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WHAT ARE THE FINANCIAL MECHANISMS UNDER THE CLIMATE CHANGE REGIME THAT SUPPORT THE USE OF RENEWABLE ENERGY. HOW CAN THESE MECHANISMS BE IMPROVED WITHIN THE 2020 AGREEMENT?

Anna-Maria CODILEAN[*]

ABSTRACT: *The financial mechanisms that support the use of renewable energy under the climate change regime and how these mechanisms can be improved by the 2020 Agreement. Some of the sources of renewable energy that are supported through financial mechanisms from climate change policies are Bio-energy, Solar Energy, Geothermal energy, Hydropower, wind energy and Ocean energy through tidal waves. Tapping these sources for energy is financially prohibitive as the cost of generation of power is far higher than the market price of electricity. Therefore financial incentives are required to promote the use of renewable energy*

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The need for more strategic national action and need for funding to tackle climate change can be traced back as early as 1972, when the *United Nations Conference on the Human Environment*[1] in Stockholm took place . As the United Nations Framework Convention on Climate change , UNFCCC publication *The First Ten Years* points out, developed countries many years ago 'agreed that they would need to support the efforts of developing countries, but they argued against establishing a new financial mechanism believing that the Global Environment Facility, established in 1991, could serve the purpose.' On the financial mechanism, it is curious that there are no Articles in the Convention that establish the mechanism itself. Instead, several articles define what it should be or do. Article 11.1 provides for 'a mechanism for the provision of financial resources on a grant or concessional basis, including for the transfer of technology'. The article also states that 'its operation shall be entrusted to one or more existing international entities' and that 'it shall function under the guidance of and be accountable to the Conference of the Parties (COP) , which shall decide on its policies, programme priorities and eligibility criteria related to this Convention', but not on the approval of projects, a task which is left to the GEF as operating entity. Article 11.2 states that the financial mechanism 'shall have an equitable and balanced representation of all Parties within a

[*] LLB (Hons), LLM, Phd Canditate at Queen Mary University of London; ENGLAND.

[1] http://www.unep.org/documents.multilingual/default.asp?documentid=97&articleid=1503

transparent system of governance'. And Article 11.5 provides that 'developed country Parties may also provide and developing country Parties avail themselves of, financial resources related to the implementation of the Convention through bilateral, regional and other multilateral channels.'

The convention focuses on Adaptation,Climate finance, Mitigation and Technology with the aim of fulfilling the objectives set out under the climate change agreements. Adaptation refers to adjustments in ecological, social, or economic systems in response to actual or expected climatic stimuli and their effects or impacts. It refers to changes in processes, practices, and structures to moderate potential damages or to benefit from opportunities associated with climate change. Climate finance refers to local, national or transnational financing, which may be drawn from public, private and alternative sources of financing. Climate finance is critical to addressing climate change because large-scale investments are required to significantly reduce emissions, notably in sectors that emit large quantities of greenhouse gases. Climate finance is equally important for adaptation, for which significant financial resources will be similarly required to allow countries to adapt to the adverse effects and reduce the impacts of climate change . According to the Fourth Assessment Report of the International Panel for Climate Change (IPCC AR4), global greenhouse gas (GHG) emissions have grown since pre-industrial times, with an increase of 70 per cent between 1970 and 2004. With current climate change mitigation policies and related sustainable development practices, these emissions will continue to grow over the next few decades . Finally with respect to Technology, promoting the effective development and transfer of environmentally sound technologies is critical in enabling developing countries to pursue their objectives for sustainable development in a climate-friendly manner. The Convention therefore urges developed country Parties and Annex II Parties to take all practicable steps to promote, facilitate and finance, as appropriate, the transfer of, or access to, environmentally sound technologies and know-how to other Parties, particularly to developing countries, to enable them to implement the provisions of the Convention .

Under the financial mechanism of climate change a number of funds are set up in order to enable transfer of financial funds from developed countries towards developing countries in support of the the goals set up by the convention. Some of these funds such as Green climate fund,Climate Bonds, the special climate change fund, Least Developed Countries Fund, Adaptation Fund and clean development fund aim to focus the climate change mechanism in a way to lower the green house gases by way of enabling technical solution to energy generation such as through the use of renewable energy. Additional financial mechanisms that exists include carbon markets, traditional loans as well as insurance instruments that enable countries to help plan out their climate change policies such as supporting costlier renewable energy sources over cheaper carbon non-renewable sources.

Various types of renewable energy sources can supply electricity, thermal energy and mechanical energy, as well as produce fuels that are able to satisfy multiple energy service needs . Some of these renewable (RE) technologies can be deployed at the point of use i.e decentralized in rural and urban environments, whereas others are primarily deployed within large , centralized energy networks . Though a growing number of RE technologies are technically mature and are being deployed at significant scale, others are in an earlier phase of technical maturity and commercial deployment or fill specialized niche markets .

Some of the sources of renewable energy that are supported through financial mechanisms from climate change policies are Bio-energy, Solar Energy, Geothermal energy, Hydropower, wind energy and Ocean energy through tidal waves. On a global basis, it is estimated that RE accounted for 12.9% of the total 492 Exa-joules (EJ) of primary energy supply in 2008 . The largest RE contributor was biomass (10.2%), with the majority (roughly 60%) being traditional biomass used in cooking and heating applications in developing countries but with rapidly increasing use of modern biomass as well.6 Hydropower represented 2.3%, whereas other RE sources accounted for 0.4%. In 2008, RE contributed approximately 19% of global electricity supply (16% hydropower, 3% other RE) and biofuels contributed 2% of global road transport fuel supply. Traditional biomass (17%), modern biomass (8%), solar thermal and geothermal energy (2%) together fueled 27% of the total global demand for heat. Deployment of RE has been increasing rapidly in recent years . Various types of government policies as a consequence of the financial mechanism under climate change,the declining cost of many RE technologies, changes in the prices of fossil fuels, an increase of energy demand and other factors have encouraged the continuing increase in the use of RE. Collectively, developing countries host 53% of global RE electricity generation capacity

This article focuses on understanding the financial mechanisms such as the funds that aim to mitigate the problems of green house gas through incentives to use renewable energy. Further, new ideas as well as limitations of current mechanism are detailed with an aim of understanding how these can better enable the objectives of the climate change agreement in the 2020 resolution.

The basic aim of the convention under the Cancun agreement adopted in 2010[2] and reaffirmed in the Paris agreement[3] in December 2015 is to hold the increase in the global average temperature to well below 2 °C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5 °C above pre-industrial levels, recognizing that this would significantly reduce the risks and impacts of climate change . Additionally,it aims to increase the ability to adapt to the adverse impacts of climate change and foster climate resilience and low greenhouse gas emissions development, in a manner that does not threaten food production. Also to make finance flows consistent with a pathway towards low greenhouse gas emissions and climate-resilient development. Countries furthermore aim to reach "global peaking of greenhouse gas emissions as soon as possible". To achieve these aims individual countries have a wide variety of policies and instruments available to governments to create the incentives for mitigation action. Mitigation is essential to meet the UNFCCC's objective of stabilizing GHG concentrations in the atmosphere. Among others, the Convention:

- Requires all Parties, taking into account their responsibilities and capabilities, to formulate and implement programmes containing measures to mitigate climate change
- Also requires all Parties to develop and periodically update national inventories of GHG emissions and removals
- Commits all Parties to promote, and cooperate in, the development, application and diffusion of climate friendly technologies

[2] http://cancun.unfccc.int/
[3] http://www.cop21paris.org/about/cop21

- Requires developed countries to adopt national policies and measures to limit GHG emissions and protect and enhance sinks and reservoirs
- States that the extent to which developing countries will implement their commitments will depend on financial resources and transfer of technology

The Convention requires all Parties, taking into account their responsibilities and capabilities, to formulate and implement programmes containing measures to mitigate climate change. Mitigation actions could be economy-wide, cover several or single sectors, such as energy supply and demand, transport, buildings, industry, agriculture, forestry and waste management. The focus here is to analyse the financial incentives under the mitigation actions that enable renewable energy usage in pursuit of the above set aims of the convention .

Mitigation policies and measures used by developed country Parties mostly focused on the large emitting sectors, such as energy and transport. Strengthening of climate change policy portfolios resulted in policies and measures in some key areas being substantially strengthened, through more stringent requirements, wider coverage and increased investment. Regulatory and fiscal instruments were complimented by market based instruments such as GHG emission trading schemes. After three years of work, the COP, at its sixteenth session, agreed that developed countries will implement under the Convention quantified economy-wide emission targets for 2020 as communicated by these Parties. Forty-two developed countries communicated targets under the Convention after Copenhagen. The targets communicated by most parties4, are generally not represented as a single unconditional value, but as a single conditional value or a range of values. Conditions relate to the following: achieving a comprehensive global agreement, with the participation of all major economies; advanced economies agreeing to comparable mitigation efforts and actions; developing countries taking action in accordance with their differentiated responsibilities and respective capabilities; and all Parties contributing their fair share to a cost-effective global emission reduction pathway.

Under the climate change regime EU has established financial mechanism to fulfill its commitment to three targets for 2020[5]. The first is to reduce emissions by 20% on 1990 levels. The second is to provide 20% of its total energy from renewable. The third is to increase energy efficiency by 20% from 2007 levels. A low carbon roadmap has been produced to show how this target could be achieved. EU initiatives to reduce greenhouse gas emissions includes Renewable Energy Directive (RED)**.** This was put in place to help the EU meet its renewable target. In addition at least 10 % of final energy consumption in the transport sector must come from renewable resources by 2020. Each Member State has an individual target within RED. The UK's target is for 15%.

The Renewable Energy Directive sets out a common framework for the promotion of energy from renewable sources, which include wind, solar, aerothermal, geothermal, hydrothermal and ocean energy, hydropower, biomass, landfill gas, sewage treatment plant gas and biogases. In particular, these provisions establish mandatory national targets for the overall share of energy from renewable sources in gross final consumption of energy and for the share of energy from renewable sources in transport. Furthermore, the Directive lays down rules relating to statistical transfers and joint projects between

[4] As contained in document FCCC/SBSTA/2014/INF.6,
[5] http://ec.europa.eu/clima/policies/strategies/2020/index_en.htm

European Community Member States, joint projects with third countries, guarantees of origin, administrative procedures, information and training, and access to the electricity grid for energy from renewable sources. The Directive also establishes sustainability criteria for biofuels and bioliquids. It establishes an overall policy for the production and promotion of energy from renewable sources in the EU. It requires the EU to fulfill at least 20% of its total energy needs with renewable by 2020 – to be achieved through the attainment of individual national targets. Under this scheme UK for example, has set itself the target of 15% or energy to be derived from renewable resources. For this it has set a series of financial incentives that will enable suppliers to use renewable sources of energy. These include Renewables Obligation (RO) which provides incentives for large-scale renewable electricity generation by making UK suppliers source a proportion of their electricity from eligible renewable sources. Next, Feed in Tariff scheme pays energy users who invest in small-scale, low-carbon electricity generation systems for the electricity they generate and use, and for unused electricity they export back to the grid. Also there is a Renewables Heat Incentive Scheme that provides incentives for consumers to install renewable heating in place of fossil fuels. It is open to homeowners and landlords, commercial, industrial, public, not-for-profit and community generators of renewable heat. Additionally the UK Renewable Energy Roadmap sets out a plan for accelerating the use of onshore wind, offshore wind, marine energy, solar PV, biomass electricity and heat, ground source and air source heat pumps, and renewable transport. Finally, financial penalties in the form of Renewable transport Fuel obligations that makes companies that supply more than 450,000 litres of fuel per year source a percentage from renewable sources. These financial incentives given by the UK in fulfillment of its obligations under the climate change regime symbolize efforts made by many developed countries to enable the shift towards renewable energy sources from the cheaper non-renewable ones.

In the context of the U.S. GHG reduction goal, the policy actions being taken by U.S. States that provide a financial incentive, such as the American Recovery and Reinvestment Act of 2009 (ARRA), tax credits for renewable energy, and new standards for passenger cars and trucks. This is big news for the U.S. renewable energy industry. According to Bloomberg the net result could be 37 gigawatts of new wind and solar capacity — a 56-percent boost to the industry over five years, catalyzing $73 billion in new investment and enabling as many as 8 million more households to access clean, renewable, affordable energy. In exchange for the tax credit extension, Congress has lifted the 40-year ban on crude oil exports that began with the 1970s Oil Embargo Crisis. The costs of solar and wind power have been falling steadily and sharply for years. They are widely expected to become the cheapest way to generate power in the U.S. and most of the rest of the world by 2020[6] but there is a potential "valley of death" as incentives expired. The 10-year, $0.023/kWh PTC already expired at the end of 2014, and the wind industry went through another disastrous boom and bust cycle along with it.

In a display of bipartisan compromise that has been vanishingly rare in recent years, Congress has agreed to extend the solar ITC at the current 30-percent rate through 2019, after which it will fall to 26 percent in 2020, 22 percent in 2021 and 10 percent in 2022. An additional commence-construction clause will extend the credit to any project in development before 2024. And the wind PTC will be retroactively applied to 2015 and

[6] www.bloomberg.com

extended through 2016, after which it will decline each year until it fully expires in 2020. This financial incentive to wind and solar gives these renewable energy time to achieve parity with conventional generation without subsidy. According to Lazard'[7] , released in November, the LCOEs for wind and solar have fallen 61 percent and 82 percent, respectively, over the past six years. This puts un-subsidized best-in-class wind and solar on par with or better than new gas-fired generation already. With continued cost declines for both renewable technologies, by the time the extensions expire after 2020, it is expected that the tipping point will have been reached where wind and solar — beyond their best-in-class onshore and utility-scale versions — are firmly in place as the cheapest kilowatt-hours around. Additionally, big corporations in US pursuing power purchase agreements (PPA's) for large off-site wind and solar energy will get competitive prices as a result of these incentives.

In Germany, electricity from renewable sources is supported through a feed-in tariff. The criteria for eligibility and the tariff levels are set out in the Act on Granting Priority to Renewable Energy Sources (EEG) which is set out to enable Germany meet its obligations under the climate change convention. According to this Act, operators of renewable energy plants are statutorily entitled against the grid operator to payments for electricity exported to the grid. The EEG also introduced the so-called market premium and the flexibility premium for plant operators who directly sell their electricity from renewable sources. Moreover, low interest loans for investments in new plants are provided for by different KfW-Programmes. In Germany, the Guidelines for the support of RES-H set out the Market Incentive Programme (MAP), stipulating support schemes for the promotion of heat produced from renewable energy.

After protracted negotiations with the European Commission and an intense national debate, the German renewable energy law has come into force (EEG 2014).Generation from renewable energy sources now accounts for a quarter of Germany's total electricity generation. Prior to the EEG 2014, German energy legislation sought to promote the development of niche technologies. In contrast, this latest reform aims to stabilize the pace at which new renewable generation capacities are being built and to contain the costs of subsidies. All generators in central Europe, including conventional electricity generators, will be affected, as the new law has implications for the future shape of electricity markets beyond Germany. By 2017, the large- and medium-scale renewable generators will be obliged to sell their electricity output directly on the wholesale or retail markets. Instead of a fixed FiT, they will receive whatever they raise for their electricity on the spot market plus the market premium. The premium is the average difference between spot market prices and FiTs for that technology. It is calculated monthly as the nominal FiT less the technology-specific volume-weighted average spot market price in that month.For example, solar power plants usually produce most of their electricity at midday when the spot price is high, so the solar volume-weighted average price is slightly higher than the plain average spot price. On average, the group of all producers using a certain technology receives a price that corresponds to its nominal FiT. Depending on the individual producer-specific feed-in profile, the producer will receive a price that is higher or lower than the group average .The EEG 2014 contains no panacea for the many issues that have to be addressed following Germany's *Energiewende*. However, it introduces

[7] https://www.lazard.com/perspective/levelized-cost-of-energy-analysis-90/

elements to control the quantity of renewable new builds, and the first step towards competitive tendering. It also goes one step further in attempting to integrate renewables into the markets by making direct marketing obligatory. This provides support to renewables just when these are needed to help the fledgling industry and provide a way forward for it to stand on its own feet.

Additionally, the German Government supports renewable energy through further development and transfer of climate-friendly[8], efficient high-tech products also by means of initiatives in the field of export promotion. An important key to the success of German technologies for the utilization of wind power, hydropower, solar energy, geothermal power and bio-energy abroad is sound financing. In particular export transactions with extended credit periods with foreign markets that involve increased (political and commercial) risks can frequently be realized only if sufficient protection against loss of receivables is available. The Export Credit Guarantees of the Federal Republic of Germany – also known as Hermes Cover – insure export transactions to make the risks involved more predictable and easier to control. If a project involves direct investments in the buyer country (e.g. equity participation or shareholder loans), Investment Guarantees can be used to cover the political risks. Thus the guarantee schemes of the Federal Republic back the risk provisioning up and facilitate the entry into foreign markets. This holds particularly true for small and medium-sized enterprises, which dominate the renewable energy sector and are much less able to absorb bad debt losses or the loss of an investment than larger companies. The Federal Government regards exports of renewable energy technologies as particularly deserving of support because they promote not only Germany as a location for industry – and in this context, in particular small and medium-sized enterprises – but also contribute to sustainable global development enabling Germany fulfill its obligations under the international climate change treaties. Therefore the Federal Government is keen to make cover available especially for this line of industry. When supporting German exporters, the promotion of renewable energy and water supply as well as environmental technologies is one of the Federal Government's priorities.

Special financing possibilities, e.g. such as more flexible payment terms and extended credit periods, are intended to serve as incentives for investments into the mitigation of climate change. That is the aim of the OECD consensus which is now called "Sector Understanding on Export Credits for Renewable Energy, Climate Change Mitigation and Water Projects" and has been in force since June 2012.This agreement includes also certain projects and technologies that contribute to climate change mitigation in addition to the renewables previously included (among others, wind power, solar energy, bio-energy) and water projects. For example, CO2 capture and storage (CCS) technologies in power generation and technologies for the replacing of fossil fuels (waste incineration and hybrid power plants) are particularly promoted. Projects to enhance the efficiency, such as combined heat and power generation and hybrid power stations, too, may receive special support.

Similarly other developed countries such as Japan have Feed-in-Tarif schemes that support the use of solar and wind energy by obligating an electric utility to sign a contract

[8] http://www.res-legal.eu/search-by-country/germany/

to purchase electricity at a fixed price and for a long-term period guaranteed by the government if a renewable energy producer requests .

Developing country Parties have been contributing to global mitigation efforts in several ways. The *clean development mechanism* has been an important avenue of action for these countries to implement project activities that reduce emissions and enhance sinks. More recently, developing countries have agreed to implement *Nationally Appropriate Mitigation actions, or NAMAs*, with support from developed countries. The Clean Development Mechanism (CDM)[9], defined in Article 12 of the Protocol, allows a country with an emission-reduction or emission-limitation commitment under the Kyoto Protocol to implement an emission-reduction project in developing countries. Such projects can earn sell able certified emission reduction (CER) credits, each equivalent to one tonne of CO2, which can be counted towards meeting Kyoto targets. The mechanism is seen by many as a trailblazer. It is the first global, environmental investment and credit scheme of its kind, providing a standardized emissions offset instrument, CERs. A CDM project activity might involve, for example, a rural electrification project using solar panels or the installation of more energy-efficient boilers. The mechanism stimulates sustainable development and emission reductions, while giving industrialized countries some flexibility in how they meet their emission reduction or limitation targets. There is a financial incentives through the use of CER's to support renewable energy which is paid for by a 2% levy on the CER.

The CDM increases the revenues for renewable energy generation. Most of the renewable energy projects in the CDM pipeline involve electricity-generating technologies. The basic economic barrier is the relatively higher electricity generation costs for RET, although the scale of the difference varies from technology to technology and from country to country. For example, in Thailand costs for electricity from biomass are almost competitive with the average electricity tariff, while wind electricity is about double the average price. The revenues attained from selling CERs from a CDM project can help compensate for this price difference to an extent. Nevertheless, renewable energy projects do not get as much out of the CDM as other project types. Among the 1,700 projects currently at an advanced stage of the CDM project cycle, biomass projects make up the largest share, accounting for 21%, followed by hydropower projects (including large hydro) at 19% and wind energy at 12%. In total, renewable energy projects constitute 59% of the project portfolio.

Apart from helping industrialized countries meet their Kyoto targets, the CDM also has an equally weighted objective of assisting developing countries in achieving sustainable development. It can do this by attracting capital for projects that assist in shifting to a less carbon-intensive economy by using less carbon-intensive energy sources and improving energy efficiency and conservation for example renewable energy sources. Most of the renewable energy projects in the CDM pipeline involve electricity-generating technologies. The basic economic barrier is the relatively higher electricity generation costs for Renewable Energy Technologies, although the scale of the difference varies from technology to technology and from country to country. For example, in Thailand costs for electricity from biomass are almost competitive with the average electricity tariff, while wind electricity is about double the average price. The revenues attained from

[9] http://unfccc.int/kyoto_protocol/mechanisms/clean_development_mechanism/items/2718.php

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The Paris Agreement on climate change of December 2015 has placed Africa at the pivot of renewable energy deployment and enhanced renewable energy deployment in East and Southern Africa .The Addis Ababa meeting created much needed space for countries of East and Southern Africa to promote dialogue and coherence between policy makers, the private sector and civil society on unleashing the potential of renewables in Nationally Determined Contributions (NDCs) to climate action under the framework of the Paris Agreement, and to showcase strategies underway, including opportunities for regional collaboration as countries prepare to move into a post-Paris implementation phase of climate actions. Representatives of partner institutions and agencies as well participants from seven countries of the region emphasized the high potential and opportunities for enhanced renewable energy deployment in Africa and its contribution to climate change mitigation, as well as the various co-benefits of renewable for social and economic development.

Another financial incentive from the climate change convention comes from the carbon markets[10] or what is also known as emissions trading. This scheme allows one party to reduce its greenhouse gas emissions and to sell the ensuing 'environmental attributes' to a second party which is not able to reduce its emissions, but which is required to do so under regulation. The objective is to reduce emissions by penalizing carbon-intensive parties, thereby incentivising low-carbon behavior around the globe such as through use of renewable energy, where changes are the most efficient and the most cost effective for mitigation.

When mandatory and voluntary markets are considered, officials estimate the annual value of emissions trading to be US$60 billion and growing rapidly. The non-compliance market is more difficult to gauge, as it may not include the certification of new facilities or adherence to industry norms, and can be as simple as a tree-planting scheme being used to provide a level of sequestration.To date, most of the value of the global carbon market has comes from the capture and destruction of nitrous oxides (NO2) and hydrofluorocarbon (HFC-23) refrigerants, used in industrial operations. These waste gases have significantly higher environmental impacts than CO2, methane and other greenhouse gases covered under the Kyoto Protocol, and the cost to stem their release into the atmosphere is usually lower than many other options. One recent report quotes the cost to eliminate a level of emissions at €1, while comparable reductions from a renewable energy or energy efficiency project could cost from €5–€15. A study[11] estimates that projects to stem waste gases accounted for three-quarters of total credits traded last year. However that level is dropping and could decline to only one-quarter of the total value by 2012, when the first phase of the Kyoto Protocol expires. The EU Emissions Trading Scheme (EU ETS) was the first cap-and-trade allowance program off the block and, in the

[10] http://unfccc.int/kyoto_protocol/mechanisms/emissions_trading/items/2731.php
[11] http://newenergyfinance.com/

past five years, has become the world's largest. It has already entered its second phase of operation, and most of the trading regimes being developed in Australia, New Zealand, as well as two in North America, are being designed to be compatible with it. This will foster growth, as the international market expands to meet the ever-growing demand for mitigation measures and low-carbon alternatives such as wind and solar energy.

The EU ETS also recently connected with the carbon credit tracking system of the United Nations, which will provide a boost both to project developers and to carbon traders. Linking the EU's Community Independent Transaction Log and the UN's International Transaction Log will allow the import of Certified Emission Reductions (CERs) into the ETS, which now will accept all types of credits from Joint Implementation (JI) and Clean Development Mechanism (CDM) projects. European companies can convert JI/CDM credits into allowances to meet their obligations under the EU ETS, and all types of JI and CDM credits will be accepted except for nuclear reactors (excluded under the Marrakech Accords) and projects for carbon sinks (which are difficult to integrate with the ETS).

Global interest in renewables and clean energy solutions from carbon funds is stimulating a surge in green patents, according to Computer Patent Annuities. The UK firm isolated and analysed 171 relevant families of business method patents granted since 1998, in order to track the effects of the 1997 Kyoto Protocol. Of those patent families, 54 were directly related to carbon trading tools, and 33 were related to forms of carbon administration. For carbon trading alone, the 6 patent families in 2000 had grown to 9 by 2002 and to 15 in 2006.

Carbon trading is fast eclipsing more established methods of emissions control, such as direct taxation or regulation, by creating a bona-fide marketplace for carbon credits, concludes Carbon Trading: Patently Set for Growth. The potential to access a stream of hard currency has spurred technology companies to develop clean energy tools or to fund relevant research, as well as encourage private innovation in low-carbon solutions.

Although patent filings have surged since 2000, the report warns that they still are a nascent part of the overall economic picture. Carbon trading has gained a strong position in the financial market and large companies have started trading emissions, and the World Bank says an increase could also occur in trading volume as interest rises from banks, credit card issuers and private equity funds.The impact of recent problems in the world's financial sector have yet to impact these trends, and it will be worth watching the appetite for carbon trading and the general transition to mitigation measures as credit becomes more difficult to obtain. China and other developing countries have set high ambitions for the introduction of renewable energies, while the EU and other fully industrialized nations continue to stay at the cutting edge of developments in renewable.

The above financial mechanisms that support renewable energy can be further improved through the 2020 directive. To begin with the key financial incentive supporting renewables is the Certified Emissions Reduction (CER) under the CDM that enable wealthier countries to contribute towards climate change targets. As discussed above CER are very effective in supporting projects related to Carbon reduction in general. However the picture is quite different when the CERs are broken down by project type as a measure of how much ‘carbon financing’ each project type receives. Here, renewable energy projects account for only 24 percent of all expected CERs. The main reasons for this are that renewable energy projects typically reduce emissions of CO2, which has a low global

warming potential compared to other gases hydrofluorocarbons (HFCs), nitrous oxide (N2O) and methane (CH4), which in total account for about two thirds of all expected CERs. This is due to the high global warming potential of these gases, which in the case of HFC-23 is 11,700 times that of CO2. In fact, a mere 41 HFC, PFC and N2O reduction projects account for 40 percent of all expected CERs from the more than 1,700 projects in the project cycle. Renewable energy projects thus receive a disproportionately small financial benefit from the CDM. At current CER prices, the increase in the internal rate of return from the sale of CERs from a CO2-based renewable energy project is estimated at about 2 percent. This additional CER revenue can be enough to lift projects across the threshold of being economically viable. However, in some countries, energy subsidies tilt the energy market against RET such that CER revenues are not enough for a single one of the RET CDM projects currently in the pipeline to become profitable. Instead, these projects must rely on further support from official development assistance. The carbon intensity of a country's electricity mix is also an important factor. For example, countries like Thailand or Egypt have an average electricity carbon intensity of approximately 500 kg CO2/MWh. This is much lower than the likes of China (916 kg CO2/MWh) and India (896 kg CO2/MWh). The economic outcome under the logic of the CDM is that high-carbon-intensity countries benefit almost double from CERs for each conventional kWh substituted by renewable energy. By contrast, the CDM strongly promotes renewable energy projects (biogas for example) that avoid methane emissions. Methane has 21 times the global warming impact of CO2. Projects thus yield high volumes of CERs and this has a very strong impact on profitability. The other key financial barrier is the high specific upfront costs of RET. The CDM could alleviate this problem if buyers were willing to front-load their payments. RET project developers would then receive the CER revenues when they most need them. However, while there are some purchasing programmes where this is possible, buyers have mostly limited their role to purchasing CERs for payment on delivery. As a result, project developers have been forced to finance their projects from other sources.

The CDM could also help to remedy the insufficient purchasing power of potential users. The CER revenues could be used to distribute RET applications at subsidized prices. The CDM incentivises streamlined decision-making and approval procedures. Although not originally designed for the purpose, the CDM offers limited potential to overcome institutional barriers. To an extent, the opportunity for foreign investment and access to modern technology incentivises relevant government bodies to cooperate better on energy policy issues and to streamline decision making and approval procedures. Energy policy is no longer exclusively designed by energy ministries since most aspects of climate policy – and thus the CDM debate – are the responsibility of environment ministries. Moreover, renewables are gaining ever-greater importance beyond environmental considerations. This is due to their benefits regarding the more 'conventional' purposes of energy policy, especially energy security and reducing dependency on imports. Since it financially rewards the climate benefit of low carbon technologies, the CDM offers an important argument for using RET in addition to, say, reducing fossil fuel imports. This attracts greater attention from political decision-makers and the private sector. Being a mechanism established by international policy, the CDM can also give project developers better access to decision-makers compared to traditional private investments, especially if they have the official backing of the investor country.

This might help to alleviate some of the problems associated with the hierarchical nature of some host country institutions. In conclusion, the CDM can alleviate barriers against RET dissemination, but it is not a cure-all. The CDM can make renewable energy projects more profitable and also help to procure up-front financing. It may also contribute to streamlined decision-making, greater awareness of RET options and better access to decision-makers. However, additional revenues are limited and cannot counterbalance fundamental distortions in national energy markets for which additional measures need to be taken in the 2020 agenda.

Another financial incentive for renewable energy is the Feed in Tarrif used in many developed countries such as Germany which is at the for front of changes designed to make renewable energy sources market driven .The primary lessons from the German experience are that a system of FITs such as the one used in Germany can be highly effective in promoting the growth of solar PV, that the impact on trade-exposed heavy electricity users can and perhaps should be mitigated, but that FITs for new installations should be adjusted regularly and perhaps automatically in response to observed relative to targeted deployment levels so as to avoid undue increases of electricity rates for retail customers. In hindsight the German FITs for solar PV did not adjust quickly enough to rates of installations far in excess of what had been expected, even though reforms to the renewables law in response to those installations ultimately did introduce much more frequent and steeper reductions in those FITs, which allowed Germany to avoid a complete crash of PV installations along what happened in Spain and Italy. Several important lessons can be learned from the German experience. To begin with payments for solar PV have increased substantially in the past few years. Until 2007, annual payments to solar PV installations under the FIT program remained below €2 billion, but increased rapidly to close to €10 billion by 2013 and are expected to increase to about €11 billion per year before leveling off and ultimately decline. To put these payments into perspective, assuming all power generation cleared at wholesale prices and given average wholesale price levels of €50/MWh, the value of total power generation in Germany would be approximately €30 billion per year. Total payments for solar PV generation therefore would represent almost 1/3 of these total costs for only about 5% of total power production. Measured against retail rates, on the other hand, payments under solar PV FITs represent about 10% of total sales, or roughly twice the share of PV production. Over the same time frame, average FITs paid to new installations dropped from 47 €cents/kWh to 12 €cents/kWh.The increases in FIT payments were driven significantly by the large expansion of solar PV between 2009 and 2012. In hindsight, they can largely be attributed to downward adjustments to the FIT for new installations not being more rapid in response to installations exceeding targets. It would have been preferable to have designed automatic adjustments to the FITs based on known criteria at the outset rather than having to adjust the program on the go.

Next, even if ex-post a somewhat optimized FIT design might have lowered the cost impact of Germany's solar PV program for retail customers (except the exempt industrial users), high costs incurred to-date are not a good reason to abandon the solar PV program now. Since PV costs have come down dramatically, at least partially as a result of the program, building the remaining roughly 16 GW of solar PV to reach the 52 GW target as part of Germany's broader commitments to lowering and ultimately essentially

eliminating greenhouse gas emissions from its power sector will lead to only a very small additional costs to customers.

Finally, the reform efforts of the solar PV and renewable support programs in Germany should not be interpreted as an acknowledgment of a broad failure of the Germany system of FITs. Rather, while the reforms are indeed an effort to improve the design of the FIT system, for example by introducing more rapid adjustments of FITs to observed deviations of actual from desired installation levels, they are also a sign of the solar PV sector maturing. Germany is unique among OECD countries in having managed to significantly increase the share of renewables in its electricity mix – by now a power generation share of some 25% has been reached. Aggressive greenhouse gas reduction targets are widespread, including in the United States. Germany's experience therefore likely provides an opportunity to "look ahead" and see how electricity systems and the rules governing them will have to adapt when penetration rates of various renewable energy sources reach levels similar to those in Germany today and beyond.These key experiences should be incorporated to improve the feed in tarrif and other financial incentives in the 2020 agreement.

Another financial incentive is through the carbon markets . For carbon markets to continue to grow post-2020 it would be important that the 2020 agreement at the very least not disqualify international transfers as a way for parties to implement their nationally determined contributions. An affirmative recognition that parties may employ market mechanisms would provide a positive signal although some parties, including some favouring the use of market mechanisms, do not believe this would be legally required to move forward with market tools. The new agreement could consider establishing a process to agree common accounting standards, and other relevant measures, at a later stage. Any such agreement, however, would need to overcome the divergent views on the use of markets. Other forms of policy co-ordination can play an important role in the absence of international consensus. In the context of the post-2020 regime, if there is agreement that transferring units to satisfy a country's emissions-cutting obligations are legitimate – or at the very least do nothing to preclude it – such linkages could occur even in the absence of a specific, international framework such as the FVA.

Some governments have already gone down this route. The EU ETS and Australia's carbon[12] pricing mechanism entered linking negotiations before the Australian government repealed their policy last July. At the sub-national level, California and Québec held their first joint auction of carbon allowances this past January, completing the process of joining their cap-and-trade programmes together. California is also exploring the possibility of allowing forestry offsets from sub-national provinces in Brazil, Indonesia, and Mexico.A common carbon price between jurisdictions could alleviate some of the economic competitiveness concerns about uneven abatement costs faced by businesses, particularly when the link occurs between key trade partners.Bilateral linking does require prior co-ordination. For example, the accounting standards used to measure emissions must be consistent, to ensure a tonne is a tonne across the common market. The use of market stabilization measures, for example setting a minimum and maximum price within a carbon market, must be harmonized to prevent firms from exploiting arbitrage opportunities. The potential risk of these bilateral arrangements is if

[12] http://ec.europa.eu/clima/policies/ets/linking/index_en.htm

governments agree linkages without putting in place sufficiently stringent accounting or technical standards. In the absence of international guidance on the kinds of transfers that are acceptable, and a common accounting framework, the responsibility to ensure environmental integrity rests with the jurisdictions that link. Governments that link bilaterally or in a club would need to agree to stringent accounting rules, registry systems, among other aspects, and those wishing to join the scheme would need to meet these standards.

The most effective solution to co-ordinate market policies is a set of agreed international rules and mechanisms that can be in the 2020 agreement. The Kyoto architecture provides a common unit, common approaches, and common accounting that offer some certainty to carbon market investors. Ultimately, however, that system is tied to a view of differentiation and requires a level of international governance that does not engender broad participation. A new UNFCCC regime could develop rules in line with these political realities. Whether this occurs under a FVA, or a new set of deliberations in the ADP, developing common multilateral standards for markets will require international consensus. This should be one of the goals of the 2020 agreement.

In summary, some of the sources of renewable energy that are supported through financial mechanisms from climate change policies are Bio-energy, Solar Energy, Geothermal energy, Hydropower, wind energy and Ocean energy through tidal waves. Tapping these sources for energy is financially prohibitive as the cost of generation of power is far higher than the market price of electricity. Therefore financial incentives are required to promote the use of renewable energy. The United Nations Framework Convention on Climate change agreed that they would need to support the efforts of developing countries by means of a mechanism for the provision of financial resources on a grant or concessional basis, including for the transfer of technology. The convention provides the basis for developed country Parties to provide and for developing country Parties to avail themselves of, financial resources related to the implementation of the Convention through bilateral, regional and other multilateral channels. Further, the climate change convention through its mitigation policies has set in place different options for developed as well as developing countries. Developed countries use feed-in-tarrifs to support local renewable energy companies through support prices for the feed in tarrif's. Additionally export credits are used to enable export of renewable technologies to developing countries. The clean development mechanism enables the developed countries to promote renewable energy in developing countries through the use of CER's. Also carbon markets and emissions trading enable the developed countries to enable renewable energy projects in low carbon countries whilst protecting their industries that continue to have a high carbon energy requirement. Whilst many of these financial mechanism have gone a long way in achieving the goals set out by the climate change convention , further changes re needed in the 2020 agreement such as through coordinated market policies so as to avoid arbitrage opportunities in separate carbon markets, and moving away from price support to market based feed in tariff .

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