorous and integrated approach is necessary to reconcile more effectively the trade-offs necessary for:

- Efficient resource allocation, emphasizing proper pricing, taxation and various forms of institutional and economic policies that provide the enabling environment and non-distortionary incentives, reflecting its scarcity value, including associated externalities, while avoiding top-down and institutionally-intensive approaches in institutionally-weak countries;
- Recasting climate change so that it no longer approached in isolation, as a goal in itself, but instead properly integrated with equally pivotal concerns of energy security, efficiency and access to low income and other societal groups.
- Revenue, cost compliance and administration affect interactions with the wider tax system, more generally, and impact both the choice of instruments and the level at which taxes a reset so that associated costs are properly recuperated in pricing.
- Competitiveness and terms of trade concerns, to confront growing fears of disadvantaging domestic producers in world markets and the cost and investment implications to meet more exacting environmental concerns;
- Fiscal considerations, particularly as hydrocarbons consume among the largest balance of payments (either in imports or exports) or fiscal revenues in most countries;

This requires aligning interests among multiple stakeholders -- each doing their part in innovating and investing in a more decarbonized economy, and leveling the playing field for emerging technologies while their costs are being reduced.

A long term energy strategy must rely on technological substitution of the current capital stock of non-liquid fossil fuels towards a greater mix of LNG based plant, geothermal and hydro electricity (particularly low head and run-of-river facilities), with renewables playing a niche role, and eventually mainstream option in the energy mix. An overhaul of existing systems will require a broader effort, with transitional arrangements that include:

- Financing adaptation programs (while underlying solutions are being worked on) through supporting investments -- e.g. storm barriers, resettlement, carbon capture, retrofitting investments to reduce energy intensity in production processes, use and storage (CCUS) that could be recognized as part of the climate change agenda.
- As tracking arrangements leave a heavy burden on countries, whose targets rely on what is called nationally determined contributions, policy efforts need to balance attention towards important global factors that remain "out of the radar" from country level trackings, such as maritime and air transport, the Arctic and Antarctic continents, which

have their special environmental issues. For instance, the shipping industry emits more CO₂ per year than any European country.

- Similarly, the global economic context may keep conditions in a constrained growth path, with limited surplus generation prospects in developed countries for R&D for new Technologies, and fossil fuels (making them more competitive against non-traditional sources), reducing in turn surplus generation capacity of emerging economies relying on extractives, depriving them from important source of development financing.

VII. THE FUTURE OF THE PAST

"Real knowledge is to know the extent of one's ignorance" Confucius

"The only source of knowledge is experience"
Albert Einstein

This century is set to be shaped by a series of hugely demanding and closely interlocking challenges. The eradication of poverty, dealing with conflict and achieving the sustainable use of natural resources is among them. Linked to all these are difficult issues about energy – particularly having adequate and secure supplies of energy at affordable prices and consuming energy in appropriate ways to avoid environmental damages^{15, 16}.

A solution to either of these threats is relatively straightforward; however, a solution to both simultaneously is one of the great challenges facing the world. Linked to all these are difficult issues of managing in the midst of transitions, economic adjustments and associated discontinuities. More than ever before, this will require excellent planning as much as skillful, rapid and flexible execution to respond to emerging developments¹⁷.

We are thus thrust in a situation of high stakes and trade-offs requiring decisions under uncertain conditions. Once we overcome current crisis conditions, global energy demand is expected to rise by over 50% over the next 30 years, and fossil fuels probably accounting more than 80% of the overall increase. Simply calling for a cut in consumption is not a sufficient solution to the challenges we face, particularly in enhancing energy security while fueling economic recovery, growth and poverty alleviation globally¹⁸.

In the end, though, achieving tangible progress while addressing environmental issues effectively require a much better understanding than what we have at present to ground solutions on stronger and better empirical evidence of the underlying incentives at work generated by current technical, institutional and policy conditions.

Technological innovations can have a pivotal role to play in harnessing new sources energy supply. They have however their costs and time frames for their

development, as well as their policy, institutional and governance requirements to provide the enabling environment to attract resources and deliver progress.

In all, this is not a dash to renewables or curbs in energy use, but a race to reduce carbon emissions across many fronts – an endeavor that requires as much an international effort for innovation, as a series of local, down-to-earth adaptive investments compatible with economic development. This requires a hard-nosed approach distinguishing trend from fad.

VIII. CONCLUSION: LEADING THROUGH TURBULENT TIMES

“The world as we have created is a process of our thinking. It cannot be changed without changing our thinking” Albert Einstein

“No matter if it is a white cat or a black cat, as long as it can catch mice, it is a good cat” Deng Xiaoping

Summing up, goal-setting, international agreements, awareness raising (the staple of much of environmentalists’ constituencies) can be useful, but only up to a point. A top-down and muscular approach to nudge towards action and institutional compulsion, while expedient in the short term, confront binding constraints (such as institutional weaknesses, poor economic incentives difficult to overcome, etc.).

At the bottom of it all, such approach has in effect led to perfunctory and mechanistic (checking-the-box) compliance behavior, with consequent limited progress on the ground. Collective decision-making bodies, whether international agencies or publicly owned utilities, by and large tend to dilute accountabilities by making everyone responsible -- in effect leaving no one properly responsible.

Moreover, with overly inflexible and not-fit-for-purpose governance arrangements, traditional institutions and their linear planning and modeling practices are just unable to predict increasingly recurrent spikes and slumps. We must accordingly learn how to discern emerging changes in demand signals. Policies and institutional arrangements must avoid rigidities normally associated with long term investment plans and policies, manage relationships with civil society to detect and respond to emerging demands, optimizing cost performance and sustainability under volatile conditions. The challenge will be to embed new capabilities that enable flexibility while keeping an eye on effectiveness and responsiveness.

Above all, we must learn to tolerate leaving the perfect, the silver bullet, and the certainty of dealing with well-proven developments. There is no substitute than a certain level of ambiguity and, above all, learning and understanding evolving conditions. There is no alternative to reconsidering the foundations of future planning.

There is good and bad news in all this. On the one hand, the huge mass of information and crosscurrents taking place in today’s world makes its sorting and evaluation extremely difficult. There are accordingly no hard-and-fast rules for policy and investment action; rather they are guides of thought processes and planning to assess evolving conditions to adjust to new conditions. On the other, this opens up opportunities for recasting existing arrangements through:

- Improved flexible planning methods, with risk and mitigation arrangements, explicit “stress-testing” to equip the energy sector with capabilities to cope with increasing disruptions;
- Newly integrated digital and tracking capabilities that include long term strategic, as well as short term tactical and operational planning horizons;
- Improved monitoring of market and economic indicators, social media and scientific feeds to offer “over the horizon” insights to detect emerging societal demands, and application of frontier knowledge in the physical, life, and social sciences or the advancement of cutting-edge technologies. In time, this should include mega environmental issues in need of better understandings, such as those affecting stability of continental ice sheets, the role of deep ocean in climate change, etc.

As the world begins to move towards planning for recovery, uncertainty is likely to remain part of life for the foreseeable future. This may well require greater participatory and collaborative planning vehicles with stakeholders, and more flexible supply and investment chains able to withstand this volatility and enhance speed, agility, variety, or innovation to respond more effectively to unexpected changes.

In the end, the effort will require many players working independently, but coherently. This can only be achieved through proper pricing, taxation and various forms of institutional and economic policies that align interests among multiple stakeholders and provide the environment to invest and innovate in the more decarbonized economy foreseen in the Paris accord ²⁰.

Given the unpredictable technological and other changes over time, some room for improvisation may be instrumental in coming up with new approaches, even allowing form to follow function in shaping of institutional reforms, to ensure that they respond to emerging concerns.

Accordingly, a certain amount of trial and error or learning by doing will probably be inevitable, if not helpful. A change agenda is not an option but a necessity, not only on fuels but also in strategies, structures, and leadership practices – enticing and harnessing unorthodox thinkers and their mold-breaking notions. With increasing availability of data to track outcomes and analytical capabilities, new technical

skills are bound to free the transformative forces for innovation to enhance conditions to morph fringe and exploratory ideas to mass markets.

As has happened elsewhere, the crisis is creating opportunities to respond to emerging societal demands, including better attention to sustainability of projects, their energy efficiency, their compatibility with the environment, etc. --not as marginal add-ons, but as deliberate and agile ways of designing and carrying out projects.

IX. EPILOGUE: QUO VADIS?

"Come now, let us reason together". Isaiah 1:18

Political (and other) debates have become increasingly divisive — the world over. So has the exchange on environment and energy policies.

At the risk of armchair psychoanalyzing complex developments, it seems that those deeply concerned with the environmental agenda have defended their beliefs bordering on the religious — casting themselves as the paragon of righteousness. Their oftentimes-abrasive postures tended to favor top-down impositions and associated policy prescriptions, irrespective of costs and complex fault-lines that run through almost any society.

All too often, such positions have generated their share of resistance, and at times been devoid of archival sources, serious diagnoses of the forces that are at play, the local policy and institutional environment and capacity, and how they affect behavior and decisions. Oftentimes proponents criticize the world (not totally unjustifiably) for their consumer culture, for despoiling their environment and maintaining antiquated power structures... failing dismally in recognizing tectonic shifts that are proving to be deeper and more seismic than had been gauged, catching everyone literally thoroughly unprepared and surprised, holding assumptions oftentimes off-base.

Instinctively, humans seek order in the universe and, in politics, a clear formula or approach for decision making. In reality, though, randomness — whims, quirks, gaffes — determine oftentimes the relations between individuals, just as it does among nations and policy response. This requires processes, open to critical reviews, time, clear-sightedness and a gravitas born from thorough experience and understandings of the underlying forces at work, their tradeoffs and economic consequences and impact.

In the process, these postures tend to dismiss contrarian views, including postures that challenge the underlying science of climate change. The paltry results of current mainstream thinking calls, if anything, for a more comprehensive consideration, including of those in the "outside the box" fringes and a revisiting of their objections. Above all, we need to keep the two halves

sides of the debate together in spite of their wrangles. The world needs them together...

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