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**A “CAP AND INVEST” STRATEGY  
FOR MANAGING THE INTERGENERATIONAL  
BURDEN OF FINANCING ENERGY TRANSITIONS**

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**Abstract**

The investment in sustainable energy required to meet the climate change commitments made by 190 countries signatory to the 2015 Paris Accord is in the order of \$100 trillion over the next 2 decades. Reducing carbon emissions requires a financing strategy for managing risk that is an intergenerational burden. This paper proposes a “cap and invest” strategy for building up the necessary infrastructure to reduce greenhouse gas (GHG) emissions consistent with national commitments. “Cap and invest” is in sharp contrast to “cap and trade.” An economy-wide general environmental tax (GET) on consumption is the basis for financing the energy transition. The GET creates a large “pool of capital” to de-risk investment in emerging low-carbon solutions in support of an energy infrastructure resilient to the threat of climate change. Innovation in governance is an integral part of the policy to leverage the capital markets through public–private partnership in green financing.

**Keywords:** “cap and invest,” environmental trust fund, financing intergenerational burdens, general environmental tax, global energy transitions

**JEL Classification:** Q4, Q5

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# 1. INTRODUCTION

There is an urgent need for effective action to reduce the world's greenhouse gas (GHG) emissions, which are associated with the long-term sustainability of energy infrastructure (Ng and Nathwani 2018). The problem of climate change is an issue that imposes intergenerational burdens and requires a strategy for managing future liability. Several factors conspire to undermine progress: Demographics drive the demand for energy in concert with income shifts in the global demographic profile. According to the International Energy Agency (IEA 2017), global energy demand will increase from 20 terawatt (TW) per year in 2020 to 25 TW per year by 2040, and nearly double current levels by 2060. The share of fossil fuels within the current global energy mix is high at 85%, and this share will have to decline sharply to be compliant with GHG emissions decreasing to a level that matches a global temperature rise of less than 2°C (IPCC 2011).

Meaningful actions to decarbonize the global energy system have been delayed by a lack of firm commitments resulting from local and regional pressures within political jurisdictions. Target setting and compliance all too often run up against the harsh realities of financing requirements. The core of the global effort to cut emissions will have to be built from the bottom up, through ambitious national action focused on specific opportunities to cut emissions (Levi 2009). With the Paris Climate Change Accord of 2015 and voluntary commitments of nations, there is optimism for some movement toward tangible actions. Now, there is urgency in dealing with the climate change threat, and, in our view, robust financing is the critical ingredient required for the deployment of solutions at scale.

We propose a fresh approach to reinforce and advance the voluntary target-based approach embedded within the United Nations Framework Convention on Climate Change (UNFCCC). Here we focus on tackling a global problem, but with a specific focus on how any country can initiate the actions required to create a large pool of capital for financing investments to de-carbonize the economy over the long term.

In section 2, we briefly describe the essence of the climate change challenge, largely influenced by the heavily fossil fuel-based attributes of the current global energy system. In section 3, we identify and explain the limitations of current policy instruments: cap and trade versus a carbon tax regime. In section 4, we examine the efficacy of carbon tax, as well as its limitations. In section 5, we propose a “cap-and-invest” strategy for achieving a resilient low-carbon climate energy infrastructure. As an alternative, a tax on economy-wide consumption combined with a coherent framework for innovation in governance is a key requirement to advance the dialogue on this complex public policy issue. This tax on consumption is similar to a carbon tax, but its principal difference lies in the allocation of the burden to the end consumers rather than producers. The burden of reducing the cost of carbon emissions is not assigned solely to the producers of carbon-intensive products and services. Since carbon is embedded in the final consumption of all goods and services, and the supply chains are intricately linked across production processes, a limited focus on producers alone does not address the fundamental issue of consumption at the economy-wide level. It is consumption or final demand for goods and services that drives the production system. Thus, we move away from the laborious process of identifying the “carbon-heavy” or “carbon-light” content of a product or a service for tax purposes to reduce lobbying pressures for exemptions from the burden on one sector (e.g., steel) vs. another (e.g., cement or aluminum). This general environmental tax

(GET), as advocated, is meant to be a simple, transparent, and effective method for raising the necessary capital for investments in de-carbonization.

Furthermore, we explain the aspects of institutional governance required to establish trust and confidence for managing the large pool of capital that becomes available for investment through GET. The proceeds of the GET would be “ring-fenced” within an Environmental Trust Fund (ETF) dedicated to supporting investment for the long-term sustainability and resilience of infrastructure. We highlight the requirements for innovation in governance to ensure that a large and growing pool of investment capital within the ETF can deliver the intended results, to gain public acceptance of the tax and further catalyze public–private collaboration for additional financing capacity.

Our unique contribution is to provide a sound basis for the re-direction of tax revenues from consumption to support long-term investments in a resilient low-carbon climate infrastructure to serve future generations. A stable and increasing pool of capital is a prerequisite to help de-risk new technology solutions. Redirecting scarce societal resource from consumption to investment as a critical financial resource to support de-carbonization has not been identified in the literature on green financing strategies.

## 2. MANAGING THE GLOBAL ENERGY TRANSITION

Climate diplomacy, as practiced over 25 years, has consumed an enormous amount of political capital and goodwill. The UNFCCC 2015 Paris Accord on climate change, with voluntary national targets and timelines, has helped to reset the frame for achieving meaningful change, but requires a credible source of financing and a deep pool of capital to meet investment needs. At its core, the climate change challenge is an energy technology policy problem. Breaking down the global challenge into a “right-size” approach to achieve positive outcomes at a national level would be a valuable example of best practice leading the way.

Achieving meaningful reductions in carbon emissions to address global climate change need not conflict with the wish to improve the standard of living for all people. By 2050, the world population will exceed 9 billion. Without a significant change in the global development profile, an additional 2 billion to 3 billion will be living in poverty, inconsistent with the United Nations (UN) Sustainable Development Goal SDG1: “No poverty.” A move from the status quo to a “low-poverty” world (implying relatively low energy use) would still entail a near doubling of global primary energy demand from the level of 17 TW per year<sup>1</sup> in 2015 to 30–35 TW per year in the 2050–2060 timeframe (IEA 2017). Given the existing supply mix of the energy system, this would translate into a doubling of GHG emissions, a pathway entirely inconsistent with the intent of the 2015 Paris Accord.<sup>2</sup>

The focus of global efforts should be on developing an energy system that does not undermine the essential functioning of the environmental ecosystem, but delivers non-carbon energy supplies at scale. This calls for a massive level of investment, in the order of \$69 trillion over the next 2 to 3 decades. This is the estimate of the total cost in

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<sup>1</sup> 1 TW per year = 8760 terawatt-hours (TWh) = 31.5 exajoules of energy (EJ).

<sup>2</sup> If no action is taken, continued expansion and operation of fossil fuel infrastructure would lead to global warming of 2.4°C to 4.6°C by 2100, due to high levels of atmospheric CO<sub>2</sub> concentration. The environmental stress resulting from this will create ripple effects that have the potential to undermine the economic livelihood, food supply, and security of millions of people according to the Intergovernmental Panel on Climate Change (IPCC 2007) and the Waterloo Global Science Initiative (WGSi 2012).

the IEA “Sustainable Development Scenario” (IEA 2017).<sup>3</sup> What then can we do to make a significant impact on climate change, and at the same time help shape the directions for change that take into full account the need for energy and investments to re-shape the profile of energy infrastructure?

### **3. LIMITATIONS OF A CARBON CAP-AND-TRADE REGIME OR A CARBON TAX**

Experience to date with the cap-and-trade regime has revealed significant limitations and carbon tax as a policy instrument has seen mounting challenges from a skeptical public. Neither approach appears capable of delivering coherent international actions that would achieve the long-term stabilization of GHG concentrations at a level that would prevent serious interference with the climate system. Should we rely strictly on a carbon price, the ability to achieve significant reductions in emissions, from a global perspective, will be in doubt (Ball 2018).

Here we provide a summary critique of the limitations of both cap-and-trade and carbon-tax regimes directed strictly at a small group of identifiable large emitters. The central message is that under the umbrella of an internationally negotiated climate treaty, neither a market-based cap-and-trade approach nor a narrow carbon tax on producers can begin to break the back of aspirational emission reduction commitments.

#### **3.1 Development of Cap and Trade**

Cap and trade has emerged as one response to climate change over the last 2 decades. Indeed, 27 European countries have had an emissions trading scheme in place since 2005. Moreover, 23 US states and 4 Canadian provinces also participate in regional trading schemes, such as the Regional Greenhouse Gas Initiative (RGGI 2009)—a regional initiative adopted in 2009 by a number of northeastern US states and Eastern Canadian regions (RGGI 2012). In 2012, California’s Cap-and-Trade Program took effect, with an allowance budget established to 2020, and Quebec and Ontario participating in this system as of 2017 (CEPA 2018). Australia’s carbon regime will transition from a flat charge approach to a floating price market beginning in 2015.<sup>4</sup> In June 2013, the People’s Republic of China (PRC) began testing its own carbon emissions trading scheme in the city of Shenzhen.<sup>5</sup>

In theory, cap and trade has a strong appeal for various groups. Environmental groups support an overall cap that provides a high degree of certainty concerning the environmental benefit resulting from its implementation. For industrial groups, it opens up the possibility of a new market in carbon allowances, and therefore potential profits, especially when the carbon allowances are grandfathered. It also makes less visible the passing of cap-and-trade costs on to consumers. In addition, it attracts some economists because it minimizes the role of government and the cost of abatement is internalized. The scheme also appeals to some politicians because it allows them to avoid the subject of a tax increase.

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<sup>3</sup> As a counterpoint to provide a perspective, according to the US Government Estimate (CIA Handbook), \$99 trillion was the amount of money in global cash and bank accounts on 31 December 2017.

<sup>4</sup> <http://www.bloomberg.com/news/2013-06-24/australian-factories-meet-carbon-deadline-ahead-of-cap-and-trade.html>

<sup>5</sup> <http://www.economist.com/blogs/analects/2013/06/carbon-emissions>

In practice, the benefits and certainties of a cap-and-trade regime have proved to be illusory. A cap-and-trade regime imposes an overall cap on emissions. By limiting the quantity of emission permitted, it sets a price for GHG. The European Union (EU) Emissions Trading System (ETS) provides a good example. When launched in 2005, the EU ETS was considered a major step forward in the fight against climate change by setting a continent-wide limit on carbon emissions, with CO<sub>2</sub> allowances to be apportioned to member states. In 2005, the EU set a target of reducing CO<sub>2</sub> emissions to 20% below 1990 levels by 2020. With generous free allowances, companies received 7% more credits than they needed, allowing some to generate significant windfall profits and minimal reduction of emissions. In response, during the second phase, during 2008–2012, the EU set a cap 6% lower than the 2005 level. However, the problem of over-allocation continued, and because of lower emissions caused by the economic downturn, resulting in a surplus of allowances and hence depressed carbon prices, the incentives for companies to invest in clean technologies diminished. Moreover, the lack of an effective and persistent carbon pricing system from a cap-and-trade regime is a serious limitation on investor confidence. The weaknesses of the cap-and-trade approach adopted by the EU and US economies so far to reduce carbon emissions are well noted in a recent report (Ball 2018).

### **3.2 Problem of Leakage: What Actually Happened**

The intent behind the effort to enforce an overall cap on GHG emissions under the Kyoto Protocol was to establish a benchmark for a cap at the global level. However, more than a decade since its adoption, the protocol has only produced a low level of emission reductions, falling far short of averting the threatening increase of emission concentrations in the atmosphere. Also, under the Kyoto Protocol, countries could exceed their emission quotas by contributing to emission-reducing projects in non-Annex B countries through the Clean Development Mechanism (CDM). The CDM then becomes part of a broader carbon market, subsequently affecting the overall carbon price levels.

Legitimately, the CDM and associated emission reductions are only admissible as “additional to any that would occur in the absence of the certified project” (Kyoto Protocol Article 12.5). Even with a validation process in place, the counterfactual is impossible to observe, and clearly open to strategic manipulations, since both the buyer and the seller of emission reductions have an incentive to inflate the baseline (Lecocq and Ambrosi 2007). Entrants into the CDM market poured massive capital into purchasing Certified Emission Reductions (CERs). These included banks and speculators with no need for CERs, aiming to trade them on the secondary market, such as through the EU ETS. This led to the hoarding of assets for selling on better terms in the future, as well as an increase in demand for CERs from firms under the EU ETS, and from speculators who saw opportunities for arbitrage, in addition to the increased demand for CERs triggered by the entry into force of the Kyoto Protocol (Lecocq and Ambrosi 2007).

In its Directive 2009/29/EC, the European Commission recognized that the increased use of CDM credits in the absence of an international agreement could undermine the EU renewables target, as well as the incentives for energy efficiency, innovation, and technological development (den Elzen and Höhne 2008; Vasa and Neuhoff 2011). While the CDM exacerbated the misappropriation of emission allowances, the evidence of failure of the first phase of the ETS had been attributed to an oversupply of permits by the regulatory authorities (Andrew, Kaidonis, and Andrew 2010; Tan, Kaidonis, and Moerman 2008). For instance, the EU ETS in its first phase failed to achieve any

worthwhile reductions in carbon emissions, and the 2008 emissions exceeded the cap by 145 million tons (Andrew et al. 2010; Matisoff 2010).

While purportedly Phase III of the ETS will have auctioned allowances, it is unclear whether the regulatory and administrative environment will be robust enough to prevent the issue of leakage. A major shortcoming of the cap-and-trade regime is the ability to induce a high level of confidence and certainty for investment in low-carbon technologies with long lead times and high capital costs. The European Parliament initially voted to reject a “back-loading” proposal, which aimed to restrict a surplus of carbon allowances that sent carbon prices to below €5 per ton from €20 per ton in 2011 (with the caveat that the allowances would be reintroduced later).<sup>6</sup> After months of negotiation, the EU Parliament voted in support of the plan. According to a study by Sandbag Organization (2013), the EU ETS is now delivering negative ton abatement, set to cancel out over 700 million tons of emissions saved through renewable energy and energy efficiency efforts, much lower than the 2.8 billion tons of emissions originally expected.

### 3.3 Jurisdictional Difficulties

The cap-and-trade instrument has not only significant regulatory and accounting weaknesses, but there are implementation challenges for taxation across jurisdictional boundaries. Issues with the need to harmonize overlapping international, national, and subnational programs and distributional conflicts remain unresolved. For example, in the US a multitude of interactions between any federal climate policy and state and regional programs is determined by two factors: the extent to which the state and federal programs cover the same sources, and the relative stringency of the federal and state programs in question (McGuinness and Ellerman 2008).

Depending on the division of the two factors between a state or regional program and its federal counterpart, the outcome could be futile, or generate additional emissions and costs. (Jenkins 2009). Distributional impacts, additional cost burdens, and subsequent loss of economic efficiency are felt at the local level. Nationwide cap and trade (without federal preemption to develop a more demanding state program) would impose punitive burdens on a local or regional economy less able to adjust to activities requiring deep reductions.

Moreover, in the context of a global cap-and-trade regime, there could be potential arbitrage opportunities, where allowances purchased at one price in one jurisdiction can quickly be sold in another for a higher price. Importing too many cheap foreign emission rights would both depress the domestic carbon price, and create greater demand for offsets if they exist in the foreign system. Without harmonization across jurisdictions, large imbalances can arise from a trading competition perspective. Offsetting fraud becomes a larger problem in a global setting, with the provision of an offset in one jurisdiction potentially not following the same rigorous screening process as in another jurisdiction. Experience with the CDM mechanism also reveals the drawbacks and issues of complexity management when it comes to cross-border CER validation and verification.

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<sup>6</sup> <http://www.economist.com/news/finance-and-economics/21576388-failure-reform-europes-carbon-market-will-reverberate-round-world-ets>; <http://www.theguardian.com/environment/2013/jun/25/eu-emissions-trading-scheme-energy>

In summary, various studies have concluded that a large share of registered CDM projects have not been valid.<sup>7</sup> Such a problem with respect to carbon market efficiency in Europe has been revealed in a prior study by Daskalakis (2013). The PRC, the second largest economy of the world, has encountered similar issues with market efficiency in the carbon trading market (Ren and Lo 2017; Zhao, Wu, and Li 2017). The cap-and-trade mechanism may not drive the building up of capacity for sustainable infrastructure in an effective, timely manner despite the ongoing climate change threats.

It is important to note that there is an inherent difficulty in identifying a precise point in the energy transformation chain for introducing a tax on GHG emissions. The profile of the global energy system is a complex web of interactions, and emissions occur at different points in the supply chain (GEA 2012: 104). Introducing a cap on some producers at one point in the chain of energy transformation while allowing another agent a pass invariably leads to a plea for exemption and an unyielding process for settling grievances. Thus, we believe our approach to a tax on economy-wide final consumption avoids needless complexity. GET is a practical, transparent, prudent, and a fair approach to taxing GHG emissions.

## 4. EFFICACY OF CARBON TAX

Compared to cap and trade, a carbon tax is a straightforward instrument. A tax is imposed at a price per ton of carbon content on the “upstream” sources of emissions in the economy, such as coal, oil, natural gas, and mining entities that are heavy emitters. In theory, a tax on fossil energy would pass on the cost to fossil-energy users through the price of every product and service. Consequently, as users make decisions to avoid higher costs, emissions would decline, and the impact would be highest where the impact of emissions would be the greatest, producing an efficient outcome (Lippke and Perez-Garcia 2008).

A carbon tax has several advantages over cap and trade. As a revenue-generating instrument (as opposed to non-revenue-generating in the form of free allowance cap and trade), in theory a carbon tax yields a double dividend through economic and environmental benefits (Harrison 2010). Administratively, a carbon tax is simple to set up because most jurisdictions have extensive experience of imposing value added or sales tax on consumption, and its collection and enforcement (Rabe 2012). A carbon tax also ensures cost certainty for business since the external cost cannot rise above the tax rate. It offers greater transparency with respect to costs and their distribution, which can make it easier to redress impacts on those with low incomes.

However, a carbon tax has clear limitations from the perspective of political acceptability. As with any revenue-raising instrument, the mere act of levying duty (even if not implying an actuarial or budgetary increase) is bound to arouse some electoral opposition. In the case of a carbon tax, the more direct and visible nature of costs to consumers may not be politically palatable to the public due to “a combination of rational ignorance and loss aversion” (Harrison 2010).

Much of the opposition to a carbon tax is likely to come from organized groups that stand to benefit from cap and trade (Avi-Yonah and Uhlmann 2009), especially when allowances are grandfathered in or permitted to powerful industry lobby groups

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<sup>7</sup> Assuming non-additionality of between 20% and 66%, the use of carbon emission reductions in the EU ETS during 2008–2009 increased global emissions by between 30 and 106 million tons CO<sub>2</sub> equivalent (Michaelowa and Purohit 2007; Schneider 2009; Vasa and Neuhoff 2011; Wara and Victor 2008).

disadvantaged by the carbon intensity of their product. To the extent that industry (energy product and service providers) can adjust to a new cost structure, competition is set to emerge in vying for fiscal privileges, such as exemptions for particular energy-intensive entities, rebates from carbon and energy taxes, and reduced tax rates. More aware of its interests and better organized to invest in appropriation, business has time and again won out over consumers, as observed in Denmark, Finland, and Germany (Harrison 2010). Along this line, a carbon tax might appear relatively transparent, but discrimination against certain types of emitters (especially in the face of strong anti-carbon taxation lobbying powers) will generate tension over the equity aspect of the taxation.

In terms of international competitiveness, a carbon tax has negative political connotations. Although several academic studies suggest there is “little evidence to support the hypothesis that environmental regulations have had a large adverse effect on competitiveness,” politicians remain highly risk averse when confronted with threats of capital mobility (Harrison 2010; Jaffe, Peterson, and Stavins 1995). The political trade-off means more concessions granted to powerful groups that represent large industrial or major emitters.

Finally, while segregating the revenue generated from a carbon tax regime can reduce the uncertainty of environmental and social benefits, there remains suspicion that revenues under government management (based on a general perception that government is wasteful) primarily address politically appealing pet projects with high voter satisfaction. For example, a proposal, dubbed 40/40 by Alberta’s Minister of Environment, to reduce intensity-based emissions and raise the noncompliance penalty drew national attention in Canada. The plan required large emitters in Alberta to reduce per-barrel emissions by 40% and pay \$40 per exceeded ton into a technology fund (thus the 40/40 moniker). This marks a significant jump at both ends compared to the regulation in effect since 2007, which set the emission intensity reduction target at 12% and the noncompliance penalty at \$15 per ton. Note that the proposed measure is not technically a carbon tax, but rather a performance regulation. The Pembina Institute pointed out that the \$40 carbon price still falls short of meeting Canada’s 2020 target, as agreed in Copenhagen.<sup>8</sup>

However, a carbon tax remains a very difficult political proposition at high levels of taxation—where it could be most effective—if it is not clearly linked to a plausible explanation of how the revenues will be used to improve the environment and a transparent process through which a determination of the benefits is widely shared.

## **5. CAP AND INVEST THROUGH AN INTEGRATED APPROACH**

We propose an integrated approach that comprises three components for effective policy stability in support of de-carbonization in any jurisdiction:

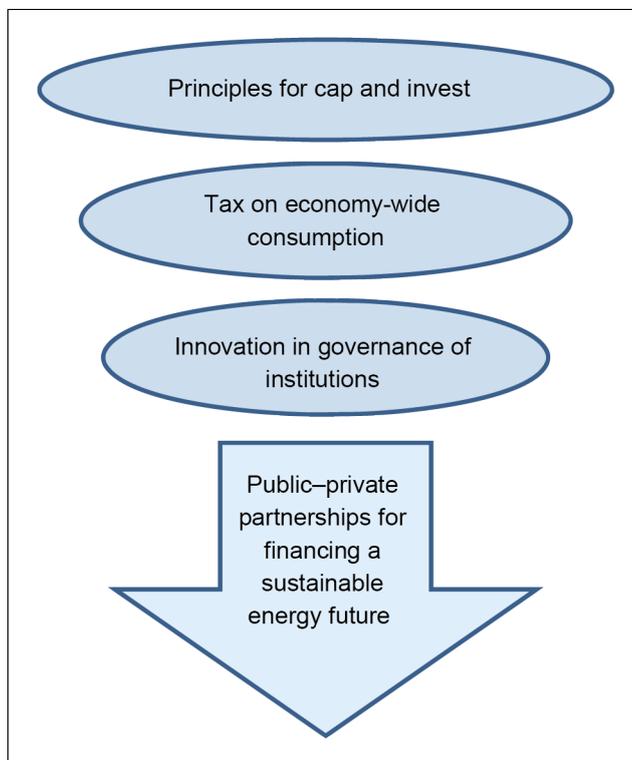
- (i) Cap and invest.
- (ii) A tax on final consumption, economy-wide, as a GET.
- (iii) Innovation in governance.

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<sup>8</sup> <http://www.pembina.org/blog/707>

These three complementary components form a framework that would enable substantial public funding for investment in the next generation infrastructure, as illustrated in Figure 1. Innovation in governance is a key part of the framework to allow “arm’s length” institutions to take initiatives and drive a global transition toward a sustainable energy future.

**Figure 1: An Integrated Approach to Financing a Sustainable Energy Future**



Source: Authors' compilation.

### 5.1 Principles for Cap and Invest

The concept of cap and invest is to enable the maximum net reduction in emissions on a life-cycle basis from the base year of the target being established to future planned reductions under aspirational targets. The goal is to reduce total national emissions substantially from the current level, such as 50% before 2050 and 80% by 2100. All solutions, subject to a list of technical and economic criteria, with no preconceived bias for or against specific technologies, would be eligible for funding from the Environmental Trust Fund (ETF). The primary test of efficacy would be net reduction of GHG emissions at the lowest cost for the maximum net benefit. The governing board of the ETF would be guided in its investment decisions by objective technical and financial criteria, and established due diligence processes. The ETF is envisaged as an “arm’s length” independent agency, not subject to directive interventions of the government of the day in its normal decision-making processes.

Commercially available technologies would have the edge in the near term for early deployment. However, what is costly today will become less so over time, through innovation and applications at scale. Initiatives new or old, however, would be subject to a simple test for acceptable investment:

What is the largest quantifiable and verifiable reduction in GHG emissions to be delivered when considered on a life-cycle basis, and at what cost?

An important criterion for a decision on the allocation of funds for investment would be clear expert judgment on the deliverability of measurable results, with validation and verification by the ETF governing board.

The “carrot” for industry in this case is a nudge to invest in clean technologies now, with the ETF—depending on project qualification—either matching the costs of capital dollar for dollar, or providing loan guarantees as a source of “risk-tolerant” capital. This provides an incentive for industry to become a willing partner, and leverage the availability of its own technical and financial resources. The “stick” is the imposition of “deep and steep targets” to be met under firm timelines, and all compliance costs for businesses and industry. Over time, most businesses that subscribe to the premise of corporate social responsibility (CSR) would identify the threat posed by a competitor more creative in achieving profitability and act to ensure its survival. In the new carbon-constrained world, not only do the penalties imposed for non-compliance become increasingly important but also firm reputation suffers. The virtue of hypothecation—redirecting investment to cleantech and sectoral innovation—is a crucial feature of an energy policy instrument to decarbonize the global economy rapidly (Prins et al. 2010).

The goal is to create a drive for innovation, and to create the backbone for a multiplicity of solutions to be deployed at the local, regional, and national levels. The key players and actors can begin to coalesce around a credible set of solutions that are cost effective and technologically feasible. These can then be integrated with a more coherent long-term system view, and implementation on a large scale where national and regional priorities converge. Yoshino and Taghizadeh-Hesary (2017, 2018) have proposed a similar scheme, in which tax on carbon is utilized in the form of seed money for green hometown investment trust funds to increase the rate of return and reduce the risk for private sector investment in green (renewable energy) projects. This scheme was designed as a community-based fund, collecting community (hometown) investors’ money for risky projects. It was initiated in Japan after the Fukushima nuclear disaster in March 2011 and was successful in collecting investments for small and medium-sized renewable energy projects.

## 5.2 Taxation Regime on Economy-Wide Consumption

A tax on consumption—an increase of one or two percentage points on the existing sales tax, designated as a General Environmental Tax (GET)—would result in a pool of investment capital available for funding projects. The annual revenues from the tax over a 50-year period, leveraged through public–private partnerships, would provide sufficient resources to reshape the national carbon footprint.

We note that there is little enthusiasm for increased taxes at any time in any jurisdiction, with both the public and politicians averse to new taxes. If the public narrative is framed as an investment in our own future to address a compelling global environmental threat, a tax on consumption that spreads the burden fairly across all individuals has the potential to be widely accepted. The cap-and-invest approach limits large impacts on a narrow group of industries, sectors, or communities. Any reduction in emissions arising from reduced consumption—due to the marginal elasticity effect of a tax—is a positive effect, but only a small part of the benefit. The larger benefit is that this approach relies on “ring-fencing” the revenues from the consumption tax to be redirected for investments to deliver a low carbon energy future. GET would be a tax for a designated purpose to reduce the national carbon footprint.

The premise of a functioning democracy is the tacit agreement of citizens who willingly pay taxes in exchange for government services. For government, its capacity to tax is its only source of revenues to deliver the services implied in the social contract. In essence, citizens' consent through taxation provides the binding glue of accountability between public officials and the expectations of constituents.

Widespread acceptance of the threat of climate change and its impacts on future generations is necessary for an open public dialogue. The citizen as taxpayer has a compelling interest in ensuring that taxes are used for the identified purpose. In promoting a tax on economy-wide consumption, we draw upon the consent of all citizens to strengthen the base for political discourse, to address this important global challenge—how to decarbonize the economy. The impact on the climate, arising from our actions through current use of fossil fuels, is a case of an intergenerational burden that requires a broad base of consent. The levy is the mechanism of accountability that will dictate action by public officials.

The additional revenue generated by a 1% or 2% point increase in taxation, explicitly identified as the GET, is dedicated solely to investment in solutions required for a clean environment.<sup>9</sup> The proposed GET is somewhat closer to a carbon tax than other measures, but with a fundamental difference—it does not seek to identify the “carbon-heavy” or “carbon-light” content of the product or service. It reflects the fact that whatever we consume to support our lifestyle contains an embedded energy component. Thus, collectively, we are part of the problem that our consumption engenders.

The need to devise complicated tax schemes to punish one sector over another, or pointing solely to industry as the problem, is largely mitigated. It is perverse to punish truckers for bringing our food supplies to our local grocery stores by increasing fuel taxes, as it is to blame airlines for flying us to destinations we desire. Businesses and industry make products and services available because we demand them and consume them, often in prodigious amounts. A small levy, no more than 2% of gross consumption, is reasonably low at the individual level, but at the national level it adds up to a substantial resource. If the resources can be directed to solving a problem that has emerged as an existential threat globally and with the possibility of large cost impacts for the national infrastructure, it is not a huge sacrifice to put in place the capacity to mitigate emissions and adaptation for a climate-resilient future.

One reason that a carbon tax is likely to meet political difficulty is that it entails concentrated costs and diffused benefits. In contrast, cap-and-trade promises concentrate benefits and diffused costs, and are therefore more politically palatable (Harrison 2012). The GET approach, in conjunction with an ETF, not only has the politically palatable feature of concentrated benefits and diffused costs, but also maintains the feature of transparency of a tax-based regime.

### **5.3 Innovation in the Governance of Institutions**

The most serious objection to such a bold move is the potential threat of misuse of tax revenues. We accept this concern as critical to the proposal. Pork-barrel politics can derail all good intentions. Temptations to favor some constituencies or industries for political gain are present. We believe that rigor, transparency, and innovation in governance for institutions managing such a large undertaking would be necessary.

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<sup>9</sup> For those disadvantaged in our society, there are already several effective compensating measures of tax relief in place (e.g., exemptions on food, textbooks, and rebates to low-income individuals).

A national ETF, established through an Act of Parliament, with the requisite authority and necessary constraints in its operations, would manage the proceeds. The ETF created with a specific mandate by Parliament and recognized as an arm's length entity separate from government departments could be effective in minimizing overt political influence in its decision making. Clarity around the goals and vision for use of these funds would have to be included in the enabling legislation for the ETF. The concern that monies would disappear into a proverbial "hole in the ground" could be eliminated by strict adherence to the legislative requirements and stipulations within the mandate of the ETF.

### **5.3.1 The Environmental Trust Fund: Institutional Exemplars**

The concept of a national fund that draws on current contributions to address a future societal liability is well known. Such funds have been established in several countries. At the core of the concept is recognition of intergenerational liabilities that span several decades. The enterprises of various Sovereign Wealth Funds and public pension reserve funds demonstrate this endeavor. There are successful national funds, such as the Canada Pension Plan (CPP) reserve fund and the Government Pension Fund of Norway (GPFN). An understanding of their features and the governance architecture is essential for the integrity of the institutional framework. The design of a concept model for the ETF draws upon some of the successful features of these plans. We describe the two designs identified above as illustrations of best practice.

*Canada Pension Plan.* The CPP is operated and managed by a private-sector entity, the CPP Investment Board (CPPIB), independent of the government. The CPP has undergone drastic reforms since its establishment almost half a century ago, and is presently in good health (Little 2009). Lessons and experience can be drawn from the framework and management of the CPP to inform the proposed ETF model for addressing a different problem—reducing the burden of climate change risks for future generations.

The Canadian Pension Plan Investment Board Act (CPPIB Act) in December 1997 created the CPPIB in the form of a Crown Corporation. The CPPIB Act sets out the objectives of the board, holding the CPPIB accountable to all Canadians. It also prohibits the CPPIB from carrying out any business activities inconsistent with its objectives, and any variation would require an amendment to the law (Mendelson 2005; Government of Canada 2007). The character of independence is reflected in the strong regulatory safeguards (within the CPPIB Act) to protect the CPPIB from political interference. The nomination and appointment process aims to limit ministerial influence on the board, to maintain professional standards, and ensure the primary fiduciary goal of maximizing the rate of return.

The Board is governed by clear legislation that prescribes a transparent reporting framework. It is required to produce quarterly and annual financial statements, in accordance with the accounting principles enshrined in the Handbook of the Canadian Institute of Chartered Accountants (Battle and Tamagno 2007). Along with financial statements, the Board is also required to produce a comprehensive annual report that reviews the governance objectives, changes in investment policies and practices, and performance. These documents must also be accessible to the public.

In 2010, the CPPIB released its Policy for Responsible Investing (CPPIB 2010), with guiding principles for responsible governance and investment decisions in consideration of environmental, social, and governance (ESG) factors that would produce a positive influence over long-term financial results. This adoption of responsible investing principles facilitates engagement with other institutional investors

in promoting transparency and performance on EGS factors among the companies in the CPP investment portfolio (CPPIB 2017).

*The Government Pension Fund of Norway.* The GPFN (commonly known as Government Pension Fund Global) was established by an act of the national parliament in 1990 as a long-term policy designed to offset the curse of resource wealth that may distort the economy. It serves as a tool for macroeconomic stabilization against the potential short-term costs of fluctuating revenues (Clark and Monk 2009).

In 2001, the Norwegian Parliament adopted a fiscal guideline that non-oil deficit be limited to 4% of the fund, to provide predictability in the level of spending. The Ministry of Finance formally owns the fund as a deposit account with the Norwegian Central Bank. Norges Bank Investment Management (NBIM) administers the actual operational management of its assets as a special unit reporting to the Bank's Governor and the Minister of Finance. While the Ministry of Finance has the responsibility for the key long-term strategic decisions affecting expected return and risk, the bank's main responsibility is to maximize expected returns relative to the benchmark and variations determined by the former (Vikøren 2008). The focus is on long-term policy stability, to ensure the viability of funding to meet the needs of future generations.

Given its transparent nature, integrity of democratic processes, and commitment to accountability and intergenerational equity, and moral obligations to society, the GPFN is widely acclaimed for its governance model and has a high Truman (2008) score. It has adopted a mission statement to manage the fund responsibly and to embrace an investment objective of long-term return that is consistent with sustainable development.

### **5.3.2 Importance of an Arm's Length Investment Framework**

The exemplary governance of the GPFN and the CPPIB lends weight to our proposal for an arm's length entity such as the ETF with the right governance structure to manage a large pool of investment capital. The ETF serves the purpose of addressing costs and benefits that cut across generations, i.e., the intergenerational liability arising from the benefits that accrue to the current generation through the use of fossil fuels with the costs and damage to critical infrastructure borne by future generations. The two national funds described above offer a working model for the ETF as a credible approach for the financing of climate-resilient infrastructure. Tanzi (2000) provides a comprehensive view of public spending in the 20th century.

Citizen consent for taxation is the basis for action. The GET is made transparent by ensuring that all receipts are accounted for and deposited in a special ETF, kept at arm's length from government and managed by an ETF Investment Board (ETFI Board), accountable directly to parliament. In essence, this concept puts the financial burden on every citizen to contribute to a pool of capital for benefits that will accrue in the future to their children and grandchildren. The policy stability and governance associated with the management of the investment portfolio will provide confidence in the ability to accomplish the major goals of climate reduction targets within a generation or two, i.e., over a 30–70-year period.

### **5.3.3 Collaborative Public–Private Approach to Financing**

The ETFI Board would establish an investment program to foster the development of low-carbon technologies. The pool of investment funds available in the ETF could further be co-invested with business and industry projects that de-risk emerging low-carbon technologies through a collaborative public–private partnership approach

to financing. As the economy grows, the available pool of capital for investments will continue to increase.

For instance, this approach to financing through public–private partnerships is complementary to the notion of the issuance of large-scale green bonds through the capital market in recent years, aiming to finance the long-term development of sustainable infrastructure projects in various countries (Climate Bonds Initiative 2017). Reportedly, \$3.8 billion was raised in 2017 alone by Canadian public and private entities through the issuance of green bonds in alignment with responsible investing principles (Climate Bonds Initiative 2017).<sup>10</sup> It is worth noting that countries in Asia, including the PRC, have also been active in utilizing green bonds as a financial instrument to raise funding through the capital market and thus finance the development of green infrastructure. In 2017, the PRC reportedly issued \$36 billion of green bonds (Climate Bonds Initiative 2017). Hong Kong, China, as a global financial center of the PRC, is emerging to establish itself as a green finance hub in Asia (Ng 2018).

## **6. CONCLUDING REMARKS AND POLICY IMPLICATIONS**

In conclusion, the paper highlights the following key implications.

### **6.1 Technological Options and Infrastructure**

- Identifying a viable investment portfolio comprising low-carbon technologies and supporting infrastructure is a key step in achieving a global energy transition. For instance, the Waterloo Global Science Initiative spearheaded the vision of a low-carbon electricity ecosystem in its document “The Equinox Blueprint: Energy 2030,” which takes into account the scale of the challenge and the requirements to de-risk select transformative technologies (WGSI 2012).
- A low-carbon electricity ecosystem comprising the core elements of baseload power with smart urbanization, and off-grid electrification, each combining diverse energy technologies in generation, distribution, and storage, has been identified as providing a pathway for future energy systems.
- A transition away from fossil fuels will require massive investments for the renewal of the energy infrastructure with a view to sustainable economic development.

### **6.2 Cap-and-Invest Strategy for Driving a Global Energy Transition**

- The proposed strategy for decarbonizing a national economy through the cap-and-invest principles, in concert with a General Environmental Tax (GET) and an Environmental Trust Fund (ETF), is necessary to address the challenge of managing the intergenerational burden. A designated institution such as the ETF, providing the impetus for public–private partnership to foster responsible

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<sup>10</sup> The Province of Ontario in Canada released its green bond program in 2014 in support of its series of infrastructure spending for eligible projects combating climate change.

financing initiatives, is proposed as an alternative policy option. This approach, with modifications by jurisdictions, is particularly relevant in the Asian context.

- Currently, cap-and-trade or carbon tax mechanisms have not been sufficiently effective in driving the necessary levels of investment in infrastructure for sustainable economic development at scale.
- Transformation of the existing global energy system requires patient capital, and thus there is a compelling need for investments that de-risk emerging technologies through deployment at scale across countries in Asia, where there are fragmented jurisdictions on relatively smaller geographical scales than in other areas.
- To manage the uncertainty of investment cycles in the decision processes, a predictable flow of investment capital—namely revenues generated from tax on an ongoing basis—is required.
- A stable policy environment with a clear commitment to reducing the intergenerational burden associated with current GHG emissions is necessary.

### **6.3 Reallocating Public Funding for Sustainable Development**

- A small tax, 1%– 2% on economy-wide consumption, with revenues to be ring-fenced through an ETF, is part of the plan to enable a cap-and-invest strategy.
- The creation of an arm's length agency would be necessary to manage such a fund, with an explicit mandate to support the national goals of a cap on emissions, and then investment in the development of necessary solutions to effect change at scale.
- To gain public trust and allow the development of an orderly political consensus, it is imperative to develop innovation in governance among pertinent institutions that would be complementary.
- Revenues from (public) funding, if complemented by the vast amount of financial resources from institutional investors in the international capital market seeking long-term financial performance, would reduce the underlying cost of capital and attract the necessary allocation of resources to the development of sustainable energy infrastructure.

The recent interest in green bonds around the world, particularly in Asia, suggests the potential for closer alignment and collaboration between governments and private corporations issuing such financial instruments and the institutional investors seeking responsible investing opportunities. The green bond compliance requirements and third-party assurance imposed on the bond issuers are expected to mitigate concerns regarding the effectiveness of the investments in reducing emissions.

In summary, the technological pathways for change need to be identified, while creating the drive for innovation and competitive national advantage. The opportunity is to create new global markets and the foundational basis of a new economy with a view to solving the global problem of climate change. Innovation in governance and technological innovations, in combination, would enhance the national scientific and industrial capacity to catalyze change at the global level.

## REFERENCES

- J. Andrew, K. Kaidonis, B. Andrew. 2010. Carbon Tax: Challenging Neoliberal Solutions to Climate Change. *Critical Perspectives on Accounting*. 21. pp. 611–618.
- R. S. Avi-Yona and D. M. Uhlmann. 2009. Combating Global Climate Change: Why a Carbon Tax Is a Better Response to Global Warming than Cap and Trade. *Stanford Environmental Law Journal*. 28 (3). pp. 3–58.
- J. Ball. 2018. Why Carbon Pricing Isn't Working – Good Idea in Theory, Failing in Practice. *Foreign Affairs*. 97 (4). pp 134–146.
- K. Battle and E. Tamagno. 2007. *Public Pension in a Development Context: The Case of Canada*. *Social Policy and Development*. Programme Paper. Ottawa, Canada, United Nations Research Institute for Social Development.
- California Environmental Protection Agency, Air Resources Board (CEPA). 2018. *Sacramento, California*. <http://www.arb.ca.gov/cc/capandtrade/capandtrade.htm>.
- CPPIB. 2010. *Policy on Responsible Investing*. Toronto, Canada, Canadian Public Pension Investment Board.
- . 2017. *CPPIB Annual Report 2017*. Toronto, Canada, Canadian Public Pension Investment Board.
- G. L. Clark and A. H. B. Monk. 2009. The Legitimacy and Governance of Norway's Sovereign Wealth Fund: The Ethics of Global Investment. *Environment and Planning*. A42 (7). pp. 1723–1738.
- Climate Bonds Initiative. 2017. *Bonds and Climate Change 2017: Canada Report*. <https://www.climatebonds.net/>.
- M. den Elzen and N. Höhne. 2008. Reductions of Greenhouse Gas Emissions in Annex I and Non-Annex I Countries for Meeting Concentration Stabilisation Targets. *Climate Change*. 91 (3–4). pp. 249–274.
- G. Daskalakis. 2013. On the Efficiency of the European Carbon Market: New Evidence from Phase II. *Energy Policy*. 54. pp. 369–375.
- Government of Canada. 2007. *Canada Pension Plan Investment Board Act*. <http://laws-lois.justice.gc.ca/eng/acts/C-8.3/>.
- GEA. 2012. *Global Energy Assessment – Toward a Sustainable Future*. Vienna: International Institute for Applied Systems Analysis; Cambridge, UK, New York, NY: Cambridge University Press.
- K. Harrison. 2010. The Comparative Politics of Carbon Taxation. *Annual Review of Law and Social Science*. 6. pp. 507–529.
- . 2012. A Tale of Two Taxes: The Fate of Environmental Tax Reform in Canada. *Review of Policy Research*. 29. pp. 383–407.
- IEA. 2017. *World Energy Outlook 2017*. OECD/International Energy Agency. <http://www.iea.org/weo2017/>.
- IPCC. 2007. *Climate Change 2007: Synthesis Report*. *IPCC Fourth Assessment Report*. International Panel on Climate Change. [http://www.ipcc.ch/publications\\_and\\_data/publications\\_ipcc\\_fourth\\_assessment\\_report\\_synthesis\\_report.htm](http://www.ipcc.ch/publications_and_data/publications_ipcc_fourth_assessment_report_synthesis_report.htm).

- . 2011. *Special Report on Renewable Energy Sources and Climate Change Mitigation*. Intergovernmental Panel on Climate Change. <https://int.search.tb.ask.com/search/GGmain.jhtml>.
- A. B. Jaffe, S. Peterson and R. Stavins. 1995. Environmental Regulation and the Competitiveness of US Manufacturing: What Does the Evidence Tell Us? *Journal of Economic Literature*. 33. pp. 132–163.
- J. Jenkins. 2009. *Cap and Trade Worked for Acid Rain, Why not for Climate Change?* The Breakthrough Institute. [http://thebreakthrough.org/blog/2009/05/cap\\_and\\_trade\\_worked\\_for\\_acid.shtml](http://thebreakthrough.org/blog/2009/05/cap_and_trade_worked_for_acid.shtml).
- F. Lecocq and P. Ambrosi. 2007. The Clean Development Mechanism: History, Status, and Prospects. *Policy Monitor*. pp. 134–151.
- M. A. Levi. 2009. Copenhagen's Inconvenient Truth: How to Salvage the Climate Conference. *Foreign Affairs*. 88 (5). pp. 92–104.
- B. Lippke and J. Perez-Garcia. 2008. Will either Cap and Trade or a Carbon Emissions Tax be Effective in Monetizing Carbon as an Ecosystem Service? *Forest Ecology and Management*. 256. pp. 2160–2165.
- B. Little. 2009. *Fixing the Future: How Canada's usually Fractious Government Worked together to Rescue the Canadian Pension Plan*. Toronto, ON: University of Toronto.
- D. C. Matisoff. 2010. Making Cap-and-Trade Work: Lessons from the European Union Experience. *Environment*. 52 (1). pp. 10–19.
- M. McGuinness and A. D. Ellerman. 2008. *The Effects of Interactions between Federal and State Climate Policies*. Center for Energy and Environmental Policy Research, Washington, DC.
- M. Mendelson. 2005. *Financing the Canada and Quebec Pension Plans*. Toronto, Canada: Caledonian Institute of Social Policy.
- A. Michaelowa and P. Purohit. 2007. *Additionality Determination of Indian CDM Projects—Can Indian CDM Project Developers Outwit the CDM Executive Board?* Climate Strategies Working Paper. Zurich: University of Zurich.
- A. Ng. 2018. From Sustainability Accounting to a Green Financing System: Institutional Legitimacy and Market Heterogeneity in a Global Financial Centre. *Journal of Cleaner Production*. 195. pp. 585–592.
- A. Ng and J. Nathwani. 2018. Sustainable Energy Infrastructure for Asia: Policy Framework for Responsible Financing and Investment. In Subhes C. Bhattacharyya, ed. *Routledge Handbook of Energy in Asia*, Routledge, UK, 284–295.
- G. Prins, I. Galiana, C. Green, R. Grundmann, A. Korhola, F. Laird, T. Nordhaus, R. Pielke, S. Rayner, D. Sarewitz, M. Shellenberger, N. Stehr, and H. Tezuko. 2010. *The Hartwell Paper*. Institute for Science, Innovation and Society. Oxford: University of Oxford.
- B. Rabe and C. Borick. 2012. Carbon Taxation and Policy Labeling: Experience from American States and Canadian Provinces. *Review of Policy Research*. 29. pp. 358–382.
- C. Ren and A. Y. Lo. 2017. Emission Trading and Carbon Market Performance in Shenzhen, China. *Applied Energy*. 193. pp. 414–425.

- RGGI. 2012. *Regional Greenhouse Gas Initiative*. <http://www.rggi.org/>.
- Sandbag Organization. 2013. *Drifting Toward Disaster: The EU ETS Adrift in Europe's Climate Efforts*. [http://www.sandbag.org.uk/site\\_media/pdfs/reports/Drifting\\_Towards\\_Disaster.pdf](http://www.sandbag.org.uk/site_media/pdfs/reports/Drifting_Towards_Disaster.pdf).
- L. Schneider. 2009. Assessing the Additionality of CDM Projects: Practical Experiences and Lessons Learned. *Climate Policy*. 9 (3). pp. 242–254.
- A. Tan, M. Kaidonis and L. Moerman. 2008. Balancing the Seesaw: How Australia's Carbon Pollution Reduction Scheme Can Fail. In Proceedings of the *21st Australasian Finance and Banking Conference, Sydney, Australia*. <https://www.business.unsw.edu.au/about/schools/banking-finance/seminars-conferences/australasian-finance-banking-conference/21st-australasian-finance-and-banking-conference>.
- V. Tanzi and L. Schuknecht. 2000. *Public Spending in the 20th Century: A Global Perspective*. Cambridge: Cambridge University Press.
- E. Truman. 2008. *A Blueprint for Sovereign Wealth Fund Best Practices*. Peterson Institute for International Economics. Number PB08-3.
- A. Vasa and K. Neuhoﬀ. 2011. *The Role of CDM Post-2012*. Berlin: Climate Policy Initiative/DIW.
- B. Vikøren. 2008. Norges Bank's Experiences with the Organization of the Government Pension Fund—Global. In Proceedings of *Commodities, Energy and Finance*. Vienna: SUERF: The European Money and Finance Forum.
- M. Wara and D. G. Victor. 2008. *A Realistic Policy on International Carbon Offsets*. Stanford Law School Working Paper. <http://www.law.stanford.edu/publications/details/4032/>.
- WGSi. 2012. *Equinox Blueprint: Energy 2030*. Waterloo, ON: Waterloo Global Science Initiative.
- N. Yoshino and F. Taghizadeh–Hesary. 2017. *Alternatives to Bank Finance: Role of Carbon Tax and Hometown Investment Trust Funds in Developing Green Energy Projects in Asia*. ADBI Working Paper 761.
- . 2018. Alternatives to Private Finance: Role of Fiscal Policy Reforms and Energy Taxation in Development of Renewable Energy Projects. In V. Anbumozhi, K. Kalirajan and F. Kimura, eds. *Financing for Low-Carbon Energy Transition: Unlocking the Potential of Private Capital*. Springer nature Singapore Pte Ltd.
- X. Zhao, L. Wu, and A. Li. (2017) Research on Efficiency of Carbon Trading Market in China. *Renewable and Sustainable Energy Reviews*. 79. pp. 1–8.