ECONOMIC APPROACHES TO PROMOTION OF CLEAN ENERGY

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The uncontrolled exploitation of Earth's resources has resulted in irreversible changes in the environment generally and the climate in particular. Therefore, a global and immediate policy response is urgently required to reduce greenhouse gas emissions and mitigate climate change. There is compelling evidence that climate change is the greatest and widest-ranging market failure ever seen. To combat the resultant market failure and externalities, there is a need to tackle climate change through economics. The paper aims at portraying the certainty associated with the economic approaches, rather than the policy approaches for combating climate change. A carbon tax seems to be a potent mitigation policy, other policies being cap and trade, renewable portfolio standards, feed-in tariffs, production tax credits. If these policies are implemented exclusive of each other, irrespective weaknesses may cause hurdles, however, if harmonised internationally, they can be effective in promoting clean energy and thereby helping combat climate change. We compare these policies in different countries with a view to comprehensively analysing their respective roles in combating climate change.

I. INTRODUCTION

We stand today at the brink of a long term anthropogenic and ecological change, prompted not by the forces of nature but our own exploitation of the planet's resources.[1] This has led to irreversible impacts including but not limited to the melting of the Polar Regions, rise in sea level and changes in rainfall patterns around the world. It is also likely that the average global temperature will rise by at least two degrees Celsius by the end of this century.[2] It has also been established in various scientific studies that any such warming of the planet will lead to increased natural calamities like floods and cyclones,

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[1] *See also* Intergovernmental Panel on Climate Change, Cambridge, *Climate Change 2007: Synthesis Report* (2007), available at http://www.ipcc.ch/pdf/assessment-report/ar4/syr/ar4_syr.pdf (Last visited August 10, 2017).

[2] *Id*.

declined crop yields and ecological degradation.[3] At the same time, it is important to note that a significant increase in global temperatures correlates with an average 5 percent loss in global GDP, with poor countries suffering costs at a rate in excess of 10 percent of their GDP.[4]

Some countries and regions like the United States of America ('U.S.') and the European Union ('EU') already have fairly successful carbon pricing regimes in place in the form of carbon taxes and emissions trading schemes.[5] On the other hand, some other countries have chosen to introduce general taxes on energy consumption instead of direct taxes on carbon content.[6] This can be a good starting point for a shift in policy by countries while they deliberate on the modalities of a harmonised carbon tax regime. Such a gradual shift may be necessitated because the political consensus in favour of a direct carbon tax will be difficult to achieve in low and middle-income countries, which have economic growth priorities and lack the capacity to administer such regimes.[7]

In order to be effective in combating climate change by promoting clean energy, countries must first negotiate and share policy experiences and researches. In the science of climate change, where there is significant uncertainty, negotiations and joint researches would help bridge the information gap leading to a common realisation of the impending disaster. Secondly, countries must decide upon the appropriate forum to discuss and implement any such mitigation policy, on a priority basis. The jurisdictional issues facing the World Trade Organisation ('WTO') and United Nations Framework Convention on Climate Change ('UNFCCC') negotiations must not be the stumbling blocks while deciding upon this matter of global concern. The WTO could potentially be the preferred forum, given the important nexus between international trade and climate change. Finally, any prospective policy regime must give the highest importance to the African continent, given the fact that Africa will produce the India and China of today in the middle of this century. A rapidly growing

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3 Stern, N. et al., *Stern Report: The Economics of Climate Change*, Research Group on Climate Change, ix, available at http://mudancasclimaticas.cptec.inpe.br/~rmclima/pdfs/destaques/sternreview_report_complete.pdf (Last visited August 10, 2017).

4 Due to the rising temperatures, there is an increased risk of natural calamities. Further, rising temperatures mean rise in sea levels and melting of the polar icecap leading to the coastal cities getting submerged under water. This would cause huge economic loss. The reason why the developing countries would be worse off is that they do not have the required technology or the resources to adequately combat the rising sea levels or the increasing natural calamities. *See also*, Stern, N. et al., *Stern Report: The Economics of Climate Change*, Research Group on Climate Change, ix, available at http://mudancasclimaticas.cptec.inpe.br/~rmclima/pdfs/destaques/sternreview_report_complete.pdf (Last visited August 10, 2017).

5 William Nordhaus, A Question of Balance: Weighing the Options on Global Warming Policies (2008).

6 *Id*.

7 *Id*.

African economy must then be able to learn from the past lessons without having to choose between economic growth and climate change mitigation.

In this article, we explore the costs and benefits of various economic approaches available to policy makers to promote clean energy. Among the main approaches are carbon tax; a cap and trade system involving emissions credits; renewable portfolio standards; feed-in tariffs and other production tax credits. The aim of this paper is to find the best possible solution to promote clean energy amongst the aforementioned alternatives. Part II of the paper deals with the need for the adoption of an economic approach to promoting clean energy. Part III deals with the solutions that different countries and states have devised, in order to tackle the issues arising out of non-renewable energy sources and as a corollary, promote clean energy. Part IV compares these approaches to promote clean energy while Part V seeks to determine the best possible way forward.

II. ECONOMIC PERSPECTIVE

Economics plays a very important role with respect to the issue of clean energy. Ceteris paribus, the cheaper the commodity, the higher is its demand. Similarly in promoting clean energy, states must keep in mind that consumers are not going to purchase the commodity if the cost of, for example, solar energy is twice that of energy produced through coal or petroleum. Therefore, governments have come up with indigenous ways to ensure that prices of clean energy are competitive, if not lower that their non-renewable counterparts. Simple economics is therefore key to the promotion of clean energy. If solar energy were cheaper, why wouldn't a consumer buy it?

One way to make clean energy cheaper is to make its substitute costlier. This approach is called carbon-tax, where emitters of carbon are taxed. However, this makes the cost of energy in itself costlier, which is ultimately borne by the consumers.

Carbon dioxide emissions are a classic example of 'externality', meaning that emissions occur at no cost to the emitting facility, but at an enormous cost to society as a whole.[8] An externality is indicative of a market failure. This market failure is caused where the marginal cost of production to the polluter is lesser than the marginal cost of production to the society is higher. Therefore, economically, the market resources are not optimally utilised. Hence, a carbon tax sends a clear signal to polluters. Since pollution imposes a negative externality on others, polluters should be compelled to internalise that cost by paying the tax.[9]

[8] Nicholas Stern, *The Stern Review: The Economics of Climate Change*, available at http://www.hm-treasury.gov.uk/media/4/3/Executive_ Summary.pdf (Last visited August 10, 2017).

[9] David G. Duff, *Tax Policy and Global Warming*, 51 Can. Tax. J. 2063, 2090 (2003).

Theoretically, a carbon tax should be revenue neutral, which implies that the tax raised from taxing carbon emissions can be used to reduce other taxes. The reason why carbon tax would be revenue neutral is because there would be no excess of revenue that ought to be collected by the Government. The tax in itself ought to be a deterrent to prevent the carbon emissions. Thus, there should be no overall increase in the tax burden on the society because the aim is primarily to increase social efficiency by making people aware of the full social cost.[10]

However, the situation is not ideal. The government collects revenues from carbon tax, thus it is important to see how the revenues from the carbon tax are utilised. The ultimate economic effects of a carbon tax would depend on how the revenues from the tax are used by authorities levying them. The reduction of federal budget deficits or lowering of existing marginal tax rates are measures that would reduce the total costs to the economy from a carbon tax.[11] One way to utilise the revenues would be to provide subsidies to the renewable energy sector. This would help further counter carbon emissions.

III. ECONOMIC APPROACHES

A. CARBON TAX

Carbon tax is an initiative introduced by governments to ensure that environment polluters pay the social cost[12] of their actions.[13] It is the most widely accepted and implemented approach to promote clean energy. This concept is similar to the 'polluter pays principle',[14] which expounds that those who pollute should bear the costs of managing it to prevent damage to human health or the environment.[15] After the 1992 Rio summit, imposition of carbon tax has been considered as a part of international law.[16] Governments use carbon tax as

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[10] Tejvan Pettinger, *Carbon Tax – Pros and Cons*, Economics Help, available at http://www.economicshelp.org/blog/2207/economics/carbon-tax-pros-and-cons/(Last visited August 10, 2017).

[11] Congressional Budget Office, *Effects of a Carbon Tax on the Economy and the Environment*, Congress of The US, available at http://www.cbo.gov/sites/default/files/113th-congress-2013-2014/reports/44223_Carbon_0.pdf (Last visited on August 10, 2017).

[12] Cost of Carbon, *The Cost of Carbon Pollution*, available at http://costofcarbon.org/faq (Last visited August 10, 2017) (The social cost of carbon pollution calculates the economic cost of these problems and estimates the damage done by each ton of carbon dioxide that is spewed into the air. The current estimate is around $40).

[13] Green Garage, *8 Main Pros and Cons of Carbon Tax*, An Eco-friendly Blog, available at http://greengarageblog.org/8-main-pros-and-cons-of-the-carbon-tax (Last visited August 10, 2017).

[14] Principle 16, the Rio Declaration on Environment and Development, 1992.

[15] Duncan Clark, *What is the polluter pays principle?*, The Guardian, available at https://www.theguardian.com/environment/2012/jul/02/polluter-pays-climate-change (Last visited August 10, 2017).

[16] Garage, *supra* note 13.

a mechanism to internalise the externalities that are caused by climate change. A carbon tax helps differentiate the products based on price. Due to the tax, products having a polluting manufacturing process would be priced higher than other products[17]. Decision makers can allocate the tax proceeds at their discretion. For instance, revenue from a carbon tax might be used to subsidize new solar and wind electricity facilities.[18]

In this respect, it is necessary to note that harmonised carbon taxes hold advantages over quantitative limits imposed through government control and regulation.[19] First, a carbon tax regime avoids the problems related to choosing a baseline. In a price approach, the natural baseline is a zero-carbon tax.[20] Second, a carbon tax policy will be better able to adapt to the element of uncertainty, which pervades the science of climate change and its mitigation. To elaborate, a carbon tax is a legislative step taken irrespective of climate change policies. The reason is that the quantity limits on emissions are related to the amount of greenhouse gas ('GHG') emissions, while the price limits are related to the flow of emissions. Therefore, the tax is quantifiable, whereas other policy implementations are not as certain, rather economical, as carbon tax. From this arises another complication of price volatility, which is the third reason why carbon tax policies are likely to cause less volatility in the prices of carbon emissions.

Fourth, quantity limits policies often witness administrative arbitrariness and corruption through rent seeking and other means. This also sends off negative signals to potential investors. In the price-based approach like in the case of a carbon tax, the investor has an assured long term regulation to adapt to and can weigh in the costs involved.[21] Fifthly, the most contentious issue in any international negotiation on climate change mitigation either at the level of WTO or UNFCCC has been the issue of equity between the high-income and low-income countries. The price-based approach in the form of carbon taxes seems to be easier to implement such equity-based international adjustments than the quantity based approach. An example of that adjustment can be that the countries will be allowed a full participation when their incomes

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[17] Centre for Climate Change and Policy, *Options and Considerations for a Federal Carbon Tax*, February, 2013, available at https://www.c2es.org/publications/options-considerations-federal-carbon-tax (Last visited August 10, 2017).

[18] Donald B. Marron & Adele C. Morris, *How Should Governments Use Revenue From Corrective Taxes?*, BROOKINGS, available at https://www.brookings.edu/wp-content/uploads/2016/07/How-Should-Governments-Use-Revenue-from-Corrective-Taxes-Marron-Morris-1.pdf (Last visited August 10, 2017).

[19] Quantitative limits are imposed on polluters thereby they cannot emit more than a certain quantity of harmful substances.

[20] For quantitative limits, as explained above, a baseline is required above which a polluter cannot legally pollute. In case of carbon tax, the baseline is zero pollution, as it doesn't follow a quantity-based mechanism. It is more certain.

[21] WILLIAM NORDHAUS, A QUESTION OF BALANCE: WEIGHING THE OPTIONS ON GLOBAL WARMING POLICIES (2008).

reach a given threshold ($10,000 per capita as proposed by one leading economist) and poor countries receive transfers for an early participation.[22] Finally, the carbon tax will essentially be a Pigovian Tax[23] that balances the marginal social costs and benefits of additional emissions, thereby internalising the costs of environmental damage. It can act as an incentive for the consumers and producers to shift to more energy efficient sources and products.[24]

A general tax on energy consumption combined with a technology-centric policy that favours entrepreneurs and investors who develop low-energy consuming, energy intensive products (like the national policy goals adopted by China and India)[25] can be a good starting point from where they can gradually move towards a direct carbon tax as a part of an international harmonised regime. Another approach for the time being can be a combination of 'cap-and-tax' which would combine the strengths of both quantity and price approaches and might also address the concerns of environmentalists that a price based approach does not impose hard constraints on emissions.[26] However, at the same time, any prospective policy must be flexible enough to adjust as new evidence becomes available over time. The carbon tax approach gives us this flexibility.

The higher price of emissions encourages firms, as well as consumers, to develop engines that are more efficient.[27] Levying carbon taxes encourages alternatives[28] such as the development of solar and hydropower i.e. green electricity or renewable energy sources.[29] This system may ease the transition to a post-oil economy, as well as mitigate the damage caused by environmental pollution. Most importantly, it sends across a message that people must bear the social cost of their activities.[30]

On the other hand, levying carbon taxes on companies may lead to production shifting to countries ('pollution havens') with no or lower carbon taxes.[31] This implies that a company operating from a country levying carbon tax, may outsource or shift majority of its production operations to a country with no carbon taxes. Such a move could have a large economic impact on the trade routes of the world.

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22 *Id*.
23 *Id*.
24 *Id*.
25 *Id*.
26 *Id*., 203.
27 PETTINGER, *supra* note 10.
28 *Id*.
29 *Id*.
30 *Id*.
31 *Id*.

B. CAP AND TRADE

Under this approach, a 'cap' on greenhouse gas emissions is a limit backed by scientific data and analysis.[32] This cap is equivalent to the annual allowable emissions of the targeted pollutant. Firms are allocated a certain number of allowances to pollute, which cumulatively fulfil the cap,[33] and companies are required to pay penalties in case they exceed the cap. The 'trading' happens when companies buy and sell allowances that permit them to emit only a certain amount. Such trading gives companies a strong incentive to save money by cutting emissions.[34]

If the cap is set too high, an excess of emissions will enter the atmosphere and the scheme will have no effect on the environment. Likewise, a high cap can also reduce the value of allowances, causing losses in firms that have reduced their emissions and banked credits. On the other hand, if the cap is set too low, allowances are scarce and overpriced. Some cap and trade schemes have safety valves to keep the value of allowances within a certain range. If the price of allowances gets too high, the scheme's governing body will release additional credits to stabilize the price.[35] The price of allowances is usually a function of supply and demand.[36]

Numerous cap and trade programs include offset provisions allowing firms to purchase additional allowances from the regulator, by investing in additional pollution-reducing programs.[37] Under a cap and trade program, the regulated firms use their own industry knowledge and expertise to decide the most sensible method of reduction. Additionally, firms also cover emissions beyond their allocated amounts, by purchasing allowances from other firms.[38]

For environmentalists, the cap and trade approach signifies a declining cap on carbon dioxide emissions. For industries, this approach offers the possibility of a new market in carbon allowances, which gives potential for sizeable income for companies that can inexpensively reduce their carbon dioxide emissions. For economists, the cap and trade system permits markets to account for externalities, by virtue of price determination of carbon. For

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[32] Environmental Defence Fund, *How Cap and Trade Works*, available at https://www.edf.org/climate/how-cap-and-trade-works (Last visited on August 10, 2017).

[33] Roberta Mann, *How to Love the One You're With: Changing Tax Policy to Fit Cap-and-Trade*, 2 SAN DIEGO J. CLIMATE & ENERGY L. 145, 156 (2010).

[34] ENVIRONMENTAL DEFENCE FUND, *supra* note 32.

[35] Rinkesh, *What is a Cap and Trade System, Conserve Energy*, available at http://www.conserve-energy-future.com/what-is-cap-and-trade-system.php (Last visited on August 10, 2017).

[36] Sarah Dowdey, *How Carbon Trading Works*, HOWSTUFFWORKS SCIENCE, available at http://science.howstuffworks.com/environmental/green-science/carbon-trading.htm (Last visited August 10, 2017).

[37] *Id*.

[38] *Id*.

politicians, cap and trade is an opportunity to combat global warming, without implementing complex regulatory schemes or imposing a tax, such as the carbon tax, on every fossil fuel.[39]

It is evident that the cap and trade approach offers the benefit of increasing limits on carbon dioxide emissions and, theoretically, compels the market to choose the most efficient and innovative carbon dioxide reduction mechanisms.[40]

The effectiveness of a cap and trade system can be impeded by numerous factors. There are difficulties insetting baselines[41] for emission reduction targets, determining how and to whom to freely distribute allowances, and the controversial use of offsets in place of meaningful emission reduction measures.[42] Moreover, despite promising fixed reductions in carbon dioxide emissions, uncertainty persists about the price of such reductions.[43] If the price of carbon rises too high, there will be political pressure to relax the carbon cap, which defeats the principle benefit of a cap and trade system.[44]

However, there is an economic disadvantage to this model. It is a deterrent against polluting, however, if a polluter knows that the Board will issue fresh credits if the price is too high; the polluter can pre-empt the same. Therefore, there is a need to eliminate the market forces to arrive at a genuine allowance/cap.

In our view, a cap and trade system creates a complicated, artificial market, whose basic features are controlled by government intervention. This artificial market comprises of the demand and supply created due to the variations in price of allowances to pollute. Since it is artificially controlled by government agencies, it violates basic principles of free market systems, and compromises on organic demand-supply processes. When bureaucrats are vested with the authority to determine quantitative processes, then by virtue of lobbying the government for securing favours for any one particular industry,[45] what remains is a mere perception of a free market, and not a free market itself.

C. FEED IN TARIFFS

A feed-in tariff ('FIT') is another policy that promotes the rapid increase in production of renewable energy resources. A FIT practically gives

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[39] Avi-Yonah & Reuven S., *Combating Global Climate Change: Why a Carbon Tax is a Better Response to Global Warming than Cap and Trade*, Stan. Envtl. L. J. 28, no. 1 (2009): 3-50.

[40] Richard B. Stewart And Jonathan B. Wiener, Reconstructing Climate Policy 67-68 (2003).

[41] Virginie Marcha et al., *Environmental Outlook to 2050 Climate Change Chapter*, OECD, available at https://www.oecd.org/env/cc/49082173.pdf (Last visited August 10, 2017).

[42] Yonah & Reuven, *supra* 39.

[43] *Id*.

[44] *Id*.

[45] Environmental Defence Fund, *supra* note 32.

a guarantee to the producers of renewable energy electricity that the electricity they produce will be consumed—if not by the consumers then the State will buy it. FIT targets the other side of the economic spectrum. The other approaches discussed above, deal with restrictions being put on the non-renewable forms of energy production, by putting a restriction on the amount of energy that can be produced by limiting the carbon emission or making them more expensive. FIT on the other hand, makes it more economical or cheaper so as to promote clean energy. These payments are generally awarded to producers even before they start production, primarily as a long-term contract sets over a period ranging from 10 to 20 years.

FIT regulations have been successful in various states around the world, most specifically in the EU. Six U.S. States (California, Hawaii, Maine, Oregon, Vermont, and Washington) also have similar regulations for FITs for promoting renewable energy. Some U.S. States also have voluntary FITs. This voluntary FIT is evidence of the growing interest in these regulations. These regulations help not only to promote renewable energy but also help in job creation. Therefore, they are the most popular among politicians.

D. PRODUCTION TAX CREDIT

Production Tax Credit ('PTC') is a U.S. Government incentive that provides producers of renewable energy with financial support to develop and become competitive with non-renewable energy producers. Producers who generate electricity through wind, solar, geothermal, or 'closed-loop' bioenergy are eligible for the production tax credit. This scheme provides financial support, typically 2.3 cents per kilowatt-hour, for the first ten years of a renewable energy facility's operation.

The PTC is a major incentive for wind power production in the US. This added incentive has helped to gain significant economic benefits for wind energy producers, according to the U.S. Department of Energy:

From 2007 and 2014, U.S. wind energy production capacity nearly quadrupled. This meant that at an annual rate, investments of $15 billion poured in. The end result was that more than 550 manufacturing stations were built in 43 U.S. states. This has driven down the cost of producing wind energy significantly, now less than half its original cost in 2007. However, the Congress has been back and forth with the extension, renewal and expiration of these policies, which has created a lot of uncertainty in the wind industry.

E. RENEWABLE PORTFOLIO STANDARDS

A Renewable Portfolio Standard ('RPS') is featured in U.S. state legislations or federal regulations that require electricity suppliers to include

renewable resources in their electricity generation portfolios. Hitherto, in the United States, 35 states and the District of Columbia have adopted RPS policies or renewable purchase obligations.[46] Five of these states have RPS goals, rather than mandatory requirements.[47] Initially, many states adopted RPS policies as part of electric industry restructuring. However, recently, several states have implemented various policies by legislation or proceedings that are distinct from restructuring activities. Each state has made their RPS different in terms of technologies satisfying the purchase obligation, size limitations, special set-asides for certain technologies, different target dates, and utilities possibly owning the renewable facility.[48]

Renewable Portfolio Standards all create a protection for renewable energy producers in the market. One disadvantage of this protection can be that after a certain point, the renewable energy producers will have to sustain themselves.[49] Also, RPS, especially in the U.S., mandates that utilities produce a said minimum percentage of their total energy production from renewable resources by a certain date.[50]

In some states, this minimum percentage renewable energy production can be purchased in the form of Renewable Energy Certificates to meet this requirement.[51] These certificates are issued to renewable energy producers based on the amount of energy they feed into the grid. Selling the certificates is another way for the renewable producer to supplement its revenues.[52]

The problem with the transferability of certificates is that they are only profitable as long as the demand for these certificates is higher than the supply, thus benefitting the renewable energy producers. However, with more incentive and profits, the number of renewable energy producers will increase, thus increasing competition. This competition will push the prices down to a critical point after which these certificates will no longer be profitable.[53] Therefore, if the amount of renewable energy produced exceeds the required amount, certificate prices will crash. This can damage the economic viability of the renewable producers.[54]

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46 American Coal Council, *Renewable Portfolio Standards*, available at http://www.americancoalcouncil.org/?page=rps (Last visited August 10, 2017).

47 *Id*.

48 *Id*.

49 *Id*.

50 *Id*.

51 *Id*.

52 David Toke, *Renewable financial support systems and cost-effectiveness*, Journal of Cleaner Production, 15 (3): 280–287.

53 A. Kildegaard, *Green Certificate Markets, the Risk of Over-Investment, and the Role of Long term Contracts*, Energy Policy, 36, 3413– 3421 (2008).

54 *Id*.

The goals of RPS mandates are essentially making electricity generated from renewable sources economically competitive with the electricity generated from fossil fuels.[55] This has a positive effect on the development in the renewable energy field.[56]

The proponents of RPS claim that this approach creates market demand for renewable energy supplies. This demand results in environmental improvement from reduced air pollution, climate change mitigation, habitat preservation, and conservation of natural resources.[57] Further, natural gas prices become lower due to displacement of gas generation by renewables; power prices become less volatile; and there is local economic development from new jobs, taxes, and revenues.[58]

Notwithstanding the obvious benefits, it remains to be seen whether the price paid to fulfil a federal RPS would be appropriate for the incremental net benefits arising from reduced pollution.[59]

IV. COMPARISONS

Carbon taxes and cap-and-trade programs share several major advantages over alternative policies. Both approaches reduce GHG emissions, by encouraging the lowest-cost emissions reductions, as well as encouraging investors and entrepreneurs to develop new low-carbon technologies.[60] As an outcome, both policies generate government revenue that can be potentially used in productive ways.[61]

However, a carbon tax and cap and trade differ in numerous dimensions. Due to its easy and quick implementation, it would become effective immediately.[62] Thus, the effects of a carbon tax system would be seen faster

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55 Sam Schoofs, *A Federal Renewable Portfolio Standard: Policy Analysis and Proposal*, INSTITUTE OF ELECTRICAL AND ELECTRONIC ENGINEERS, available at http://www.wise-intern.org/journal/2004/wise2004-samschoofsfinalpaper.pdf (Last visited August 10, 2017).

56 UND Energy Blog, *Pros and Cons of National Renewable Energy Portfolio Standard*, available at http://undenergylaw.blogspot.in/2012/03/student-post-pros-and-cons-for-national.html (Last visited August 10, 2017).

57 Julian Dumanski, *Evolving concepts and opportunities in soil conservation*, 3 ISWCR 1 INTERNATIONAL SOIL AND WATER CONSERVATION RESEARCH (2015).

58 AMERICAN COAL COUNCIL, *supra* note 46.

59 Cato Institute, *Evaluating the Case for Renewable Energy: Is Government Support Warranted?*, available at http://www.cato.org/pubs/pas/pa422.pdf (Last visited August 10, 2017).

60 Noah Kaufman, *Carbon Tax v. Cap and Trade,* WORLD RESOURCES INSTITUTE, http://www.wri.org/blog/2016/03/carbon-tax-vs-cap-and-trade-what%E2%80%99s-better-policy-cut-emissions (Last visited August 10, 2017).

61 *Id*.

62 Marshall Saunders, *Carbon Tax Needed Now To Slow Climate Change,* CITIZENS CLIMATE LOBBY, available at http://citizensclimatelobby.org/files/CCLEditorialPacket.pdf (Last visited August 10, 2017).

than a cap and trade system. A carbon tax imposed in domestic fora is also a great advantage in the international fora to demand for an international agreement curbing carbon dioxide emissions.[63] Having an international agreement would ensure that the advantage taken by companies to shift production to weaker regulatory regime countries would not be possible. This agreement could help implement an international cap and trade system, as well as enact measures preventing the abuse of production havens by countries with dominant regimes.

However, a carbon tax system comes with practical limitations. Those political considerations may be increased due to the instability in energy prices and economic concerns. No government wants to tax its citizens because that will lead to fewer votes.[64] Therefore, a cap and trade system may be more viable politically, because it is not labeled a tax.[65] Nevertheless, the political advantages of the cap and trade system are not as real as they seem. Climate change legislators argue that the costs associated with both a carbon tax and cap and trade are substantially similar. Both these process would increase energy costs.[66]

Cap and trade provides benefit certainty, meaning that it provides certainty with regard to the environmental benefits resulting from its implementation, because it imposes an overall cap on the level of emissions permitted in the economy.[67] However, by virtue of this, there is a lack of cost certainty, which is that there is no regard for the cost incurred by the economy at large or by individual polluters. In contrast, a carbon tax provides cost certainty, because the precise amount of the tax to be collected from the stakeholders is fixed in advance; it is certain that a particular amount of revenue will be earned by this method.[68] However, because the effect of imposing a carbon tax on GHG emissions cannot be determined in advance, the carbon tax does not offer benefit certainty.[69]

It has been noted that economists like carbon tax for its predictability. The price of carbon undercap-and-trade schemes usually fluctuate with the weather and changes in economic conditions. This can be attributed to cap-and-trade schemes setting definite limits on emissions, and not a fixed price

[63] International Institutions and Global Governance Programme, *The Global Climate Change Regime*, Council for Foreign Relations, available at https://www.cfr.org/report/global-climate-change-regime (Last visited August 10, 2017).

[64] Stephen Power & Leila Abboud, *Climate Effort Could Be Stalled by Credit Crisis*, Wall St. J. (2008).

[65] *Id*.

[66] *Id*.

[67] Luca Taschini et al., *Carbon Tax v. Cap and Trade – Which is better*, The Guardian, available at https://www.theguardian.com/environment/2013/jan/31/carbon-tax-cap-and-trade (Last visited August 10, 2017).

[68] *Id*.

[69] Yonah & Reuven, *supra* note 39.

on carbon.[70] By contrast, carbon taxes are stable, which empowers businesses to know the price of carbon and invest in alternative energy accordingly.[71] In addition to this, a carbon tax is simpler to implement and enforce, by virtue of simplicity in adjusting to market-based changes.[72]

The dominance of one system over the other would depend on how each approach is formulated.[73] The design of either approach will establish their environmental and economic efficacy. It is not necessary that one approach has to be prioritised over the other; if both are well-designed, they could be used in tandem. The imperative factor here is that applying costs on pollution provides an incentive for everyone, from industry to households, to be part of the solution. Ultimately, the crucial factor in reducing GHG emissions is the vigour of economic policies. Strong policies will provide impetus to growth in clean, renewable energy and will encourage adoption of greener practices.[74]

V. CONCLUSION

In our opinion, the goal is not solely to reduce pollution, but also to subsidize the renewable energy industry in a manner that large-scale implementation brings overall costs into a more competitive range. It is imperative to consider that environmental justice, carbon taxes, renewable portfolio standards, feed-in tariffs or production tax credits as well as cap and trade programs can be harmonised.

A more robust and nuanced approach that ensures clean energy, as well as promotes principles of public participation, equity, and empowerment, while still maintaining an optimal and efficient market-based system, is what we can look forward to.

Each crisis presents us with an opportunity to reform and grow further. Similarly, climate change mitigation also has an immense business potential; the climate change industry is a likely growth sector of the future. It is now the job of regulators to draw the contours of these sectors to make them sustainable and equitable. Carbon tax policy might not seem a swashbuckling program but it is also less likely to face political opposition and compromise.

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70 *Id*.
71 Dowdey, *supra* note 36.
72 *Id*.
73 Luca Taschini, *supra* note 67.
74 *Id*.