Governing Clean Energy Subsidies: What, Why, and How Legal?

August 2012
ICTSD Global Platform on Climate Change, Trade and Sustainable Energy

Arunabha Ghosh with Himani Gangania

ICTSD
International Centre for Trade and Sustainable Development

A joint initiative with
Global Green Growth Institute
Peterson Institute for International Economics

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Published by

International Centre for Trade and Sustainable Development (ICTSD)
International Environment House 2
7 Chemin de Balexert, 1219 Geneva, Switzerland
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Publisher and Director: Ricardo Meléndez-Ortiz
Programme Manager: Ingrid Jegou
Programme Officer: Mahesh Sugathan

Acknowledgments

This paper is produced by the Global Platform on Climate Change, Trade and Sustainable Energy of the International Centre for Trade and Sustainable Development (ICTSD). The concept of the research has been informed by ICTSD policy dialogues during the past year, in particular a dialogue organised in Washington DC in November 2011 by the Peterson Institute for International Economics (PIIE) with support of the Global Green Growth Institute (GGGI) and ICTSD as well as a high-level Roundtable in Geneva organised in December 2011 on the occasion of the Eighth Ministerial Conference of the WTO. The author thanks Ricardo Meléndez-Ortiz, Ingrid Jegou, Christophe Bellmann, Mahesh Sugathan, Marie Wilke and Joachim Monkelbaan from ICTSD for their guidance and inputs during the production of the paper and Vyoma Jha (CEEW) for valuable comments. The author is also grateful for the comments on an earlier draft received from Gary Horlick (Law Offices of Gary N.Horlick), Chris Beaton (International Institute for Sustainable Development) and Luca Rubini (University of Birmingham).

ICTSD is grateful for the support of GGGI as well as its core and thematic donors, including the UK Department for International Development (DFID); the Swedish International Development Cooperation Agency (SIDA); the Netherlands Directorate-General of Development Cooperation (DGIS); the Ministry of Foreign Affairs of Denmark (Danida); the Ministry for Foreign Affairs of Finland; the Ministry of Foreign Affairs of Norway; Australia's AusAID; the Inter American Development Bank (IADB); Oxfam Novib and the Deutsche Gesellschaftfür Internationale Zusammenarbeit (GIZ).

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Citation: Ghosh, Arunabha; with Himani Gangania; (2012); *Governing Clean Energy Subsidies: What, Why and How Legal?*; International Centre for Trade and Sustainable Development, Geneva, Switzerland, www.ictsd.org

ISSN 2225-6679

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Founded in 1996, the International Centre for Trade and Sustainable Development (ICTSD) is an independent think-and-do-tank based in Geneva, Switzerland and with operations throughout the world, including out-posted staff in Brazil, Mexico, Costa Rica, Senegal, Canada, Russia, and China. By enabling stakeholders in trade policy through information, networking, dialogue, well-targeted research and capacity-building, ICTSD aims to influence the international trade system so that it advances the goal of sustainable development. ICTSD co-implements all of its programme through partners and a global network of hundreds of scholars, researchers, NGOs, policymakers and think-tanks around the world.

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The Global Green Growth Institute (GGGI) is a new kind of international organisation that has been established to accelerate “bottom up” (country- and business-led) progress on climate change and other environmental challenges within core economic policy and business strategies. The Institute provides an international platform for evidence based learning and policy innovation that helps to illuminate practical opportunities for progress on the twin imperatives of economic development and environmental sustainability, while deepening cooperation among developed and developing countries, the public and private sectors, and practitioners and scholars. Founded in June 2010 and established in Seoul, GGGI is committed to help developing and emerging countries pioneer a new “green growth” paradigm, and is scheduled to be converted into an international organisation in October 2012.

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Abbreviations and Acronyms

ADB	Asian Development Bank
APEC	Asia-Pacific Economic Cooperation
ARRA	American Recovery and Reinvestment Act
CO2	Carbon dioxide
CSI	California Solar Initiative
CSP	Concentrated solar power
DOE	US Department of Energy
DSM	Dispute Settlement Mechanism
EEG	German Renewable Energy Sources Act
EIA	US Energy Information Administration
EU	European Union
FiT	Feed-in tariff
G20	Group of Twenty
GATT	General Agreement on Tariffs and Trade
GBI	Generation-based incentive
IEA	International Energy Agency
IREDA	Indian Renewable Energy Development Agency
JNNSM	Jawaharlal Nehru National Solar Mission
KWh	Kilowatt hour
LCR	Local content requirement
MNRE	Indian Ministry of New and Renewable Energy
NAFTA	North American Free Trade Agreement
OECD	Organisation for Economic Cooperation and Development
PTC	Production tax credit
PV	Photovoltaics

R&D	Research and development
RE	Renewable energy
RPO	Renewable purchase obligation
RPS	Texas Renewable Portfolio Standard
SCM	Subsidies and Countervailing Measures
SERC	Electricity Regulatory Commission
SETA	Sustainable Energy Trade Agreement
T&D	Transmission and distribution
TPR	WTO Trade Policy Review
TRIMS	WTO Agreement on Trade-Related Investment Measures
TRIPS	WTO Agreement on Trade-Related Aspects of Intellectual Property Rights
VC	Venture Capitalist
W	Watt
WTO	World Trade Organization

Foreword

Climate change is an unprecedented challenge facing humanity today. As fossil fuel-based energy use is the biggest contributor to anthropogenic greenhouse gas (GHG) emissions, a rapid scale up and deployment of renewable or sustainable energy sources could significantly reduce the emissions responsible for climate change. From a development perspective, developing countries face the enormous challenge of reducing carbon intake while ensuring people's access to energy and powering rapid economic growth. Most countries are also seeking ways to enhance their energy security by reducing their reliance on fossil-fuel imports. Developing sustainable energy through a switch to cleaner, low-carbon transport fuels and technologies along with greater energy-efficiency measures could make a positive contribution toward achieving these goals.

Efforts to scale up sustainable energy require generation costs to be as low as possible. Relatively high capital costs associated with renewable energy investments, the non-consideration of environmental and health externalities in fossil-fuel pricing, and the enormous levels of subsidies still granted to fossil fuels make this a challenging proposition. Alternatively, renewable energy costs are enduring a rapid global decline that will likely continue for some time. In certain locations renewable energy generation has already attained 'grid-parity', equalling the cost of fossil fuel-based power generation.

While incentives such as feed-in tariffs and tax breaks help, lowering the costs of equipment and services used to produce sustainable power can facilitate the scale-up process, enabling economies of scale and cost optimisation for renewable energy projects. Addressing barriers to trade in sustainable energy goods and services can also contribute to scale economies and cost-optimisation, as trade in sustainable energy goods can be hampered by tariffs, subsidies, diverse or conflicting technical standards, and lack of harmonisation or mutual recognition efforts.

In striving to lower production costs, policymakers often seek to promote domestic manufacturing of renewable energy equipment and the provision of services, with many policymakers viewing the sustainable energy sector as a potential engine for job creation. These factors could potentially induce sustainable energy policies designed with protectionist intent and trigger trade disputes in the sector. Canada and Japan are in the midst of the World Trade Organization's (WTO) first ever trade dispute over renewable energy feed-in tariffs and local content measures. Moving forward, the urgency of addressing climate change will require, among other policy responses, a clear and coherent governance regime for sustainable energy and related goods and services supported by trade rules and robust markets. The current stalemate in the WTO's Doha negotiations, particularly in efforts to liberalise environmental goods and services, has prevented action to address barriers to trade in sustainable energy goods and services. Even a successful conclusion of the round would leave a number of trade-related rules pertaining to sustainable energy – such as subsidies – unclarified, given the Doha mandate's lack of a holistic perspective on energy.

With such a scenario, sustainable energy trade initiatives may present worthwhile alternatives. These possibilities include a Sustainable Energy Trade Agreement (SETA), a stand-alone initiative designed to address barriers to trade and enable a trade policy-supported energy governance regime to advance climate change mitigation efforts and increase sustainable energy supply.

This agreement might be pursued initially as a plurilateral option – either within or outside the WTO framework – and eventually be "multilateralised". It could serve to catalyse trade in sustainable energy goods and services and address the needs and concerns of participating developing countries, many of which may not be in a position to immediately undertake ambitious liberalisation in sustainable energy goods and services. A SETA could also help clarify existing ambiguities in various trade rules and agreements as they pertain to sustainable energy and provide focalised governance through effective, operational provisions.

A key issue that must be addressed by any sustainable energy trade initiative is the contentious issue of clean energy subsidies. Countries will certainly use subsidies as part of their policy tool-kit to scale-up sustainable energy production, as a number of alternative options – such as effective carbon-pricing or taxation measures – are difficult to implement given political and socio-economic realities. Implementing pricing mechanisms that could capture the various 'harms' associated with the widespread use of fossil-fuels could likewise be prohibitively difficult, and policymakers may also view clean energy subsidies as an important tool to create jobs and boost domestic manufacturing capacity. Ensuring that clean energy subsidies remain out of the hands of vested interests and do not adversely affect the interests of a country's trade partners are additional crucial considerations moving forward.

This paper emphasises the importance of understanding what types of clean energy subsidies countries usually provide, why countries provide them, and how they fit into existing legal mechanisms. A SETA, by simultaneously addressing these questions and clarifying existing WTO subsidy rules, could add to the certainty and predictability of a country's trade and investment climate, qualities essential for policymakers and the private sector in their efforts to continue the scale-up of sustainable energy.

This paper was conceived by the International Centre for Trade and Sustainable Development (ICTSD) and written by Arunabha Ghosh, Chief Executive Officer of the Council on Energy, Environment and Water (CEEW), an independent, policy research institution in India, with Himani Gangania, research analyst at CEEW.

The Council on Energy, Environment and Water (CEEW) is an independent, not-for-profit policy research institution based in New Delhi. CEEW addresses pressing global challenges through an integrated and internationally focused approach. It does so through high quality research, partnerships with public and private institutions, and engagement with and outreach to the wider public. Among its recent initiatives, CEEW has: published the 584-page National Water Resources Framework Study for India's 12th Five Year Plan; written India's first report on global governance, submitted to the National Security Adviser; assessed India's 22 gigawatt solar mission; developed an innovation ecosystem framework for India; facilitated the $100 million India-U.S. Joint Clean Energy R&D Centre; worked on geoengineering governance (with UK's Royal Society and the IPCC); created the Maharashtra-Guangdong partnership on sustainability; published research on energy-trade-climate linkages; produced comprehensive reports and briefed negotiators on climate finance; and supported Bihar (one of India's poorest states) with minor irrigation reform and for water-climate adaptation frameworks.

The paper is produced as part of a joint initiative of ICTSD's Global Platform on Climate Change, Trade and Sustainable Energy, the Global Green Growth Institute (GGI) and the Peterson Institute for International Economics (PIIE).

The concept of the research has been informed by ICTSD policy dialogues, in particular a dialogue organised in Washington, DC in November 2011 by the PIIE with support of the Global Green Growth Institute (GGGI) and ICTSD; a high-level Roundtable in Geneva organised on 16 December 2011 on the occasion of the Eighth Ministerial Conference of the WTO that was attended by a number of high-level representatives from WTO missions and capitals; and at a session organised at the Global Green Growth Summit 2012 in Seoul, Korea on 11 May 2012.

As a valuable piece of research, it has the potential of informing innovative policy responses on sustainable energy trade initiatives and will be a valuable reference tool for policymakers as well as trade negotiators. We hope that you will find the paper to be a thought-provoking, stimulating, and informative piece of reading material and that it proves useful for your work.

Ricardo Meléndez-Ortiz
Chief Executive, ICTSD

Executive Summary

Nearly two billion people have no access to modern sources of energy. Increasing energy access is one of the key ingredients for human development. At the same time, energy related carbon dioxide (CO2) emissions are also expected to increase over the next two decades, especially in developing countries. Clean energy subsidies are, therefore, being used to support two simultaneous transitions: from no energy to energy access; and from fossil fuel-based energy to a low-carbon energy pathway. Subsidies need not be the only way to support these transitions. For instance, a tax on fossil fuels could make some clean energy sources more viable. Moreover, international trade rules frown upon the use of subsidies, even if they are for clean energy. These rules exist to prevent distortions and discrimination in international trade. So, while one logic suggests that subsidies for clean energy could be one response to the climate change and energy access challenge, another dictates that many types of subsidies must be avoided to comply with trade rules. This report focuses on the fundamental tension between promoting energy access while reducing fossil fuel use and maintaining the integrity of international trade rules. What are clean energy subsidies and how could they be governed to reconcile this fundamental tension?

For the last three years, the world's leading economies have been promising – via the Group of Twenty (G20) – to phase out inefficient fossil-fuel subsidies that incentivise wasteful consumption. These pledges were repeated at the 19th Asia-Pacific Economic Cooperation (APEC) Economic Leaders Meeting in Honolulu, Hawaii in 2011 and at the UN Conference on Sustainable Development in Rio in 2012. These subsidies, averaging about USD 400-600 billion annually, artificially keep prices low, distort energy choices and contribute to carbon emissions. Meanwhile, subsidies for renewable energy (RE) were about USD 66 billion in 2010, of which renewable electricity accounted for USD 44 billion.

This report does not offer a comprehensive dataset of all clean energy subsidies and is not a substitute for detailed data collection. It focuses primarily on subsidies for electricity from renewable energy sources or for energy efficiency and does not cover subsidies for transportation fuels. The study's aim, instead, is to show how the different logics for clean energy subsidies converge or diverge from the logic of maintaining a robust and rule-bound global trading system. Although subsidies for fossil fuels far exceed those for renewable energy, disputes are emerging across the world on the use of clean energy subsidies. Such disputes make the investment climate for clean energy uncertain. Potential investors might be attracted by a particular country's subsidy policies and still hesitate if they anticipate trade disputes arising in the future. Likewise, governments seeking to promote clean energy sources for electricity might hesitate if they fear their support measures could be called into question at a later date. This is why more clarity is needed on the aims of clean energy subsidies and the interpretation of trade rules.

Four tensions

At least four sets of policy tensions are driving a growing international debate on the governance of clean energy subsidies. The first relates to the environment. Renewable electricity technologies and renewable transport fuels are one set of responses to climate change, but they have incremental costs over and above fossil fuels. In the absence of adequate international funding to transfer to cleaner technologies, many governments use subsidies to support these technologies and reduce their costs.

Second, tensions arise on economic grounds thanks to decisions to invest in clean energy sectors. Sustainable energy investments rose from USD 20 billion in 2004 to USD 112 billion in 2007 before dropping in the wake of the global economic crisis. Investors in clean energy might exit relatively less mature sectors sooner, or choose to defer their investment decisions until well after signs of general

economic recovery become visible. Recent boosts in investments have come on the back of stimulus spending by governments or by investments in developing countries, which have not suffered as much from the economic crisis. Once again, the role of subsidies to smooth the fluctuations in clean energy sectors and increase investor confidence has become an international concern for sustaining investments in the face of the climate challenge. But, subsidies during a recession could assume a mercantilist purpose as well, especially if domestic industrial development, manufacturing capacity and employment generation come at the expense of other countries.

The third source of tension is technology. Recent years have witnessed significant growth in manufacturing capacity and deployment of clean energy generation capacity (Germany and Spain in solar; China and the United States in wind and solar, for instance). But, many technologies still remain at the research and development (R&D) stage or have not been deployed at a scale that would make them commercially viable just yet and require different forms of financial support. While some innovation occurs indigenously, there are growing examples of bilateral initiatives, and multilateral negotiations on technology transfer have assumed a critical role. The question is how partner countries support joint ventures – through direct financial transfers or by contributions in kind – and how the fruits of such labour are shared.

Economic drivers also manifest through a fourth tension: trade policy. Governments might design subsidy programmes to concentrate spending on domestic firms and discriminate against foreign firms operating within the country or against imports of clean energy products. Subsidies could be granted to promote clean energy product exports, making domestic firms more competitive in the international market. Such concerns have been featured in several emerging trade disputes involving the largest trading powers: Canada, China, the European Union (EU), Japan and the US. The disputes could also envelop other trade powers, like Brazil and India, which have significant interests in developing robust clean energy sectors. Negotiations at the World Trade Organization (WTO) on trade in environmental goods and services are also hampered by rival definitions of how to define goods and services that have dual purposes and on how to reduce tariff and non-tariff barriers.

Why subsidise clean energy?

Investments in RE rose 32 percent in 2010 to a record USD 211 billion.Financial new investment (asset finance, venture capital, private equity, and public markets) in developing economies (USD 72 billion) exceeded that in developed countries (USD 70 billion). But, the share of RE in electricity generation (excluding large hydro) remains at only 8 percent of power capacity and 5.4 percent of electricity generation.

There are four arguments for using subsidies to promote clean energy. The public good argument stems from a desire to increase energy access and recognition of market failures. Subsidies to increase energy access are not necessarily net costs for governments, if other human development benefits are accounted for. Left to their own devices, private technology and project developers under invest in RE sectors, because the wider social benefits are disregarded and are not assigned a monetary value. Furthermore, subsidies that increase deployment of new technologies increase learning and help to bring costs for RE closer to those of non-renewable sources.

Another rationale offered for clean energy support is industrial policy. New energy technologies represent an opportunity for countries to demonstrate technological leadership and create an ecosystem that could support the development of new sectors of the economy. Firms demand government support to help secure access to patents and new technologies; to spread risk burdens; to get easy lines of credit; to secure land, water and other resources and to gain entry into the power market or access to the grid. China, for instance, has elevated alternative energy and environmentally friendly and energy-efficient technologies to the level of “strategic emerging industries”. The trouble

is that picking winners is seldom easy. Private venture capital investments often leave the riskiest projects for governments to cover, thus lowering prospects for success. Moreover, industrial policy can distort markets, credit flows, encourage rent-seeking behaviour, lock in existing technologies or add excess capacity. Thus, policy design matters – such as degression in feed-in tariffs (FiTs) differentiated by technologies – in mitigating potential perverse distortions from emerging.

A related rationale is job creation (and economic stimulus) in pursuit of "green jobs" in the RE sector: the United Kingdom aims at 400,000 jobs over eight years; India sees 900,000 jobs in biomass gasification by 2025; the German RE industry already employs 380,000 people; Spain recorded nearly 116,000 jobs by 2010; and California hosts a quarter of all U.S. jobs in the solar sector. In recession-hit economies, the jobs argument has particular resonance to justify stimulus spending: estimates suggest that the US led the field with USD 65.1 billion, followed by China (USD 46.1 billion) and South Korea (USD 32.2 billion).Such efforts need not create additional employment if job losses in fossil fuel-based energy sectors in rich countries are taken into account.

The tit-for-tat argument suggests that if one country supports its domestic industry and labour force, other governments, fearing unfair trade competition and loss of potential market opportunities, would seek to level the playing field. But, if all major clean energy producers and exporters engaged in competitive subsidising, public funds would be diverted to support firms that need not be competitive otherwise.

Clean energy subsidies in leading RE countries

There are various kinds of clean energy subsidies. One way to classify them is by the form they take. Subsidies for RE could be delivered directly as financial transfers or indirectly by virtue of preferential tax treatment. Government support can also come from regulations that create incentives to invest in clean energy. Another type of support is related to physical infrastructure or access to natural resources, which allows RE developers to lower costs of production or supply electricity to consumers more easily. Finally, trade restrictions against foreign competitors can offer a competitive edge to domestic firms.

A second way to classify clean energy subsidies is by understanding their purpose. Government support may be offered to correct for market failures and increase energy access. Subsidies may also support creating more clean energy generation capacity. Government support may also be offered to build up domestic industrial capacity to manufacture RE equipment. And, subsidies may be geared toward boosting exports of clean energy products and services.

In addition to other countries, the report examines in more detail government support measures in six countries – Brazil, China, Germany, India, Spain, and the US – which have the largest installed RE capacities and/or have registered high annual rates of growth in RE investment in recent years. Precise information on global subsidies for RE is not readily available. Furthermore, some of these additional measures are hard to compute if energy investments or import restrictions have dual purposes for both RE and fossil-fuel projects. There are also no common reporting requirements or harmonised metrics, which makes inter-country comparisons difficult. Nevertheless, the combination of the form and purpose of clean energy subsidies results in several types of support measures.

Direct financial transfers include subsidies to encourage consumers to substitute RE for fossil fuel. These have been offered through rebates in electricity bills (in Argentina and China) or covering capital costs for off-grid installations, such as solar home systems (Bangladesh), solar lanterns (India) or solar and mini-grid biomass projects under Brazil's Luz para Todos Electrification Programme. China's Golden Sun programme offered subsidies to cover installation costs for both grid-connected and off-grid projects. The California Solar Initiative offers subsidies to increase solar photovoltaics

(PV) access to low-income households and in new housing construction; low-interest loans were offered for energy efficiency building retrofits in Texas.

Feed-in tariffs have a regulatory component, for instance, when they require utilities or intermediaries to purchase electricity from renewable generators at the higher tariff price (Brazil's PROINFA programme). But, if the state bears the burden of this higher price, a financial transfer component is involved. Since Germany adopted this policy in 2000 (for wind, hydropower, solar, geothermal and biomass), more than 63 countries have started offering FiTs. These include China's Wind Power Concession programme, India's National Solar Mission, and Spain's policies for solar, wind, biomass and geothermal projects.

Preferential credit lowers the project costs (through credit lines and risk guarantees) for RE developers. Brazil's National Development Bank has offered capital cost financing at attractive rates. Germany's RE Heat Act offers funding support to increase the share of renewable energy sources for water and space heating in buildings.

Investment subsidies cover a portion of the project costs, particularly capital equipment, and to expand electricity generation capacity (PROSOL for solar thermal projects in Andalusia, Spain). Production subsidies can boost RE electricity generation (the US Renewable Energy Production Incentive) and support domestic RE equipment manufacturers and R&D (US SunShot Initiative). In addition, export subsidies, as direct grants or concessional loans, encourage local manufacturers and other firms to export clean energy products and services.

Preferential tax credits can be granted for energy consumption. They also take the form of accelerated depreciation to promote investments in manufacturing and production capacity by domestic firms. Investment tax credits have been used in India, Sri Lanka and the US to attract more foreign capital in RE. Income tax breaks (in India and the Philippines) offer investors the attraction of higher profits, while annual federal tax support in the US now amounts to USD 20 billion, three-quarters of which accrues to the wind, solar, ethanol and energy efficiency sectors. Production tax credits or generation-based incentives (wind sector in India) are paid per kilowatt hour (KWh) of electricity produced over and above the guaranteed power tariff.

Excise duty rebates on sales, royalties and other levies are targeted at increasing RE production or manufacturing capacity (Kenya and Tanzania for solar PV systems; ethanol production in the US). Export tax rebates, like export subsidies, could be used to encourage exports of RE products and services.

Regulatory support includes grid connection, forcing utilities to extend transmission lines (wind in China; Germany's RE Sources Act) to RE project sites or to build electricity substations when projects are announced, which increases the project's viability and helps developers secure loans.

Demand guarantees via renewable purchase obligations require power utilities to purchase a certain share of their electricity from RE producers, thereby expanding the RE market. China's RE law required utilities to purchase all RE generated; India introduced renewable purchase obligations (RPOs) in 2003; and Texas's regulations led to billions of dollars of investment in wind capacity. Trading via renewable energy certificates creates a market mechanism to encourage RE adoption while reducing the costs of meeting targets.

Furthermore, government procurement leverages the purchasing power of governments, thereby expanding the market for RE or energy-efficient products and services – and could favour domestic firms as well. Compulsory licensing of intellectual property (IP) is one means to give domestic firms access to advanced technologies. But, it is controversial, especially if production is not geared toward increasing energy access but say, exports of clean energy equipment.

Infrastructure support includes investments in extending the grid to faraway regions and allowing RE projects to feed power to the grid, at times for premium prices (Spain). Land acquisition and access to other natural resources for clean energy projects can be offered to build RE generation capacity, local manufacturing bases or for promoting exports. In Gujarat, India, the government established a Solar Park by acquiring land before selling it to project developers. Subsidised land has been one factor in making China internationally competitive in wind and solar energy.

Finally, investment and trade measures include market access restrictions, which prohibit foreign project developers from setting up RE generation capacity, or tariff barriers to favour domestic equipment suppliers. Other non-tariff measures that act as incentives to local firms include import quotas, while consumers bear the cost in the form of higher prices for domestically manufactured components. Export quotas are also used to curb exports of critical raw materials (such as rare earths from China) used in RE equipment manufacture. Technical standards could be also used to restrict imports by promoting standards adopted by domestic manufacturing companies.

Local content requirements (LCRs) impose a minimum share of local content in any final RE product to promote the domestic manufacturing sector (wind sector in China), or to promote local jobs (Brazil). If the market for RE is expected to grow and governments are worried about the security and quality of the RE infrastructure and continued supply of spare parts, there may be a case for promoting a domestic manufacturing base. The question is how to do so in the least discriminatory way. India's LCR rules for its National Solar Mission do not discriminate between foreign and domestic firms, as long as a percentage of the final solar PV module is made at home. The problem with LCRs, however, is usually not restricted only to discrimination against foreign firms that may be free to invest in domestic manufacturing facilities but rather against foreign imports.

Reconciling trade rules and domestic policies for governing clean energy subsidies

According to the WTO's Agreement on Subsidies and Countervailing Measures (SCM) a "financial contribution" from the government is considered a subsidy if it confers a "benefit' on the recipient" (Article 1). Financial contributions include many of the measures analysed here, namely direct financial transfers, preferential tax treatment, regulations (such as government procurement), infrastructure support (such as subsidising grid access or land), and even some forms of trade restrictive policies, such as LCRs. These measures must confer a benefit as well for the SCM Agreement to apply.

Certain subsidies (LCRs and export subsidies) are prohibited under WTO law. This is the basis for the ongoing dispute against Ontario's FiT scheme, which is contingent on LCRs. Other subsidies are actionable and can be challenged through disputes or countervailing measures if they cause adverse effects on other countries. This has been the basis of US investigations into Chinese subsidy programmes for solar manufacturing. China has retaliated with its own investigation of US measures.

Exceptions under the General Agreement on Tariffs and Trade (GATT) 1994's Article XX – which allows trade restrictions to protect human, animal or plant health or to conserve natural resources – do not explicitly apply to the SCM Agreement. So, it is unclear if the exceptions may be invoked to justify FiTs and other forms of government support directed to clean energy. Even if Article XX exceptions were applied to clean energy access and generation, it would not justify exceptions for the primary purpose of equipment manufacture. Thus, the motivation of the subsidy programme matters. Furthermore, Article 8 of the SCM Agreement included a specified list of subsidies that would be non-actionable, such as for R&D and for environmental protection. But,this provision lapsed in 2008.

A related critical issue is the scale of the subsidy and whether it is used as a transitional measure. If subsidies are used to boost domestic manufacturing capacity, it is important to assess whether it is primarily for creating jobs and promoting exports, or whether it is a means to boost energy access and a transition to a low-carbon pathway. Such clarifications on the justification and end use of subsidy measures are currently missing in existing legal provisions.

Individual country policies, emerging disputes and lack of clarity on exceptions to WTO rules underscore the tension between maintaining non-discriminatory trade practices (a primary objective of the trade regime) while also promoting greater and faster adoption of clean energy (a key strategy in the response to climate change as well as deficits in energy access). Five proposals could, therefore, offer the legal and policy clarity to reconcile this fundamental tension.

Recommendation 1: International institutions with rules governing trade, energy flows and climate change need greater coordination.

A new framework for trade rules on clean energy subsidies could consider not only the adverse and non-adverse impacts on other countries, but also the purpose of the measure: energy access, boosting clean energy generation capacity, building a domestic manufacturing base, or expanding export potential. If subsidies were used, for instance, for extending grid connections to RE sources (whether project developers are domestic or foreign firms), they should not be challenged. Again, if subsidies were offered to acquire intellectual property for emerging clean energy technologies, no adverse impact is caused even as a country is able to expand its clean energy generation capacity. Currently, however, such exceptions are not explicitly permitted under WTO rules, and until these issues are resolved, such policies might continue to attract trade disputes. Therefore, there might be a case for clarifying rules for sustainable energy under future trade-related initiatives for sustainable energy, including possibly a separate agreement – a Sustainable Energy Trade Agreement (SETA) – that could set out key principles for what would be permissible subsidies, especially if they are for non-mercantilist purposes like increasing clean energy generation capacity or offering energy access.

Recommendation 2: Common metrics to count subsidies can help to increase transparency.

Unless clean energy subsidies are measured in a transparent manner, there could be greater danger of misinterpretation and potentially more trade disputes arising. Use governmental, intergovernmental (United Nations Sustainable Energy for All initiative) and non-governmental sources of information on clean energy subsidies but standardise them to enable inter-country comparisons.

Recommendation 3: The relationship between rationalising fossil-fuel subsidy programmes and the use of subsidies to promote clean energy sources should be further investigated.

The G-20 could be an ideal forum to undertake analysis and discuss this relationship.

Recommendation 4: Establish the purpose of government support.

Currently, no forum exists where governments can discuss their reasoning for clean energy support programmes.

Recommendation 5: Meanwhile, independent assessments of alleged adverse impacts of subsidy policies could reduce the threat of unilateral trade sanctions or other penalties.

These assessments could occur through WTO Trade Policy Reviews, at the Committee on Regional Trade Agreements, or the United Nations Industrial Development Organization. Such assessments could also examine the impact of subsidies in promoting clean energy research, development, deployment and commercialisation.

Introduction

For the last three years, the world's leading economies – via the Group of Twenty (G20) – have been debating how to - and committing to - phase out inefficient fossil-fuel subsidies that incentivise wasteful consumption. The pledge was also reiterated at the 19th Asia-Pacific Economic Cooperation (APEC) Economic Leaders Meeting in Honolulu, Hawaii in 2011.[1] At the UN Conference on Sustainable Development in Rio in 2012, countries "reaffirmed the commitments…to phase out harmful and inefficient fossil-fuel subsidies…"[2] These subsidies, averaging about USD 400-600 billion annually,[3] artificially keep prices low, distort energy choices and contribute to carbon emissions. According to the *World Energy Outlook 2011*, subsidies for renewable energy (RE) were equal to USD 66 billion in 2010. Of this, subsidies to renewable electricity were equal to USD 44 billion and subsidies to biofuels were equal to USD 22 billion.[4] Counting energy subsidies is no easy task, and estimates vary. But, there is no doubt that support for clean energy is a fraction of the public funds devoted to sustaining fossil-fuel sources. The International Energy Agency (IEA) estimates that, apart from wind power, sources of renewable energy will continue to need subsidies at least over the next two decades to remain competitive, particularly if fossil fuels continue to receive subsidies and their environmental impacts are not priced.[5]

However, a fundamental tension is emerging around the governance of clean energy subsidies. Nearly two billion people have no access to modern sources of energy. Increasing energy access is one of the key ingredients for human development. At the same time, energy-related carbon dioxide (CO_2) emissions are also expected to increase over the next two decades, especially in developing countries. Clean energy subsidies are, therefore, being used to support two simultaneous transitions: from no energy to energy access; and from fossil fuel-based energy to a low-carbon energy pathway. Subsidies need not be the only way to support these transitions. For instance, a tax on fossil fuels could make some clean energy sources more viable. Moreover, international trade rules frown upon the use of subsidies, even if they are for clean energy. These rules exist to prevent distortions and discrimination in international trade. So, while one logic suggests that subsidies for clean energy could be one response to the climate change and energy access challenge, another dictates that many types of subsidies must be avoided to comply with trade rules. What are clean energy subsidies and how could they be governed to reconcile this fundamental tension? This report examines this question.

At the outset, it is worthwhile to note the scope and purpose of this study. This report does not offer a comprehensive dataset of all clean energy subsidies and is not a substitute for detailed data collection. It focuses primarily on subsidies for electricity from renewable energy sources or for energy efficiency and does not cover subsidies for transportation fuels. In addition, this study does not offer a complete inventory of subsidy measures in the countries that have been examined. Other sources would be better suited for such information. The study's aim, instead, is to show how the different logics for clean energy subsidies converge or diverge from the logic of maintaining a robust and rule-bound global trading system. In this pursuit, the study provides a common framework to analyse both the different forms that clean energy subsidies take and the different (and, at times, overlapping) purposes of using such subsidies.

Energy access and low carbon transition offer a unique opportunity for many poor countries to pursue sustainable development and human development goals. But, RE technologies face numerous barriers, including high capital costs, subsidised and distorted fossil-fuel markets, technology risks, regulatory uncertainty and policy risks, lack of access to enabling infrastructure, weak manufacturing bases as an obstacle to economies of scale, etc. Subsidies – in the form of direct financial transfers, tax concessions, regulatory support, infrastructure, and trade policies – can remove some of the barriers and help to level the playing field

(although policymakers also have to avoid potential pitfalls of political payoffs and rent-seeking behaviour by beneficiaries). Energy subsidies are also proposed to meet demands of energy security, economic and industrial development, social welfare and employment generation, technological leadership, export promotion, and so forth. Given the multiple objectives of clean energy subsidies, several tensions have either already emerged or are visible on the horizon.

Policy Tensions around Clean Energy Subsidies

At least four sets of policy tensions are driving a growing international debate on the governance of clean energy subsidies. One source of tension is related to the environment. Fossil energy sources are one of the main factors contributing to climate change. Renewable electricity technologies and renewable transport fuels are one set of responses to this challenge. But, investments in cleaner energy infrastructure have incremental costs over and above what it would have already cost to install coal- or gas-fired power plants or supply fossil transport fuels. Meanwhile, climate change negotiations are, partly, hinged on promoting the transfer of clean technologies to developing countries and providing the financial resources to adopt these technologies. In the absence of adequate international funding, many governments use subsidies to support these technologies and reduce their costs. The question is whether the financial support will be sustained over a period sufficient to scale up deployment of new and emerging clean energy technologies.

Second, tensions arise on economic grounds thanks to decisions to invest in clean energy sectors. Sustainable energy investments rose steadily from the third quarter of 2004 (at USD 5 billion) to the fourth quarter of 2007 (peaking at USD 41 billion).[6] The dip in investments began from early 2008, preceding the onset of the global economic crisis by a few months. Investors in clean energy might exit relatively less mature sectors sooner or choose to defer their investment decisions until well after signs of general economic recovery become visible. Recent boosts in investments have come on the back of stimulus spending by governments or by investments in developing countries, which have not suffered as much from the economic crisis. Once again, the role of subsidies to smooth the fluctuations in clean energy sectors and increase investor confidence has become an international concern for sustaining investments in the face of the climate challenge.

A collective international concern, however, does not mean that all countries will converge on the role of national policy. Subsidies for clean energy sectors during a recession could assume a mercantilist purpose as well, especially if domestic industrial development, manufacturing capacity and employment generation come at the expense of other countries. Governments and firms are interested not only in the collective good of cleaner, low-carbon energy, but also in industrial and economic competitiveness.

Consider the notion of a “green economy” one of the two defining themes for the Rio+20 Sustainable Development Summit in June 2012. As a concept, green economy aims at sustainable development along with poverty eradication, comprising a lens to focus efforts on advancing economic and environmental goals simultaneously.[7] While this is a laudable goal, many developing countries have stressed that pursuit of a green economy should preserve “ample flexibility and space for national authorities to make their own choices and define their paths towards sustainable development based on national circumstances and priorities”.[8] This is important, because the way clean energy subsidies are governed would depend on how much flexibility individual countries retain in defining their low-carbon pathways. Each country would give priority to different clean energy sectors and to the form of support used. However, not all support measures have similar consequences for other countries. The choices between subsidising R&D versus deployment, energy access versus manufacturing or clean energy production versus exports all have different impacts on consumers, project developers and equipment manufacturers at home and abroad.

Related to economic drivers, technology is the third source of potential tension. Recent years have witnessed significant growth in

manufacturing capacity and deployment of clean energy generation capacity (Germany and Spain in solar; China and the US in wind and solar, for instance). But, many technologies remain at the R&D stage or have not been deployed at a scale that would make them commercially viable just yet. And, between R&D and commercialisation lie other stages of demonstration and early deployment, eventually extending to market diffusion. Each of these stages requires different forms of financial support. Technological innovation and leadership in these emerging sectors (in part to build up national manufacturing capacity) are to an extent a function of a country's indigenous scientific prowess. But, many bilateral ventures are also underway to jointly develop new technologies. In India, the most recent example is the USD 100 million India-US Joint Clean Energy R&D Centre.[9] At the multilateral level, too, negotiations concerning a Technology Mechanism under the UN Framework Convention on Climate Change have assumed a critical role. The question is how partner countries support these joint ventures – through direct financial transfers or by contributions in kind – and how the fruits of such labour are shared.

Economic drivers also manifest through the fourth source of tension: trade policy. Countries wishing to develop domestic industries might design subsidy programmes in ways that concentrate spending on domestic firms. Mercantilist policies discriminate between foreign and domestic firms within a country. They can also discriminate between imported clean energy products and local manufactures. Subsidies could be granted to promote clean energy exports, making domestic firms more competitive in the international market. Such concerns have been behind several emerging trade disputes involving the largest trading powers: Canada, China, the EU, Japan and the US. The disputes could also envelop other trade powers, like Brazil and India, that have significant interests in developing robust clean energy sectors. Negotiations at the WTO on trade in environmental goods and services are also hampered by rival definitions of how to define goods and services that have dual purposes, and then how to reduce tariff and non-tariff barriers, especially if the latter promote domestic clean tech industries.

Why should policymakers and stakeholders in the trade community care about the imperatives for clean energy subsidies and the emerging tensions? The number of countries seeking to scale up renewable energy investments, driven by some or all of the four imperatives, is growing. Emerging economies, which still have to provide access to energy to many of their citizens and stand at the crossroads of choosing between alternate energy technologies, stand out in this regard. Meanwhile, calls for transparent notification of subsidies are intensifying, and some legal cases in the area of renewable energy have already entered the WTO arena. Such legal challenges could have a dual impact: constraining countries' policy space and lowering investor sentiment, if the continuity of policies supporting clean energy is called into doubt.

Under WTO law, subsidies relate to financial contributions that confer benefits on the recipient. But, the contributions can take many forms, through funds transfers, tax breaks, and provision of goods and services, among others. Interpreting WTO law as it applies to subsidies will be critical to ongoing disputes. But, it will be equally important to understand the economic and political rationale for clean energy subsidies, to capture their scope and manifestations and to draw upon empirical evidence of how they are being deployed in different countries. From an economic logic, for instance, several forms of government support (not only funds transfers, but also regulations relating to government procurement or preferential access to infrastructure) can be considered subsidies. A more comprehensive economic, political and legal understanding of such measures can offer insights on how the emerging tensions on clean energy subsidies may be resolved.[10]

The structure of the report is as follows. Section 2 critically examines four motives for subsidising clean energy, namely correcting market failures, industrial policy, employment generation, and tit-for-tat strategies. Section 3 develops a typology of subsidies by categorising them in two ways:

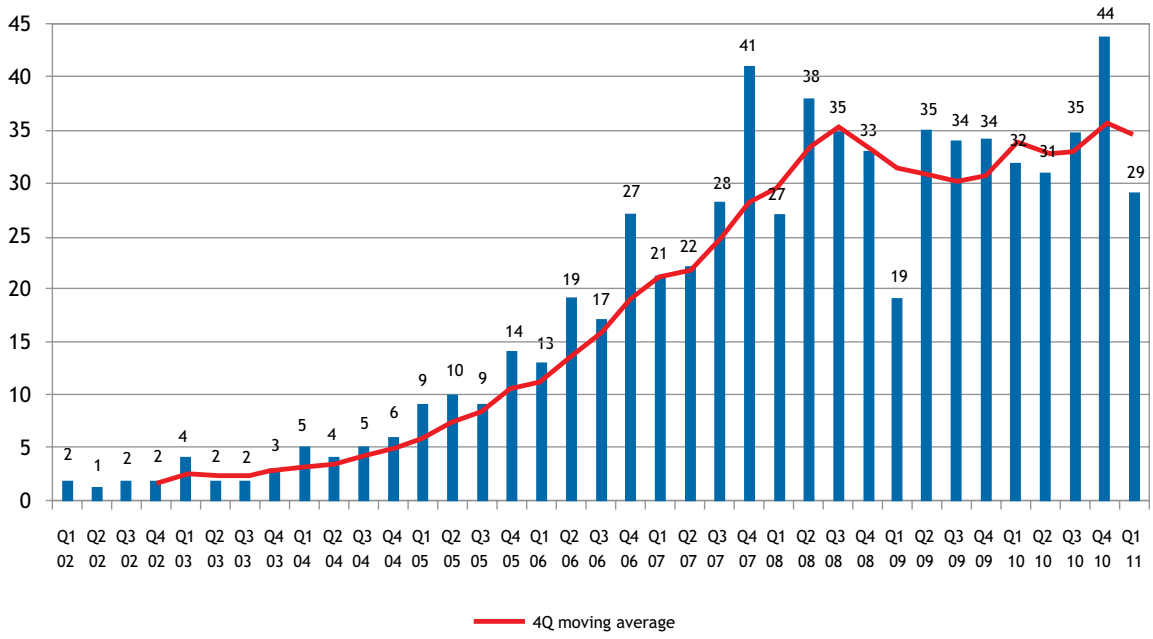
the form they take, and the purpose for which they are deployed. This approach encapsulates a broader set of government support measures than are usually treated in discussions on clean energy subsidies. Section 4, while outlining measurement difficulties for cross-country comparisons, describes important policies as well as their scale, scope and motives in six leading RE countries: Brazil, China, Germany, India, Spain and the US. These descriptions (although not comprehensive for all past and current policies) offer insight into how different types of subsidies have been used across the world and emphasise their explicit or implicit motivations. Section 5 examines WTO law on subsidies to show how rules on prohibited and actionable subsidies still do not give policy clarity in the development of clean energy. It suggests, instead, a new framework for the legal treatment of clean energy subsidies by taking into account both the expected adverse impact of subsidies for other trade partners as well as the motives behind the measures. Finally, Section 6 concludes with policy recommendations for further international discussions on the subject.

Chapter 1

Why Subsidise Clean Energy?

Renewable energy resources are naturally replenishing and virtually inexhaustible, but the amount of energy available per unit of time is limited. These resources include: biomass, geothermal, hydro, ocean thermal, wave action, tidal action, solar power and heating and wind. For the purposes of this report, we consider clean energy to be that supplied by RE resources for electricity generation or made available by energy-efficiency measures. Definitions vary across data sources. In some instances where large hydropower is excluded from estimates, the report will state it explicitly

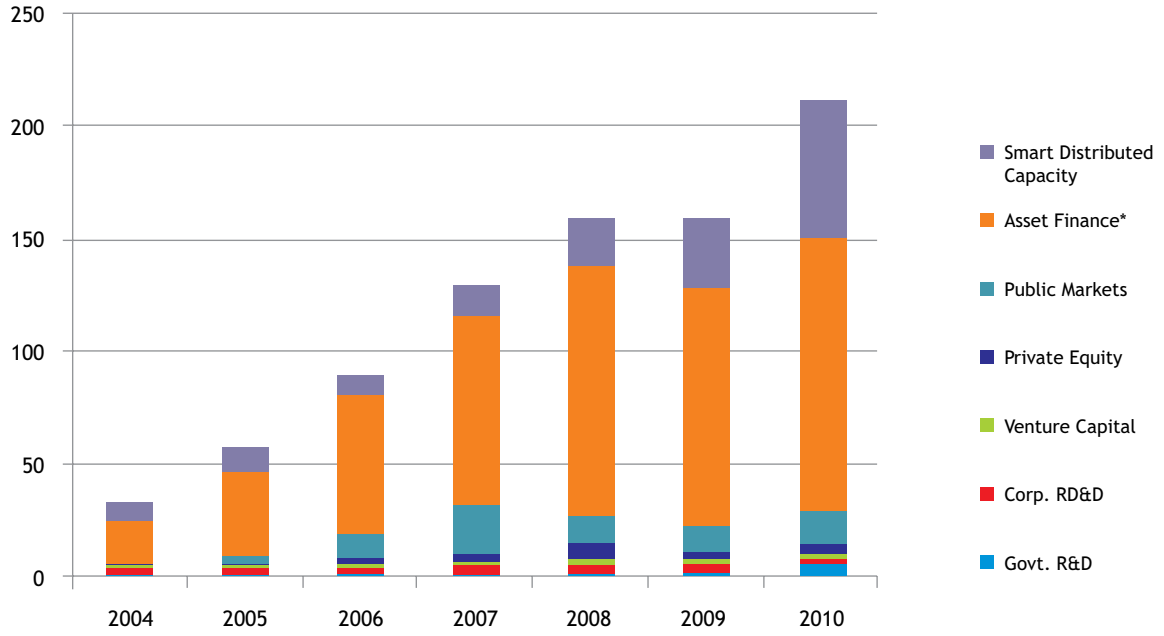
Figure 1: Global financial new investment in renewable energy, quarterly trend, USD billion (2002-2011)



Source: McCrone, Angus et al. (2011) Global Trends in Renewable Energy Investment: Analysis of Trends and Issues in the Financing of Renewable Energy, UNEP and Bloomberg New Energy Finance, p. 17.

Globally, there was a surge in RE investments from 2004 to 2007 (Figure 1). Countries like Brazil, China and India experienced compound annual growth rates in RE investments of 171 percent, 104 percent and 52 percent, respectively, during 2004-2008.[11] But, the onset of the global economic crisis halted the upward trend. Although the crisis did not fully manifest itself until late 2008 and through 2009, quarterly investment data show that the slowdown in sustainable energy investments began early in 2008 (the four quarter moving average has so far not exceeded the 2008 level).

Figure 2: New investments in renewable energy have picked up again (USD billion)

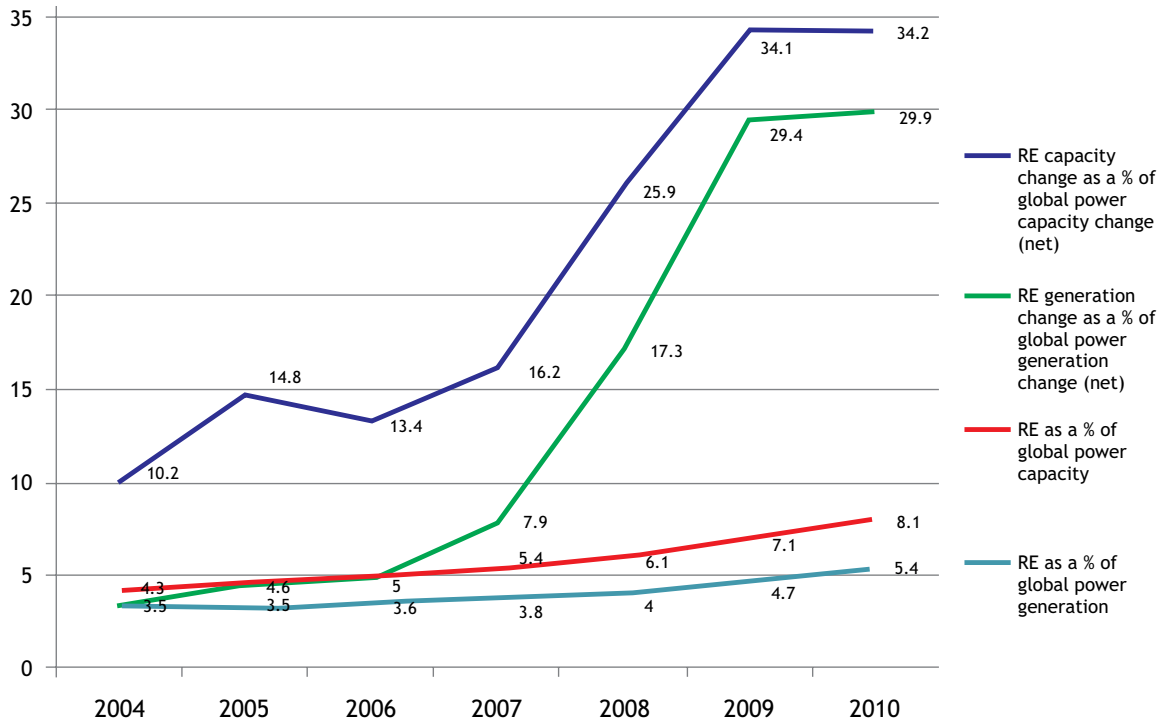


Note: Asset finance values are net of re-invested equity.

Source: McCrone, Angus et al. (2011) Global Trends in Renewable Energy Investment: Analysis of Trends and Issues in the Financing of Renewable Energy, UNEP and Bloomberg New Energy Finance, p. 13.

In recent years, RE investments have picked up again, with new investments rising 32 percent in 2010 to a record USD 211 billion (Figure 2). The gains have mostly come from sharp increases in small-scale distributed projects, in government-sponsored R&D and in asset finance for utility-scale projects. Also in 2010, financial new investment (asset finance, venture capital, private equity, and public markets) in developing economies (USD 72 billion) exceeded the developed countries' mark of USD 70 billion (investments in China and India were up 28 and 25 percent, respectively).[12]

Figure 3: Renewable energy's overall share in electricity remains small, but rising proportion of new capacity and generation (percentage)



Source: McCrone, Angus et al. (2011) Global Trends in Renewable Energy Investment: Analysis of Trends and Issues in the Financing of Renewable Energy, UNEP and Bloomberg New Energy Finance, p. 25.

However, the share of RE in energy systems remains small. In electricity generation, for example, RE (excluding large hydro) remains small at only 8 percent of power capacity and 5.4 percent of electricity generation (Figure 3). While rising investments have ensured that RE accounted for 34 percent of the net addition to global power capacity and 30 percent of the net increase in power generation, these encouraging trends are tempered when taking into account the significant upstream investments in fossil-fuel energy (exploration, mining, unconventional sources, etc.). Of the combined investment in energy of USD 1.2 trillion in 2010, RE's share was only one-sixth.[13]

Clean energy clearly has a long way to go before it can credibly threaten the dominance of fossil fuel in electricity capacity and generation. The question is whether market trends would be sufficient to push investments into the sector at a pace fast enough to meet the twin goals of energy access and climate change mitigation. If not, why and under what circumstances would clean energy subsidies be needed? This section will explore the different arguments offered for subsidising clean energy – and, as discussed earlier, underscore many of the policy tensions surrounding such support measures. Each set of arguments suggests costs and benefits for different constituencies, at the national and international levels.

1.1 Public Good Argument

One argument for subsidising clean energy stems from a desire to increase energy access and recognition of market failures. For example, increasing energy access to dispersed population settlements becomes harder the further they are from the electricity grid. This is particularly problematic for rural households. Even in densely populated regions, low electricity demand from rural households can make the installation of secondary and tertiary transmission lines and distribution systems uneconomical. Such households are unlikely to enjoy energy access unless part of the capital cost is subsidised.

Subsidies to increase energy access are not necessarily net costs for governments. The use of traditional biomass fuels for cooking and heating has severe health implications, especially for women. Access to modern energy sources means improved health outcomes, benefits that are often not included in economic cost-benefit analyses. Such omissions result in a market failure, whereby energy utilities have no incentive to extend transmission lines when the social benefits of better health outcomes are not internalised in their balance sheets. In these cases, subsidising off-grid electricity systems might make even more sense.

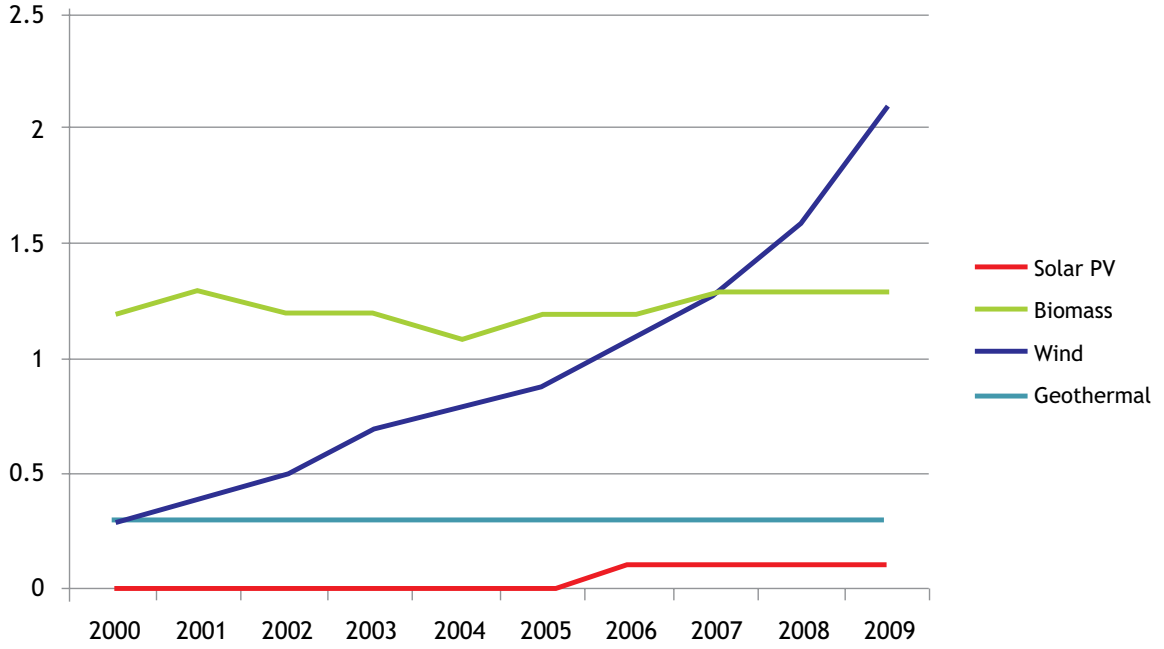
Market failures also emerge for clean energy technologies. Left to their own devices, private technology and project developers under invest in RE sectors, because the wider social benefits are disregarded. Not counting the positive environmental and health externalities of switching to cleaner sources of electricity – lower greenhouse-gas emissions and cleaner air – means that a calculation based on private returns would preclude clean energy investments. But, when the benefits of shifting away from traditional fuels are added along with the avoided fuel costs of using diesel or kerosene, subsidised off-grid RE applications have yielded significant returns. Solar PV systems, for instance, have offered economic returns and consumer surpluses of 27 to 94 percent for projects in Bolivia, China, Indonesia, the Philippines and Sri Lanka.[14]

1.1.1. Lowering RE costs

Many RE sources account for only a small share of electricity generation in most countries (Figure 4) because the average costs of additional capacity installation remain much higher than for the dominant fossil-fuel sources, like coal or gas. The costs of new technologies fall as the cumulative installed capacity increases, at a proportion known as the learning rate. Subsidies that increase deployment of new technologies increase learning and help to bring costs for RE closer to those of non-renewable sources.[15]

It should be noted, however, that subsidies need not be the first-best option to correct market failures and provide public goods. A tax on fossil-fuel consumption in electricity generation or the removal of fossil-fuel subsidies are often better options.[16] There has been a long history of using subsidies to support energy infrastructure – often wastefully. In the US, the biggest energy consumer historically, land was granted for timber and coal infrastructure in the 1800s. In the 20th century, subsidies were offered to the oil and gas and nuclear energy industries. Offshore drilling, for instance, benefited from royalty waivers and favourable leases from the federal government.[17] During the oil price spikes of the late 1970s and early 1980s, tax incentives for fossil fuels exceeded USD 12 billion.[18]

Figure 4: Worldwide share of many RE sources in total electricity generation remains small (percentage)



Source: Gelman, Rachel(2010) 2009Renewable Energy Data Book, U.S. Department of Energy (Energy Efficiency & Renewable Energy), August, p.53. Available at http://www1.eere.energy.gov/maps_data/pdfs/eere_databook.pdf; accessed 26 March 2012.

Renewable energies, however, have not been treated the same way. Supporters of clean energy, like former California Governor Arnold Schwarzenegger, argue that government policy must "level the playing field for renewable energies", in order to develop a more competitive energy market, ensure energy and national security and create jobs at home.[19] This is not an argument, *per se*, for subsidising RE if better alternatives for removing distortions in energy markets exist.

However, the public good argument – accounting for the wider social and environmental benefits – is not sufficient to use clean energy subsidies if the subsidy programme is badly designed. Where government subsidies promote an industry or a sub-sector, participants are also wary of the longevity and credibility of commitments. Changes in government or in the economic condition can result in policy reversals and rapidly wipe out expected long-term private and social gains from investing in clean energy. The sudden decision in October 2011 to almost halve the FiT for roof-top solar installations in the United Kingdom (UK), which has given rise to legal disputes, is a case in point. Such a "stop and go" approach gives rise to concerns for investor decisions and undermines the credibility of policy pronouncements in the future as well.[20]

1.2 Industrial Policy Argument

Another rationale offered for clean energy support is industrial policy. New energy technologies represent an opportunity for countries to demonstrate technological leadership and create an ecosystem that could support the development of new sectors of the economy. Should such technologies gain widespread demand, within and outside the country, domestic firms could enjoy competitive advantage. In the early stages of a sector's development, firms demand support from the government for multiple reasons: to help secure access to patents and new technologies; to spread the burden of risk; to get easy lines of credit, especially for the high capital investments for renewable energies compared to fossil-fuel sources; to secure land, water and other resources; to gain entry into the power market or access to the grid, and so forth.

China, for instance, has elevated alternative energy and environmentally friendly and energy-efficient technologies to the level of "strategic emerging industries".[21] For its 12th Five-Year Plan it is planning USD 300 billion of investment each year to be divided among seven strategic industries. The objective is to take advantage of market trends and close the relatively small gap between emerging and developed economies in these new sectors, according to its Vice Premier Li Keqiang.[22]

Such aggressive industrial policy has yielded private and collective dividends. China now accounts for three-fifths of the world's solar panel production, 95 percent of which is exported.[23] Chinese firms, of course, benefit, but the global impact has been to drive panel prices down. In 2008, 1 watt (W) of solar capacity cost USD 3.30; by end 2011, the cost was closer to USD 1-1.20/W.[24]

1.2.1 Picking winners…

The trouble is that picking winners is seldom easy. The forms of financial and other types of commercial support required at different stages of research, development, demonstration and widespread deployment of new technologies vary. At very early stages, government investment in basic R&D can create a body of knowledge and expertise necessary to stimulate further innovation. During 1961-2008, the US federal government spent USD 172 billion on basic research and developing advanced energy technologies.[25] The question is whether basic R&D can easily translate into more risky commercial investments in emerging industries and firms. The federal loan guarantee scheme, worth USD 10 billion and strongly supported by U.S. Energy Secretary Steven Chu, has become the centre of a controversy following the collapse of Solyndra, a solar company that had received USD 535 million in loan guarantees. Critics argue that governments have a long history of failed commercial investments in the energy sector. Lawrence Summers, former presidential economic adviser, described the government as "a crappy VC [venture capitalist]"![26] Venture capital investments routinely fail, but are justified as long as the upside from investment in one innovative technology makes up for the losses on other bets. The problem is that private VC investments often leave the riskiest projects for governments to cover, thus lowering the prospects for success.

1.2.2 Risking policy capture

There are other dangers of using subsidies to support industrial policy, namely perversely distorting markets and credit flows, encouraging rent-seeking and other anti-competitive practices, locking in existing technologies at the cost of future innovation or simply adding excess capacity relative to demand. China's National Reform and Development Commission, its power planning body, observed that its wind energy sector was already suffering from overcapacity, thereby questioning the need for and ability to absorb such large-scale investments.[27] In the US, federal subsidies for clean energy increased nearly threefold in 2007-2010 to reach USD 14.7 billion.[28] Thanks to a set of policies that amounted to a "gold rush of subsidies", RE firms were able to benefit from support in the form of construction loan guarantees, cash grants, property tax breaks, long-term power purchase agreements and FiTs, and wanted to do as much of this business as they could get their hands on..[29] While the policies go some way to level the playing field with fossil fuels and nuclear energy, the danger is whether too much government subsidy reduces the incentives for investors to bear commercial risks if they have too "little skin in the game".[30] The difficulty of making appropriate policy decisions is that the line between necessary government support and excessive largesse is not always clearly defined, especially if, as Michael Graetz of Columbia Law School warns, bets are made based on political motivations rather than scientific metrics.[31] In other words, policy design matters – such as degression in FiTs based on differentiated technologies – in mitigating potential perverse distortions from emerging.[32]

1.3 Green Jobs and Economic Stimulus Argument

Another rationale is job creation, with some arguing that promoting clean energy industries could create millions of "green jobs".[33] Many economies hope to tap into the large potential for employment in the RE sector: the UK is aiming at creating 400,000 jobs over 8 years; India sees 900,000 jobs in biomass gasification by 2025; and Nigeria's biofuel industry could lead to 200,000 jobs.[34] The German RE industry already employs 380,000 people with 108,000 in the solar PV industry alone.[35] Spain recorded nearly 116,000 jobs (mostly in wind) by 2010.[36] Thanks to the "green" sector growing 10 times faster than other industries since 2005, the state of California hosts a quarter of all US jobs in the solar sector and attracts a third of clean tech venture capital.[37]

The argument for green jobs has particular resonance in recession-hit economies, justifying billions of dollars of stimulus spending in pursuit of reducing unemployment rates.[38] When the economic crisis began, major economies announced up to USD 194 billion in "green stimulus" spending (including RE, energy smart technologies, carbon capture and storage and transport).[39] Comparisons between countries are difficult, partly because the investments are expected to flow over several years, but estimates suggest that the US led the field with USD 65.1 billion, followed by China (USD 46.1 billion) and South Korea (USD 32.2 billion).[40] Of the total commitments, about half was spent in 2009 (20.3 billion) and 2010 (USD 74.5 billion).[41] The expectation was that spending would amount to USD 68 billion in 2011, USD 21.4 billion in 2012 and USD 9.7 billion in 2013.[42]

Despite large commitments, stimulus spending has varied by country. Germany spent over half its allocation by 2010 and China spent 69 percent, compared with only 36 percent in the US and 7 percent in Brazil.[43] Nevertheless, the results have been striking: China now employs 1 million people in its RE sector (60 percent in solar)[44] and California witnessed a 3 percent increase in green jobs between January 2008 and January 2009 (in the middle of the global slowdown).[45]

While such efforts could increase employment in clean energy sectors, they need not create additional employment if job losses in fossil fuel-based energy sectors are taken into account. This is because subsidised clean energy has the impact of lowering energy prices overall. If the price elasticity of demand for energy is not high, i.e. lower prices do not proportionately increase energy demand, the substitution of clean energy for dirty energy would necessarily lead to job losses in fossil-fuel sectors. The net effect would depend on the balance of job creation in clean energy versus job losses in dirty energy sectors. Moreover, the overall contribution could be small in advanced economies where energy production might not account for a large share of the economy.[46]

In developing countries, however, the price elasticity of energy demand would be high given the large share of income that energy (modern and traditional sources) costs poor households. In these economies, government subsidies would drive down RE prices and could encourage job creation across the supply chain (manufacturing, installation, financing, servicing, etc.). If these policies drive overall energy prices down, the demand for fossil-fuel energy would also increase (since many households hitherto unconnected to the grid would have an opportunity to access modern sources of energy). Therefore, job losses in the fossil-fuel sectors need not occur.

That said, in the long run, subsidised energy need not have a large positive impact on jobs if clean energy sectors face overcapacity. The clean energy market, which is otherwise valued at USD 240 billion per year, has already faced a glut in 2011. Supplies of wind turbines and solar panels have exceeded demand, threatening jobs in the sector.[47] In other words, a "green" energy policy could alter the mix of jobs in the energy sector but need not increase total jobs in the long run.

1.4 Tit-for-tat Argument

The use of clean energy subsidies to promote industrial policy or create jobs has mercantilist outcomes. That is, if one country supports its domestic industry and labour force, other governments may fear unfair trade competition and loss of potential market opportunities.

Domestic industry lobbies in the latter countries could protest, "If others are doing it, so should we"! The main rationale for such measures – to level the playing field – need not result in efficient outcomes. If all major clean energy producers and exporters engaged in competitive subsidising, public funds would be diverted to support firms that need not be competitive otherwise. There might be a justification for such a policy only if the revenues from additional market share in other jurisdictions exceed the costs to the public. But with other governments following a similar policy, the probability of greater market share is diminished. Unless tit-for-tat is used as a temporary strategy to "punish" an errant country for violating an international agreement on energy subsidies, adopting a strategy of subsidising one's domestic industry solely because others are doing it is unlikely to present net positive outcomes.

1.5 Who Wins and Who Loses

Behind each reasoning for clean energy subsidies is a group of potential supporters and opponents (Table 1). The strongest rationale – the provision of a public good in the presence of market failures – benefits energy consumers by driving down the prices of clean energy. It also benefits the environment and public health agencies, since externalities are reduced. But, fossil fuel-based utilities would be expected to oppose these measures, since their market shares would be adversely affected by a growing role of RE in the energy mix of the economy. However, if the subsidies last a long time, tax payers might also oppose the measures, especially if the benefits of energy access accrue to one section of society while the revenues to fund clean energy are drawn from other (say, richer consumers).

Table 1: Clean energy subsidies have supporters and opponents

	Rationale	Potential Supporters	Potential Opponents
Public good	Energy access; market failures owing to externalities	Energy consumers; environment; public health agencies	Fossil fuel-based utilities; tax payers or electricity rate payers (depending on length of subsidy)
Industrial policy	New technologies; competitive advantage	Clean energy product manufacturers; exporters; consumers if lowers costs passed through	Other industries (depending on source of subsidy) ; tax payers if mostly for exports rather than lower energy consumption costs
Employment	Stimulus during recession; politically attractive	Skilled workers (if focus is on manufacturing)	Lower-skilled or unskilled workers (if little attention to labour-intensive activities in supply chain)
Tit-for-tat	Level the playing field	Domestic clean energy firms	Importers of clean energy components; MNCs

Source: Author

Industrial policy clearly benefits clean technology firms and exporters of clean energy products and services. Consumers would benefit only if lower costs are passed on to them; if most products are exported, domestic consumers would not necessarily benefit from lower costs of subsidised energy products. Moreover, if the subsidies are financed by withdrawing resources promised to other industries, those sectors would oppose the measures. On the jobs front, notwithstanding the long-term marginal impact on job creation, in the short run skilled workers are expected to benefit from policies that support high capital-intensive RE sectors, especially if the focus of the policies are for manufacturing. Unskilled and lower-skilled workers might oppose these measures if little attention is paid to those parts of the value chain in RE electricity that utilise their services, such as installation and maintenance services. Any shift to a low-carbon energy sector would require changing the skill profile of the energy sector workforce. Finally, tit-for-tat strategies benefit domestic clean energy firms but hurt more internationally integrated firms. The latter import raw materials and components of clean energy products. If tit-for-tat strategies undermine competitive markets, the prices of components would rise and adversely impact such firms. Multinational clean energy companies, those with operations in several countries, are also expected to lose, since they are also affected by declining profitability in foreign countries where they have business interests.

In other words, although clean energy subsidies have several rationales, the political economy of domestic and international support for them would depend on the balance of winners and losers affected by an evolving industry, changing technologies and competitiveness, and shifting domestic regulation and international rules governing trade, energy and climate change.

Chapter 2

What are Clean Energy Subsidies?

The International Energy Agency (IEA) defines an energy subsidy as any government action primarily related to the energy sector that lowers the cost of energy production, raises the price received by energy producers or lowers the price paid by energy consumers.[48] The US Energy Information Administration (EIA) further defines energy subsidies as any government action whose purpose is to influence energy market outcomes, whether these actions take the form of financial incentives, regulation, R&D or public enterprise.

2.1 A Typology of Clean Energy Subsidies

There are various kinds of clean energy subsidies. Table 2 offers a typology. One way to classify them is by the form they take. Subsidies for RE could be delivered directly as financial transfers or indirectly by virtue of preferential tax treatment. Government support might also be regulatory in nature, whereby changes in laws create the incentives to invest in clean energy infrastructure or offer disincentives to firms and consumers that continue using fossil fuel-based energy. Another type of support is related to physical infrastructure or access to natural resources, which allows RE developers to lower costs of production or supply electricity to consumers more easily. Finally, trade restrictions against foreign competitors can offer a competitive edge to domestic manufacturers or project developers.

Table 2: A typology of clean energy subsidies

	Direct financial transfers	Preferential tax treatments	Regulation	Infrastructure support	Trade / Investmentrestrictions
Clean energy access/ consumption	Consumer subsidy	Tax credits for consumers	Grid connection	Grid access for consumers; Net metering	
Clean energy generation and capacity	Feed-in-tariffs (financial transfer component)); Long-term PPAs; Preferential credit	Accelerated depreciation; Investment tax credits; Production tax credits	Mandatory grid connection for RE firms Feed-in tariffs (regulatory component-such as compulsory purchase/off-take of electricity generated) Demand guarantees (RPOs); Trading of RECs; Government procurement	Grid access for RE firms; Land (below market price); Access to water; Energy-related services from government	Investment restrictions on foreign power firms
Domestic clean energy equipment & services manufacturing/ Production	Equipment production subsidy	Excise duty rebate; Accelerated depreciation	Government procurement; Compulsory licencing of IP	Land (below market price); Access to water resources	Market access restrictions on imported equipment and services Eg: Tariffs. Quotas; technical standards; local content requirements
Clean energy goods & services exports	Export subsidy	Export tax rebate	Special Economic Zones	Land (below market price); Energy-related services from government	

Source: Author

A second way to classify clean energy subsidies is by understanding their purposes. As discussed in the previous section, government support is required if energy access has to be expanded to a larger share of the population. Market failure in clean energy development (thanks to unaccounted positive and negative externalities) adds to the case for subsidies to either extend access to clean energy or stimulate greater consumption of energy from clean sources. Subsidies may also support the creation of more clean energy generation capacity. This is only a second best solution, since generation capacity does not necessarily translate into electricity feeding into the grid (if access to the grid is problematic or incentives such as accelerated depreciation are linked only to investment and not actual power generation) or to higher power consumption (if electricity costs remain prohibitively high). Nevertheless, generation capacity is a necessary step towards greater clean energy consumption. Government support is also offered with the primary purpose of building up domestic industrial capacity, for instance to manufacture solar panels or wind turbines. A related purpose, which also supports domestic industry, is when subsidies are geared toward boosting exports of clean energy products and services.

Using the framework described in Table 2, several clean energy support mechanisms may be identified. It should be noted that several types of subsidies could be used for multiple purposes and subsidy programmes seldom have only singular goals. Yet, this framework is useful because it establishes an explicit link between types of subsidies and their applicability for different purposes. This is relevant when interpreting WTO rules (see Section 5).

2.2 Direct Financial Transfers

Consumer subsidies: These subsidies are given directly to consumers to encourage them to substitute RE for fossil fuel. In Argentina and China, consumer subsidies have been offered as rebates in electricity bills. For off-grid electricity, the subsidy can take the form of a grant to cover initial capital costs (as in the cases of Benin, Bolivia and Togo). Off-grid RE products, such as biogas digesters, cleaner cook stoves, solar water heaters and solar home systems, are different. Bolivia, Laos, Nepal, Papua New Guinea, the Philippines, Tanzania and Zambia are among countries that have used subsidies to expand rural electrification. The World Bank has provided subsidies for solar home systems in various countries to cover between 12 and 90 percent of the costs.[49] Government subsidies for off-grid projects have expanded capacity on a large scale: solar home systems (500,000 in Bangladesh, 400,000 in China and 600,000 in India); biogas digesters in India (4.2 million); and solar lanterns in India (800,000) by early 2010.[50] One-off subsidies via multilateral funding sources have also been used to offset capital costs for off-grid connections, such as the Bolivia Decentralised Electricity for Universal Access Project, which received USD 5.2 million from the Global Partnership for Output Based Aid (GPOBA) to install 7,000 PV systems for rural households, schools, clinics and small businesses.[51]

Feed-in tariffs and power purchase agreements (PPAs): FiTs offer investors in RE a preferential price (higher than fossil-fuel tariff rates) and often guaranteed by long-term PPAs and grid access. They have a regulatory component, for instance when they require utilities or intermediaries to purchase electricity from renewable generators at the higher tariff price.[52] As explained further below, if the state bears the burden of this higher price (that is usually above the prevailing market price for electricity) there is a financial transfer component involved. The long horizon for a FiT policy is important, because it allows investors (whether large project developers or individual households) to calculate the period within which they would be able to recoup their investments. Since Germany adopted this policy in 2000, more than 63 countries have started offering FiTs.[53]

There are two policy questions relevant to the governance of clean energy subsidies: what should the FiT rate be and who would pay for it? In some cases, the FiT rate is gradually reduced to encourage greater efficiency and

lower overall costs. How transparently rates are set matters in order to ensure that a few RE investors do not capture windfall profits from a high FiT. One option is to regulate the tariffs and compensate the energy service provider with a subsidy to cover costs (this was done for solar PV micro-grids in China). Another strategy is to use a reverse auctioning mechanism, and grant the concession to the bidder requiring the lowest level of subsidy. This policy was used for the Renewable Energy for Rural Markets Projects (PERMER) for off-grid concessions in Argentina in 1999[54] and, more recently, for bidding under the first phase of the National Solar Mission in India.[55]

The other question – who pays – is also important, because the extra cost could be either passed on to distribution companies, to final consumers or assumed by the government. FiT programmes could be considered financial support under three scenarios: first, when a public body uses public funds to execute the programme and provides the necessary funding; second, when the government asks a private body to execute the programme but pays for it; and third, when the government directs a private body to both execute the programme and pay for it through a reallocation of costs or other means.[56] The first model is used in Ontario, the second in the UK for small-scale projects, and the third in Germany.

In developing countries, like India, distribution companies suffer from poor financial health thanks to the burden of other subsidy programmes, inefficient infrastructure, transmission and distribution (T&D) losses and theft. Burdening consumers in poor countries with higher rates is also challenging, unless the rates are progressive (with a higher share of the FiT cost falling on richer consumers). As argued earlier, if the government assumes the cost, it is a financial transfer. But, if the tariff is available only to domestic firms, foreign investors could argue that these are unfair trade practices.

Preferential credit: For many commercial or development banks, investments in RE projects entail technology and policy risks. Such institutions could be offered low-cost credit lines and partial risk guarantees by the government to encourage them to offer preferential lending to RE project developers. The Indian Renewable Energy Development Agency (IREDA) has used financial support from the World Bank, the Asian Development Bank (ADB) and other bilateral donor agencies to offer concessional credit.

Production subsidies for equipment manufacturing: Capital grants or low-interest loans to RE producers lower the cost of equipment production or help to expand manufacturing capacity. Once again, although the type of subsidy might be similar, it is important to distinguish between subsidies directed toward expanding electricity generation capacity from those supporting local manufacturers. In India, capital costs for installing biomass projects were subsidised to lower the eventual prices charged to consumers. Although clean energy transportation fuels is not explicitly within the scope of this study, it is worth noting that to stimulate ethanol production, the US Congress passed legislation in 2005 and 2007 to set rising shares of ethanol in gasoline and offered the industry a USD 0.45/gallon subsidy (USD 6 billion per year). By 2011, two-fifths of US corn production was being used for ethanol rather than food, and this usage was more than the consumption of corn for livestock feed.[57]

Export subsidies: These subsidies are provided, again in the form of direct grants or concessional loans, to encourage local manufacturers and other firms offering clean energy products and services. Even when these subsidies are not explicitly intended for exports, their use can be distorted. One such perverse outcome of production subsidies driving exports is illustrated by corn ethanol in the US. In addition to the production subsidy (see above), an import tariff of USD 0.54/gallon was imposed. These policies not only restricted imports of cheaper Brazilian cane-based ethanol, but also made possible the export of 397 million gallons of ethanol.[58]

2.3 Preferential Tax Credits

Tax credits for consumption: Tax exemptions, such as from on personal taxes, can be used to encourage consumers to adopt RE.

Accelerated depreciation: This form of support allows project developers to use higher depreciation rates on their RE assets and thus receive related tax breaks. Accelerated depreciation also promotes investments in manufacturing and production capacity by domestic firms.

Investment tax credits: These credits have been used in India, Sri Lanka and the US to attract more foreign capital in RE. Income tax breaks (in India and the Philippines) offer investors the attraction of higher profits, thereby encouraging them to enter an otherwise riskier RE sector. In the US, annual federal tax support now amounts to USD 20 billion, three-quarters of which accrues to the wind, solar, ethanol and energy efficiency sectors, the first two sectors garnering USD 7 billion, corn ethanol getting another USD 6 billion and energy efficiency securing another USD 2 billion in 2010.[59]

Production tax credits: The credits, or generation-based incentives, are paid per KWh of electricity produced over and above the guaranteed power tariff. The amount paid is dependent on the actual amount of power produced, so there is an incentive for producers to generate more (unless the payments are capped at a certain level of electricity production). If they are not guaranteed for a certain period, however, they could be subject to shifts in policy.

Excise duty rebates: Rebates on sales, royalties and other levies are targeted at increasing RE production or manufacturing capacity. Governments in Kenya and Tanzania have provided duty exemptions for solar PV systems.

Export tax rebates: Like export subsidies, tax concessions could be used to encourage exports of RE products and services.

2.4 Regulation

Grid connections: One of the most difficult challenges for scaling up the infrastructure for RE is access to the grid. Without grid connections, projects dispersed across locations that are not close to population centres will remain unviable. Regulatory measures could be introduced that force utilities to extend transmission lines to RE project sites or to build electricity substations when projects are announced. These provisions help project developers secure loans, because financial institutions become more convinced about the viability of the proposed project to sell electricity to the grid. In China, for instance, until early 2010, a third of wind turbines (mostly located in the sparsely populated western provinces) were not connected to the national grid. In December 2009, China passed a law requiring grid operators to pay an RE project twice the rate for the electricity that could be distributed.[60] Further grid-connection regulations could also ensure that consumers in rural areas or dispersed locations benefit from extensions of the grid.

Demand guarantees (RPOs): The guarantee of ever-increasing demand for RE helps to bring prices down, owing to economies of scale. Renewable purchase obligations require power utilities to purchase a certain share of their electricity from RE producers. Over time, the share could increase, thereby creating and expanding the RE market.

Trading via renewable energy certificates (RECs): Imposing RPOs entails costs on utilities, which seek a transition period to increase their portfolio of RE sources of power. RECs are instruments signifying shares of RE used by a utility. Those that do not meet their obligations are able to purchase surplus RECs from those that surpass their targets. This regulatory system creates a market mechanism to encourage RE adoption while reducing the costs of meeting targets. An REC mechanism also allows entities or provinces located in regions not conducive to RE generation to purchase clean energy from

producers in faraway jurisdictions. A successful REC programme, therefore, depends on an integrated and efficient national or even cross-border electricity grid.

Government procurement: A major source of leverage is the purchasing power of governments. Regulatory changes that require governments to purchase more energy-efficient products or consume greater shares of RE could significantly influence market signals. The US General Services Administration (GSA) has a dual ambition to reduce the federal government's environmental impact as well as stimulate innovation in clean technologies. It is able to do this, because it has 9800 buildings and 360 million square feet under its management, offering a captive market on a large scale.[61] If a country is a signatory to the plurilateral WTO Agreement on Government Procurement (GPA), and its policies favour domestic firms (that is, have an adverse impact on foreign firms), the measure could be challenged. But, if the country is not a party to the GPA, procurement policies favouring local project developers or equipment manufacturers would be seen as a clean energy support measure.

Compulsory licensing of intellectual property (IP): RPOs and RECs are primarily geared to increasing RE generation capacity by expanding the market. If the objective is to promote domestic manufacturing capacity, compulsory licensing of IP could be one means to ensure that firms have access to the best technologies. Compulsory licensing, which has been used to increase supplies of pharmaceuticals, is potentially controversial and could invite trade disputes. Nevertheless, at UNFCCC technology mechanism negotiations, developing countries have insisted that the option should be available to them. The case for compulsory licensing might yet have to be established, especially if production is not geared toward increasing energy access but for, say, export of clean energy equipment.

2.5 Infrastructure Support

Grid access: While regulation to force grid connections to RE projects is one route (see above), direct government investment in grid infrastructure is another way to lower costs. In 2009, the Chinese government spent USD 45 billion to upgrade the electricity grid with state-owned banks providing the financing.[62] Similarly, net metering allows customers to earn revenue from selling surplus RE to the grid, which also helps utilities by helping to meet peak load demand. Net metering has been adopted in South Africa, Sri Lanka and the US, among other countries. In rural and remote areas, extension of grid access could enable populations to benefit from larger renewable energy projects that are usually grid connected.

Land acquisition and access to other natural resources: Infrastructure support can also be offered to build RE generation capacity and local manufacturing bases or to promote exports. Land acquisition is a critical factor in the RE ecosystem. In Gujarat, India, for instance, the government has established a solar park by acquiring land before selling it to project developers. Heavily subsidised land has been one factor in making China internationally competitive in wind and solar energy.[63] Similarly, governments can provide access to other natural resources, like water, for RE plants. These are potentially controversial policies, owing to competition for land and water resources for other agricultural and industrial purposes.

2.6 Investment and Trade Restrictions

Market access restrictions and investment measures: Support for the domestic RE sector also draws on trade measures. Regulations could prohibit foreign firms from participating as project developers in setting up RE generation capacity. Tariff barriers could also favour domestic equipment suppliers. Such measures might not lower costs for consumers. But, by restricting the number

of players in the market, they offer indirect support to indigenous project developers (if investment measures were used) or domestic manufacturers (if tariffs were used).

Other non-tariff measures that act as incentives to local firms include:

Quotas: Another form of trade restriction to promote domestic production is the use of quotas to restrict the imports of foreign RE products. Even though a quota does not constitute a strict subsidy under the WTO's definition in the SCM Agreement, its economic impact is to shift the financial burden away from a single domestic firm to tax payers.

Quotas may also be applied on exports of raw materials that are used in RE products. In 2010, China curbed the export of rare earths, elements that are used in high-tech equipment, including clean energy products. In the first half of 2011, China cut export quotas again by 35 percent. Speculation over the reasons for these curbs varies. However, given that China accounts for about 95 percent of the global supply, China's export restrictions triggered panic in industrialised countries (global prices for rare earths rose fourfold in 2010 and doubled again by April 2011). These measures prompted questions about whether existing trade rules were sufficient to adequately regulate or prohibit measures that threatened RE industries in other countries.[64]

Technical standards: Countries can also restrict imports by promoting technical standards adopted by domestic manufacturing companies. For instance, if foreign firms produce wind turbines of a certain capacity that is different from domestic firms, a tendering process for procuring new wind turbines could specify the domestic standard. If standards vary across countries, technology R&D costs rise as the products and components have to be modified for each potential market. This is a disadvantage for foreign firms, but it benefits domestic firms that are already using the specified standard.

Local content requirements (LCR): Finally, procurement policies could require a minimum share of local content in final RE products. The purpose of LCRs is to gradually promote the domestic manufacturing sector – allowing local firms to familiarise themselves with better technology – or to promote local jobs. If the market for RE is expected to grow and governments are worried about the security and quality of the RE infrastructure and continued supply of spare parts, there may be a case for promoting a domestic manufacturing base. The question is how to do so in the least discriminatory way. Governments could require that the products be manufactured within a given jurisdiction, even if the firm were foreign. Indeed, India's LCR rules for its National Solar Mission do not discriminate between foreign and domestic firms, so long as a percentage of the final solar PV module is made at home.[65]

The problem with LCRs, however, is usually not discrimination against foreign firms that may be free to invest in domestic manufacturing facilities but rather against foreign imports. By imposing an LCR, imports are restricted and domestic (more expensive) production is favoured. This imposes a financial burden both on domestic consumers or taxpayers as well as on foreign producers of the equipment. Thus, both the motivation for the requirement as well as the extent of harm caused to others would matter in governing the use of LCRs. Moreover, LCR provisions can distort markets in unanticipated ways. For instance, the National Solar Mission in India imposed LCRs only on silicon technology, not on thin-film technology. One consequence has been that thin-film technology has been adopted on a much larger scale (half of the installations) compared with its global share in silicon technology of approximately 14 percent.[66] Although the choice of technology is partly dependent on its appropriateness in different climatic conditions, this example still highlights the importance of using support measures that bear in mind potential market distortions.

2.7 Potential Risks with Subsidy Schemes

The range of government support for clean energy suggests that governing these

measures would be complex, especially as this requires specific methods to identify and evaluate the motivations behind the support measures in a transparent manner. Governments and other stakeholders need to be cognisant of at least four potential risks. The first is that the support mechanisms would be non-transparent. This problem has particularly plagued subsidies for fossil-fuel sectors, where tax breaks on all sorts of indirect costs (such as labour costs, repair work, etc.) have been used to abuse concessions for oil and gas drilling activities. In the RE sectors, reverse auctioning has been used to ensure that subsidies accrue to the most efficient project developers, depending on their bid prices. However, reverse auctioning, if pursued too aggressively, could also result in an adverse selection of firms that have little experience or capacity to deliver projects at the low prices they promise. In those circumstances, subsidy schemes have to be supplemented by strict penalty clauses and enforcement measures.

A second potential demerit relates to policy risks associated with government programmes. Project developers and their investors are unlikely to assume long-term technology risks associated with RE if they are also worried about the credibility and longevity of government subsidies. For instance, in October 2011, the UK government suddenly decided to cut the FiT for households installing solar panels by more than half (from GBP0.433/kWh to GBP0.21/kWh) with only a few weeks' notice. The rationale for this change was that progressively reducing the burden on the taxpayer or energy consumer and also reduce the risk (like in China or Spain) that continuing premiums on tariffs would create a bubble and overcapacity, resulting in more painful industrial restructuring and job losses in the future.[67] This sudden move extended the period for households to recoup their investments from 10 years to 18, thus reducing the incentive to install panels. Although the courts have questioned the legality of this policy shift, continuing legal appeals and challenges have prolonged the uncertainty in the market.[68] At the same time, completely rigid policies are also not helpful if the financial commitments make the programme financially unviable in the long term. While policy stability is desirable, policies should also be adaptable to changing circumstances and evidence of their impact and the maturing of the market.

Subsidies could lock in existing technologies or support incumbent firms. As the previous section argued, government intervention is justified when market failures either preclude investments in RE capacity or result in under investment in R&D for future technologies. When the purpose of subsidies is considered – ranging from increasing energy access and generation capacity to manufacturing and export promotion – public authorities have to balance efforts to increase access and capacity today with supporting newer technologies in the future. Excessive support to the former tends to create market-entry barriers for newer, more innovative firms. As a result, energy subsidies need not benefit the intended population or stimulate the RE market as originally planned.[69]

Another challenge is that stakeholder participation and consultation might get ignored in the rush to implement subsidy programmes for clean energy. This is particularly important when RE projects are intended to provide energy access to far flung communities. In the past, policies that have promoted off-grid systems have seldom factored in issues of maintenance, local capacity development, the need to ensure quality of service, etc. As a result, communities have tended to lose faith not only in the projects, but also in RE as a whole. Successful projects, by contrast, have given households a stake in managing and maintaining the systems. (In the UK example of household solar panels, consultations on FiT rates were set to conclude nearly two weeks after the revised FiTs came into effect!) In other words, financial subsidies for RE are only one part of the ecosystem of government support needed to ensure successful uptake of new technologies at scale.

Chapter 3

How Large are the Subsidies and Where Do They Go?

This section will present empirical evidence from six countries to highlight variations in the scale, schedule, sector focus and rationale listed for clean energy subsidies. The purpose is not to offer a comprehensive listing of all subsidy programmes but to illustrate the diversity of subsidies and their underlying policy premises. The six selected countries are Brazil, China, Germany, India, Spain, and the US. The last five of these are among the top five countries in the world in terms of installed RE capacity, if hydropower were not included in RE estimates.[70] If hydropower were included, Brazil would be among the leading five nations; it has also recorded high annual rates of growth in RE investment in recent years and was among the top five for new RE investment in 2010.[71]

3.1 Measurement Difficulties

There is no widely accepted methodology for calculating energy subsidies or a harmonised reporting mechanism (even in such a unified market as the EU). This makes it difficult to estimate the actual level of subsidies directed to the energy sector, especially fossil-fuel industries. For instance, tax breaks and direct financial support may be calculated. But, should the estimates also include the cost of environmental pollution (externalities not covered by industry), subsidised access to natural resources via state-owned property (i.e. mountains, aquifers, etc.) or military expenditures to protect oil shipping lanes?[72] It is unclear *a priori* whether some of these kinds of support measures, such as subsidised access to natural resources, would be considered subsidies under the WTO definition. But, if their monetary value could be computed, the financial contribution of such support becomes both more apparent and relevant to the discussion.

Likewise, precise information on global subsidies for RE is not readily available. The first problem is the lack of a common definition. As shown in Section 3, a broad understanding of clean energy support measures would include regulation, access to infrastructure and trade policies in addition to financial transfers and tax exemptions. Even classifying a single measure, such as FiT, could be complicated depending on how it is designed, who bears the cost and who benefits.

The second, related, problem is that some of these additional measures are hard to compute. If transmission lines were extended only to connect a RE project, one can compute the cost of the extension and include it under infrastructure support. But, if with the expansion of the grid, both RE and fossil fuel-based projects benefited, how would the support for clean energy be distinguished? Similarly, an import restriction on components for RE projects might be considered a trade policy measure in favour of the domestic industry. But, if the components had multiple uses (in other industries or for fossil-fuel power as well), then the extent of support conferred only for clean energy purposes would have to be determined not by the increased tariffs, but by the proportion of the imported product whose end use is solely in the RE sector.

Third, there are no common reporting requirements or procedures whereby information from different countries may be collected and collated. Most available statistics are estimates by reputed agencies like the IEA and the US Energy Information Administration (EIA). For this study, information on clean energy investments as presented in annual reports by the United Nations Environment Programme (UNEP) and Bloomberg New Energy Finance (BNEF) is used. But, these reports do not cover all forms of government support apart from a small component of government-funded R&D and stimulus spending during the recession.

The absence of common reporting guidelines leads to the fourth challenge, namely the difficulty of comparing data across countries. Where subsidy programmes run for multiple years, the overall budget of the programme may be available, but it is difficult to find

information on annual spending. Also, while concessional loans may be calculated, loan guarantees are harder to compute, unless the project fails and the guarantee is invoked by commercial lenders. Access to infrastructure is particularly difficult to estimate. There are many claims about Chinese firms getting subsidised access to land for RE projects, but there are no reliable market rates for the land. Comparisons also matter when considering the purposes of the support measures. In the case of fossil-fuels, for instance, energy subsidies as whole in industrialised countries tend to be geared more toward production while developing countries use the subsidies to support energy consumption.[73]

Noting these challenges, the following subsections describe government support policies in different countries but do not make an attempt to compare the numbers across countries or over time. The country studies outline the types of subsidies, their sector focus, their rationale (whether for energy access and capacity installation or for manufacturing and exports), and their scale and timeline (where information is available). The **annexes** to this report offer more detailed tables for each country. It should be noted, however, that these are not comprehensive listings of all past and current subsidies. This section lists some major policies that show the range of subsidies that have been applied at different times across major economies with significant RE capacity. Furthermore, these tables may also include some examples of subsidies for cleaner transport fuels that fall outside the scope of this report.

3.2 Brazil

Financial transfers and regulatory support in the past decade have been responsible for increasing Brazil's RE capacity and diversifying its sources of electricity. The *Luz para Todos* Electrification Programme was announced in 2003 with the goal of extending electricity access to 12 million people (10 million in rural areas).[74] While not solely dependent on RE, the programme did rely on distributed energy systems and isolated networks using RE sources (including 130,000 PV systems and mini-grid-based biomass projects). Funding for the programme drew mostly (more than 70 percent) on the RGR (*Reserve Global de Reversão*) for loans and the CDE (*Conta de Deasenvolvimento Energético*) for subsidies; the remainder came from federal states, municipalities and power supply companies, in equal measure. National funds were also used to subsidise up to 90 percent of initial investment for regions with low electrification rates; consumers were spared the cost of network expansion.

Another major scheme was the Programme of Incentives for Alternative Electricity Sources (PROINFA), which began in 2002. In its first phase, its aim was to develop 3.3 **gigawatts** (GW) of RE (wind, biomass and small hydro-electricity) before 2007 with subsidies from the Energy Development Account.[75] Eletrobrás, the largest power utility, purchases electricity at preset preferential prices with a guarantee for a minimum 70 percent of the contracted energy for the long-term (20 years) power purchase agreements (PPAs) and full coverage to exposure risks to short-term markets. In addition, the Brazilian National Development Bank (BNDES) provides special financing (up to 70 percent of capital costs, low interest rates, amortisation for 10 years, etc.) for PROINFA projects. In its second phase, the programme introduced RECs to promote further investment and source 10 percent of electricity from renewable sources within 20 years.[76]

In addition to energy access, other objectives also underlie PROINFA. These include: job creation (150,000 jobs); attracting private sector investment in the RE sector (expected USD 2.6 billion); and support to domestic industry (with a minimum of 60 percent of construction costs drawn on national companies).[77]

3.3 China

In February 2005, the 10th National People's Congress enacted a law to promote RE supply and improve the country's energy infrastructure. Additional supporting laws were enacted for the development of the RE industry in the medium and long term. These included measures for managing special capital for RE development, administrative regulations and price and cost-sharing arrangements for RE power generation.

China's RE industry has picked up since 2007, when it developed a blueprint to develop the wind, solar and biofuel sectors. The Golden Sun programme, introduced in 2009, was designed to offer national and provincial level subsidies to grid and off- grid solar PV projects, aiming for 500 megawatts (MW) of PV installed capacity by 2012.[78] At the national level, grid-connected projects (with minimum peak capacity of 300 kW) and off-grid projects were eligible for subsidies to cover installation costs of 50 percent and 70 percent, respectively (a capacity limitation of 20 MW per province was imposed). Developers had to satisfy quality standards set by the grid company, which would be certified by other agencies. In June 2011, the 50 percent installation subsidy was replaced by a fixed tariff.[79] Eventually, 640 MW of projects were proposed, with a total investment of RMB 20 billion.[80]

The Wind Power Concession programme (2003-07) invited domestic and international companies to bid for large scale projects (100-200 MW).[81] Projects would be selected based on both the price/kWh as well as the share of domestic components used. The bid price was guaranteed as the FiT for the first 30,000 full load hours achieved; subsequently, the applicable return was the average local FiT on the power market at a given time. Concessions were offered mostly for 25 years (shorter periods in some cases). The programme added 3.35 GW via annual competitive bidding.[82]

One of the ostensible aims for China's strategy is to increase the share of RE capacity in its energy mix: from 8 percent currently to 15 percent by 2020 (this is equivalent to shifting an economy like Italy to renewables). As a result, in 2010 alone, USD 54.4 billion was invested in clean energy, putting China in the lead globally for investments.[83] The National Development and Reform Commission (NDRC) expects to award about 20 projects by 2012 to reach 20 GW of installed wind capacity in 2020. In biofuels, for instance, the Agricultural Biological Mass Energy Industrial Development Programme (2007-2015), operating under the Department of Agriculture, aims to produce 23.3 billion m^3 of marsh gas annually and build 8000 large- or medium-sized marsh gas projects.[84]

Feed-in tariffs have been used in both the wind and solar energy sectors with visible impact. China is now the world's biggest wind farm operator. It also seeks to increase solar power capacity tenfold in five years. It announcedin 2011 a FiT rate of RMB 1 (USD 0.16) per KWh of power fed into the grid.[85]

The other aim, as indicated previously, is to develop a domestic manufacturing base as the foundation for its RE investments. Concessions in the wind sector, for instance, have used LCRs effectively. Three projects (100-200 MW) in Jiangsu, Inner Mongolia and Jilin provinces had 70 percent LCRs. Two Chinese firms, Sinovel and Xinjiang Goldwind are now among the top three wind turbine makers in the world. Wind turbine costs have fallen by two-thirds since 2007. In solar, seven of the top ten PV module manufacturers are Chinese, compared with only two in 2007. Solar panel prices fell 40 percent in 2010-11, again benefiting consumers throughout the world.[86]

The danger is, of course, overcapacity, threatening not only Chinese firms, but also the support policies that have had significant impacts in a short period. Both solar and wind manufacturers complained of rising inventories with, in the latter case about 27 percent of turbines lying idle. If such trends continue, the government could either reduce subsidies for manufacturing or promote more installations at home rather than exports abroad.

In addition to FiTs, LCRs and capital subsidies, regulations have helped. In December 2009 the 2005 RE law was updated to emphasise better coordination between the RE sector and the electricity sector at local and national levels. Utilities were required to purchase all RE generated and could be penalised for failing to do so. In addition, the RE fund was strengthened, allowing the Ministry of Finance to supplement the fund from general revenues.[87]

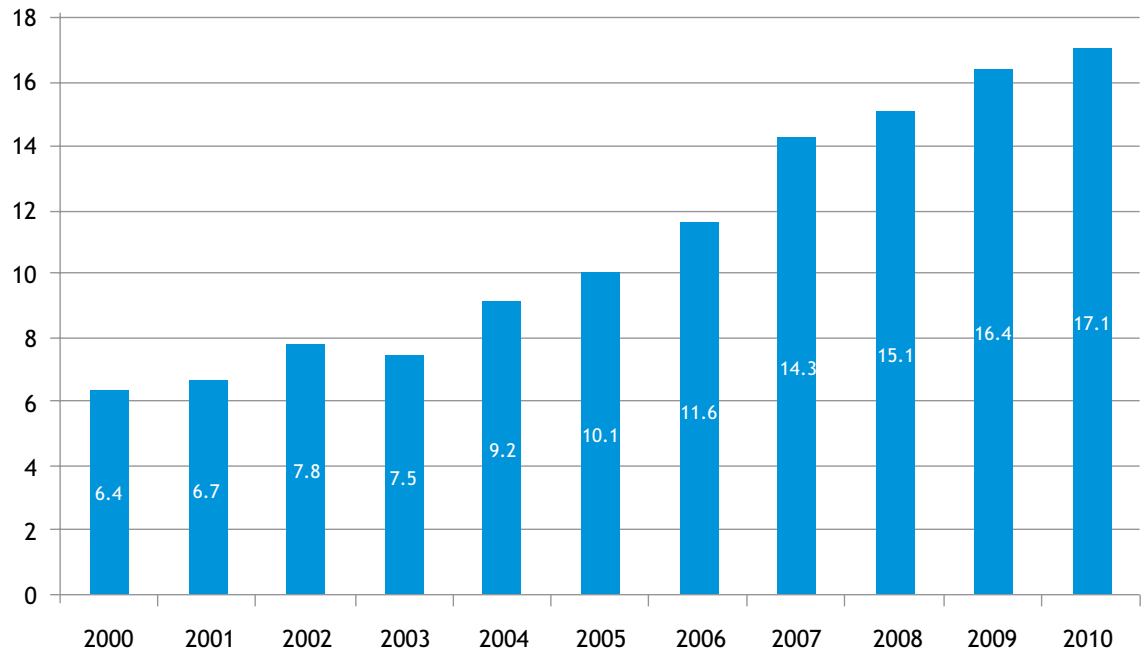
Building on the success of the RE sector in China, its 12th Five-Year Plan now aims for significant additions to generation as well as manufacturing capacity.[88] Solar installations are expected to grow tenfold in the next five years to reach the 10 GWp (gigawatt peak) target. The aim is to have 1-2 firms with

polysilicon production capacity of 50,000 tonnes and another 2-4 firms with 10,000 tonnes capacity as well as 1-2 firms with 5 GW cell production capacity and 8-10 firms with 1 GW of cell production capacity.[89] For the wind sector, a target of 90 GWp of installed capacity has been set, including 6 onshore and 2offshore large bases (with a 70 GW capacity addition).[90] There are also plans to support the growing RE capacity with smart grids and regional power transmission channels. The planned investment in grid capacity extension alone is USD 400 billion during the plan period.

3.4 Germany

The share of RE in total electricity consumption in Germany has risen consistently over the past decade (Figure 5). This was, in part, because Germany was the first to introduce FiTs to encourage RE investments under the Renewable Energy Sources Act (EEG) in 2000. The EEG's core principles were: priority access for RE to the grid, giving priority to transmission and distribution; equalisation of additional costs between all RE suppliers and grid operators; and financial support via the FiT but subject to ratcheting down the subsidy periodically (degression).[91] The EEG was revised for the period 2004-08 to increase targets for the share of RE in total electricity supply (12.5 percent by 2010 and 20 percent by 2020).[92] The EEG also obligated grid operators to purchase and transmit all electricity generated from renewable sources but split the costs; project developers would bear the cost of connecting to the grid while grid operators would pay to upgrade the infrastructure. The act also sought nationwide equalisation of electricity volumes and FiTs so as to avoid arbitrage in purchase contracts, and the details had to be made publicly available.

Figure 5: Renewable energy's share in Germany's electricity consumption has steadily risen (percentage)



Source:Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (2011) Development of renewable energy sources in Germany 2010, Berlin: BMU, 31 July, p.7. Available at http://www.erneuerbare-energien.de/files/english/pdf/application/pdf/ee_in_deutschland_graf_tab_en.pdf; accessed 26 March 2012.

Further revisions of the EEG came into effect in 2009, 2010 and again in 2012. The aim has been to offer attractive FiTs to encourage both onshore and offshore investments. RE is now expected to account for 35 percent of electricity generation by 2020, 50 percent by 2030, and 80 percent by 2050. Onshore wind FiTs are currently at EUR 8.93 cents/kWh (with tariff reduction at 1.5 percent per year). Offshore wind projects can expect EUR 15 cents/kWh until 2018 (previously it was only up to 2015). In the hydropower, solar, geothermal and biomass sectors, FiTs vary by size of project, reducing for larger sized projects (tariff structures have been simplified since 2009).[93]

The costs for the FiTs were passed on to consumers, a cumulative burden of EUR 85.4 billion during 2000-2010.[94] With economies of scale and technological improvements, the need to maintain high FiTs has also diminished. Thus, the grid regulator plans to reduce solar FiTs by 15 percent from early 2012.[95] Even then, for projects commissioned during 2004-08, the FiT burden would be an additional EUR 122.3 billion until 2030.

Generous FiT schemes made Germany, a country with one-third the average solar irradiation of India, a renewable energy powerhouse in terms of installed capacity. It added 7.4 GW of solar capacity in 2010 alone. In addition to solar heat and power, Germany is also among the top five in the world for installed wind and biomass power capacity.[96] The manufacturing industry, however, faces competition from cheaper Chinese supplies, even though the German Renewable Energy Federation maintains that its competitive advantage lies in the quality of its products.

In addition to the EEG, Germany introduced a Renewable Energies Heat Act (EEWärmeG) in 2009. The Act aims to increase the share of RE for heat production to 14 percent by 2020 and makes the use of RE for space and water heating mandatory for new buildings. The share of RE depends on the technologies deployed (solar thermal installations 15 percent; gaseous biomass 30 percent; other biomass installations, liquid biomass, geothermal heat 50 percent). Funding to support the transition in existing buildings increased from EUR 130 million in 2005 to EUR 350 million in 2008, further rising to EUR 500 million from 2009.[97]

3.5 India

India has a long history of promoting RE. It was one of the first countries to establish a dedicated Ministry of Non-Conventional Energy Sources, now renamed the Ministry of New and Renewable Energy (MNRE). The Indian Renewable Energy Development Agency (IREDA) was incorporated in 1987. However, the trajectory shifted from 2003, when the Electricity Act liberalised the power market and called on each state's Electricity Regulatory Commission (SERC) to institutionalise minimum purchase of RE electricity or RPOs; non-compliance would invite penalties. Furthermore, "open access" provisions allowed RE power generators to access distribution systems and transmission lines for a nominal fee.[98]

The objectives of the Electricity Act were further strengthened in 2006 with a national tariff policy, under which SERCs had to specify RPOs with distribution companies and set time limits for implementation. The policy also introduced preferential tariffs and competitive bidding to select projects. By April 2010, 18 states had established or drafted RPOs for 1-15 percent of total electricity generation.[99]

In December 2009, the government introduced generation-based incentives (GBIs) for wind power projects with a minimum capacity of 5 MW. The GBI (USD 0.01/kWh against the average wind power price of USD 0.06/kWh) was an additional incentive to the SERCs' preferential tariffs. The overall programme budget was INR 3.8 billion (USD 81.6 million).[100]

Feed-in tariffs have also been used for small hydro and biomass projects. A small hydro scheme for 2009-10 offered capital subsidies for new plants with capacity ranging from 100 kW to 25 MW. For 100-1000 kW projects, the subsidy was USD 500/kW, but it was double that amount for "special category" and northeast states. For 1-25 MW plants, capital subsidies amount to USD 1 million for the first MW and an additional USD 100,000 for each extra MW for the targeted states.[101]

Perhaps the most exciting developments have been in the solar sector. Since it was launched in 2010, the Jawaharlal Nehru National Solar Mission (JNNSM) has been a key part of the National Action Plan on Climate Change. The JNNSM offers attractive FiTs after projects have been selected by a reverse auctioning process. The overall objective is to install 22 GW of solar power (grid and off-grid) using both PV and concentrated solar power (CSP) technologies by 2022. In the first phase (2010-12), targeting 1000 MW, the Central Electricity Regulatory Commission (CERC) announced 25 year-long PPAs with FiTs of USD 0.36/kWh for PV projects and USD 0.31/kWh for CSP ones. The rates are expected to be revised downward for each batch of auctioning (the lowest bids had already dropped to about USD 0.15/kWh by end-2011).[102] For the mission's first phase, LCR rules are applied to solar PV modules and cells, although solar thermal projects are spared (and these provisions are not present in state-level solar missions in India). Annual module production is expected to exceed 2500 MW by 2015 while JNNSM targets 4000-5000 MW of capacity by 2022 (or one-fourth of the expected installed capacity by that date).[103]

Notwithstanding the partial requirements for local manufacturing, India's policies are primarily aimed at increasing generation capacity. India has targeted that by 2012, 10 percent of all new capacity in the power sector would be in renewables. With energy access for millions of potential consumers currently not connected to any modern source of electricity a key political imperative, it is unlikely that LCR requirements will be a reason to hold back on rapid deployment of RE capacity.

3.6 Spain

Spain has been promoting RE in several sectors and with a succession of laws since the mid-1990s. More recently, the Sustainable Economy Law set the goal of meeting the European target of a 20 percent share for RE in total energy consumption. The Act's role is to stimulate R&D and innovative projects and offers tax deductions as incentives.[104]

Another law (RD 2818/1998), passed in December 1998, was significant because it allowed RE producers to feed all power generated into the grid and receive a premium over the wholesale price. The premiums were updated annually. In March 2004, a new law (436/2004) made the system more predictable by publishing prices and premiums in advance as a fixed percentage of the average electricity price (the premium for RE over the average electricity tariff was 40 percent, but for solar it was 250 percent).[105]

Regional governments have also had a role. The government of Navarre introduced an Energy Plan in 1995 to support energy efficiency and investments in RE capacity. From 2002, these measures were supported by a dedicated training centre and funding support lines for biomass, solar PV and thermal and wind.[106] In addition to promoting RE and diversifying sources of energy, job creation was key objective of the programme.[107] The Programme for the Promotion of Solar Thermal Energy Installations (PROSOL) of the Andalusia government offered direct grants and subsidised loans to install projects. In 2007, the grant component was 40 percent of the cost of solar panels. This was reduced to 30 percent in 2009, but wind energy was included among beneficiary sectors.[108]

Numerous laws have also helped to increase the use of RE in buildings. At the federal level, these have included upgrading building codes and certifications for the energy performance of buildings. The government is also providing EUR 1 billion (USD 1.28 billion) for refurbishing buildings during 2008-12. Regional governments in Catalonia, Extremadura, Madrid, Murcia, Navarre and Valencia have promoted the use of solar PV, solar thermal and biomass in buildings.[109]

The biofuels sector has received support in the form of regulations for the mandatory commercialisation of biofuels. The National Energy Commission (*Comisión Nacional de la Energía*) was tasked with issuing biofuel certificates, managing the certification process

and monitoring compliance (ITC/2877/2008). Minimum targets for biofuel use were set at 2.5 percent for biodiesel and bioethanol by 2009 and 3.9 percent by 2010. By 2009, production capacity of biofuels had reached 4 mtoe (million tonnes of oil equivalent).[110] The government has also supported the sector by providing subsidies to biodiesel and bioethanol R&D projects, often involving several Spanish companies. For biomass, recognising that imported products were sharply driving down prices and adversely impacting domestic industry, the government launched a strategy to develop forest residue biomass and linked it to the development of rural areas.[111]

For energy efficiency, Spain developed an action plan for 2008-12 that would devote EUR 2.4 billion of public investment.[112] The expectation was to stimulate private investments of EUR 22.2 billion that would focus on efficiencies in the transport, buildings and industrial sectors.

Finally, the Renewable Energy Plan (REP), which ran from August 2005 to December 2010 (building on an earlier programme in place since 2000) set the target of RE at 30 percent of electricity consumption and 12 percent of primary energy consumption by 2010. The rationale for the policy was to reduce dependence on oil imports, meet international commitments under the Kyoto Protocol and to phase out nuclear power. Thus, wind power targets were raised from 13 GW to 20.15 GW by 2010. For solar, the target was 1200 MW by 2010 (up from 400 MW by 2007). In order to meet these goals, EUR23.6 billion was budgeted (mostly from private sources), but EUR 4.956 billion was set aside for FiTs.[113] Solar thermal projects were awarded investment subsidies to cover 37 percent (in some cases 50 percent) of total project cost.[114]

A special regime for FiTs was introduced in 2007 (Royal Decree 667/2007) to cover RE facilities up to 100 MW in capacity. Up to 50 MW, project operators could either choose a FiT or a feed-in premium over the market price. FiTs were guaranteed for 25 years for PV, tidal and small hydro projects, for 20 years for wind and geothermal and for 15 years for biomass projects. For projects between 50 MW and 100 MW, a bonus was promised for the electricity generated. The exception was solar PV, which was not subject to the cap on project size to avail the FiT benefits. In 2009 the cap was raised to 500 MW for PV projects, although the FiT was reduced to EUR 0.32/kWh for ground-mounted projects and EUR 0.34/kWh for rooftop systems (earlier the tariff level could go up to EUR 0.44/kWh).[115]

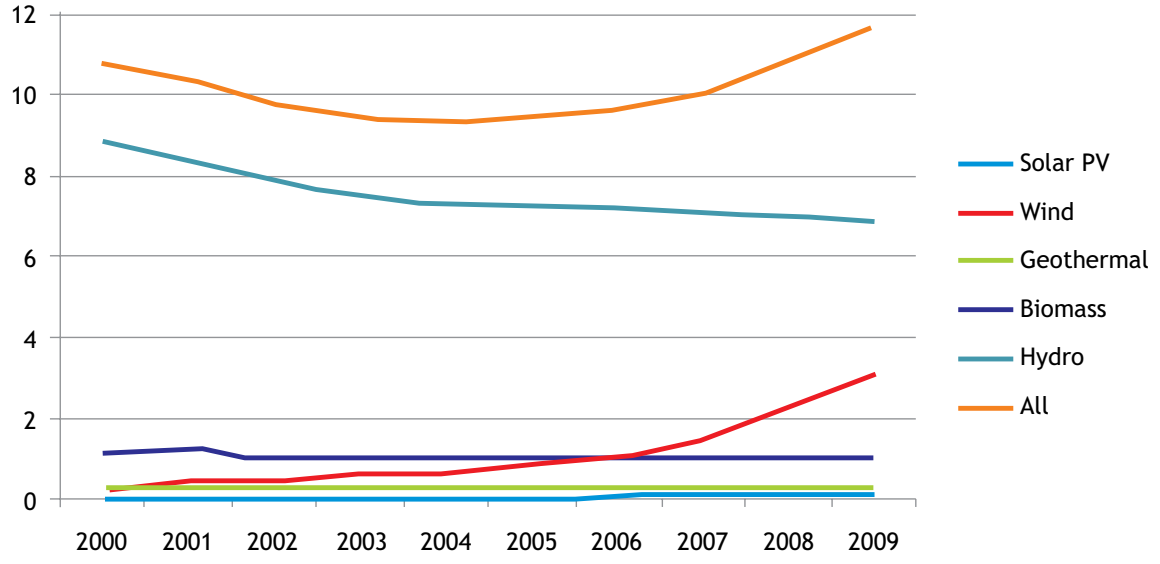
Unlike Germany, however, Spain's policies to support RE projects are more threatened in the long term. When it launched its FiT scheme, the aim was to install 400 MW of RE capacity by 2010. By September 2008, Spain had already installed 344 MW with an expected FiT cost burden of EUR 53 billion over 25 years (75 percent more than the cost of conventional power).[116] The economic crisis, rising public debt and competition from cheaper imports have made Spain's support policies unviable. Thus, in December 2010, FiTs for solar PV were cut retroactively, partly to discourage speculative investors who had little experience in RE, but it also resulted in a "crisis of confidence" for existing industry players.[117] (FiTs for wind projects were competitive with fossil fuels by 2010.) The unsustainability of generous support measures over the long term constitutes the policy risk described in the previous section. RE projects need longer recovery periods, owing to the high upfront cost of capital, so the policies and cost burdens have to be calibrated from the early stages as well.

Moreover, the purpose of the subsidy also matters. In 2010 the government estimated that with all the efficiency measures and policies to promote RE capacity at home, Spain would have surplus energy to sell into the wider European market. To that extent, Spain's policies were also geared toward promoting RE exports. However, with the persisting economic crisis in Europe, there is no guarantee that domestic RE capacity would find the markets to justify the subsidies that local producers received. In fact, even for 2020, with a planned 40 percent RE share in electricity generation, Spain's policies are contingent on grid connections to Central European markets.[118]

3.7 United States

The US has been promoting RE for more than two decades. If hydropower is included, the Department of Energy (DOE) estimates that RE's share in total electricity capacity is about 12 percent (Figure 6), although the share of RE in total energy production is lower (8.7 percent in 2000; 10.6 percent in 2010).

Figure 6: Renewable energy's share in total electricity capacity in the United States (percentage)



Source: Gelman, Rachel (2010) 2009Renewable Energy Data Book, Energy Efficiency & Renewable Energy, U.S. Department of Energy, August, p.24. Available at http://www1.eere.energy.gov/maps_data/pdfs/eere_databook.pdf; accessed 26 March 2012.

The Federal Energy Policy Act 1992 established the Renewable Energy Production Incentive (REPI) to offer support for RE projects using solar, wind, geothermal, biomass, landfill gas, livestock methane and ocean resources. A FiT rate of USD 0.02/KWh applied for the first ten years of a project's operation. REPI was reauthorised in 2006, subject to the availability of annual appropriations.[119]

More recently, DOE's SunShot Initiative has focused on leveraging the potential of solar power in the US (the highest in the industrialised world) to reduce the costs of utility scale solar installations by 75 percent (approximately, USD 0.06/kWh) to make them cost competitive with other sources of energy. In this way, solar power could account for 15-18 percent of U.S. electricity generation by 2030. The objective is also to "re-establish American technological leadership, strengthen US economic competitiveness in the global clean energy race, and lead to America's secure energy future".[120] Thus, the initiative has a strong manufacturing component, with emphasis on R&D to reduce PV module costs and increasing PV manufacturing at home. The DOE has invested USD 60 million since 2007 for a PV incubator programme to attract over USD 1.3 billion of private investment. Smaller grants support non-hardware concepts, while larger grants (up to USD 5 million) with 50 percent cost shares over 18 months are used to demonstrate and deploy technologies at scale.[121]

Specific policies for large-scale wind projects are also available. A Production Tax Credit (PTC) was introduced in 1992. Currently, a tax credit of USD 0.021/kWh is available for electricity generated from utility scale wind turbines under the PTC. In order to stimulate investment during the recession, the American Recovery and Reinvestment Act (ARRA) of 2009 extended the PTC, giving projects coming online during 2009-12 the choice between an investment tax credit of 30 percent or a 30 percent grant.[122]

Some programmes have had an explicit jobs creation focus, even if the results are mostly in the form of political payouts. The Volumetric Ethanol Excise Tax Credit (VEETC) was set up by the American Jobs Creation Act, 2004. Running until December 2011, the policy gave eligible blenders or retailers USD 0.45/ gallon tax credit on pure ethanol blended with gasoline.[123] In 2006, the policy alone accounted for 54.6 percent (USD 2.6 billion) of the federal ethanol subsidy and 41.6 percent of total RE subsidies.[124] Ethanol production has also received large subsidies from the Department of Agriculture, accounting for up to 20 percent of the corn harvest in 2006.[125] In August 2011, a new USD 510 million initiative was launched to promote next-generation biofuels.[126] And a rule proposed by the U.S. Department of Agriculture (but not yet implemented) suggests that production subsidies might be available only to biorefineries with at least 51 percent U.S. ownership. If implemented, this would be a discriminatory measure and potentially disputed by trade partners like Brazil, Canada, China, Germany and India.[127]

State-specific programmes have been equally important in the US. Connecticut combined a zero emissions REC scheme with a reverse auction to select companies that needed the least subsidy. This was combined with 15 year-long contracts to guarantee policy certainty.[128]

The California Solar Initiative (CSI), launched in 2009, provides financial incentives with a total budget of USD 3.2 billion over 10 years, of which USD 216 million is devoted to increasing solar PV access for low-income households.[129] Another CSI programme for solar water heating has a budget of USD 350 million to offer rebates to replace natural gas and electric heaters.[130] The California Energy Commission's New Solar Homes Partnership works with builders to encourage uptake of solar installations in new construction. With a budget of USD 400 million over 10 years, it hopes to install 400 MW of solar technologies. Subsidies for standard housing (USD 2.25/W) are raised in the case of affordable housing projects (USD 3.15/W).[131] Californian utilities also use FiTs over multi-year contracts (10, 15 or 20 years). Until 2016, property taxes are also exempted up to 75-100 percent of the value of solar energy systems.[132]

Colorado has used both concessional loans and tax exemptions to promote RE projects. In 2006 Boulder offered a tax rebate of about 15 percent on the sale and use of solar installations (amounting to 1 percent of the average system cost or USD 50,000 for 500 kW PV installations).[133] The state also used USD 13 million of ARRA funds in 2009 to offer loans for RE and energy efficiency projects.[134]

In Texas, the LoanSTAR revolving loan programme was initiated by the state's Energy Office in 1988. Approved by the DOE, by 2007 USD 240 million had been given as low-interest loans. Much of the focus has been on energy saving, emissions reduction and building retrofits.[135] Loan maturity periods were also increased from four to eight years in the mid-1990s and then again to ten years in 2002.F

The development of wind energy in Texas showcases how a combination of support measures for more than a decade have made the state host the largest wind power capacity in the US. Texas has a potential wind power potential of 524,800 MW (or 493 percent of current electricity consumption).[136] By end-2010, 10085 MW of wind capacity had been already installed. The key trigger for this development was the 1999 Texas Renewable Portfolio Standard (RPS). The mandated use of RE was raised periodically resulting in USD 1 billion of investments in wind power; the ten-year goal for the policy was met within six years.[137] The RPS was complemented by a federally supported production tax credit, offering 1.5 cents/kWh of electricity generated, adjusted for inflation.[138] The Texas Tax Code also offers 100 percent property tax exemptions on the value of on-site solar, wind or biomass power-generating devices.[139]

But, subsidy programmes have also resulted in perverse outcomes thanks to overcapacity and the viability of grid connections. In Texas, an investment of USD 3 billion in grid capacity to connect wind projects in dispersed locations to urban consumers was found to be viable only if coal power projects were also included in some of the transmission line corridors.[140]

Chapter 4

What Role for Trade Rules in Governing Clean Energy Subsidies?

In light of the country examples discussed above, this section will examine how the WTO's rules on subsidies and exemptions apply to disputes on clean energy subsidies. It will examine how vulnerable some of the policies and measures might be to legal disputes at the WTO. It will, then, revisit the typology of subsidies set out in section 3 to present an alternative framework that could reconcile the tensions between ensuring that domestic policies are not discriminatory against trade partners and the different motivations for supporting clean energy.

4.1 Subsidies at the WTO

According to the SCM Agreement, a "financial contribution" from the government is considered a subsidy if it confers a "benefit" on the recipient (Article 1). Financial contributions include: direct transfer of funds; when the government foregoes revenue; when it provides goods or services or if the government delegates a programme to a private body that it would normally have followed. A benefit is conferred only if the government's contribution is more favourable than what would be available to the RE project developer or manufacturer in the open market.

This broad treatment of subsidies would cover many of the measures noted in the typology developed in this report, namely direct financial transfers; preferential tax treatment; regulations (in the form of government procurement policies or the establishment of special economic zones); infrastructure support (such as subsidising access to the grid or offering land at below-market prices) and some forms of trade restrictive policies, such as LCRs (since these are prohibited; see below). But, for the SCM Agreement to apply, the measure must also confer a benefit. So, if the subsidies simply cover some of the costs of acquiring RE systems or setting up plants in remote locations, they might not necessarily be treated as a benefit.[141] In these situations, it could be argued that government support is only a compensation to encourage actions, either through climate mitigation or energy access measures, that may not have occurred otherwise. Further, it might be preferable to measure net subsidy (the difference between the gross cost to the government funds allocated for the subsidy and the revenue resulting from the measure) to get a more accurate assessment of the conferment of benefit. But the SCM Agreement does not specify this.

The SCM Agreement further classifies subsidies as either prohibited (Article 3) or actionable (Article 5).

4.2 Prohibited Subsidies

Article 3 of the SCM Agreement prohibits export subsidies and measures favouring domestic over imported goods, i.e. local content requirements. These subsidies are assumed to be damaging to other countries and, therefore, must be "withdrawn without delay" (Article 4.8).

One dispute that has emerged recently is over LCR provisions in Ontario's Green Energy and Green Economy Act, 2009. The Act requires that 60 percent of materials in RE projects be locally sourced. Japan initiated consultations at the WTO's Dispute Settlement Mechanism (DSM) in 2010, and the EU followed in August 2011.[142] The EU has claimed that, as a "significant" exporter of wind power and solar PV equipment (EUR 300-600 million during 2007-09), it was harmed by Ontario's LCR. In response, the Ontario Energy Minister defended the provisions on the grounds that they were necessary to create jobs:[143] "[W]e will [stand up] against anybody outside of Ontario that wants to threaten our efforts to create jobs". In other words, LCR provisions remain contentious as they have as much to do with generating employment as with RE capacity installation.

4.3 Actionable Subsidies

Actionable subsidies, although not prohibited, may be challenged either through the DSM or through countervailing action, if they cause "adverse effects to the interests of another Member".[144] Actionable subsidies may be contested if they are "specific", that is directed toward a particular industry (Article 2). If a specific subsidy causes adverse effects for foreign firms, it is actionable under the WTO (Article 5). Even if the subsidy is actionable, the complaining party has to prove the harm caused (the subsidy is not automatically considered illegal). Unlike prohibited subsidies, therefore, the violating country has to only remove the adverse effects of the measure rather than the measure itself (Article 7.8).[145]

4.4 Adverse Effect

Assessing adverse effects means, first, determining that the financial contribution confers a benefit, and second, that there is a connection between a particular policy and subsequent commercial losses. As noted earlier, if the subsidy recipient enjoys contributions more favourable than were otherwise available, then the measure is considered a benefit.[146] Establishing whether harm was caused will, of course, vary case by case.

The US solar manufacturing industry was jolted in August 2011 when three firms – Solyndra, Evergreen Solar and Spectra Watt – filed for bankruptcy. The industry, having faced stiff competition from Chinese suppliers, claims that subsidies unfairly promote Chinese firms while eroding market share for other firms. (China produces 60 percent of all solar panels but exports 95 percent of its production. The US solar market alone is worth USD 6 billion annually, and China had exported USD 1.6 billion of panels to the country during January-August 2011.) Rising competition, on one hand, and lack of clarity on subsidy impacts, on the other, can result in distorted arguments. US Senator Wyden from Oregon argued that if the demand for solar products was rising but American production was continuing to fall, China must be violating trade rules, a claim that does not necessarily follow but has political traction.

Consequently, in October 2011, seven US-based solar panel manufacturers (led by German subsidiary, SolarWorld) filed a case with the US Commerce Department to protest Chinese solar subsidies and demand countervailing tariffs of more than 100 percent of the price of Chinese panels.[147] By December, the US International Trade Commission had unanimously decided that there was evidence that US firms had indeed been injured by subsidised Chinese imports, raising the trade dispute to a higher level that could lead to countervailing and anti-dumping duties.[148]

But in March 2012, the US Department of Commerce's preliminary findings suggested imposition of low tariffs as Countervailing Duties (CVD): 4.73 percent on imports from Trina Solar, 2.9 percent from Suntech, and 3.59 percent from all other remaining Chinese manufacturers. On 17 May, the Commerce Department also imposed higher anti-dumping (AD) duties: 31.14 percent on panels from Suntech, 31.22 on panels by Trina Solar, 31.18 percent on all other companies that requested individual duty determinations, and nearly 250 percent to all other Chinese manufacturers, including state-controlled companies. These duties were applied 90 days retroactively.

In retaliation, China announced its own investigation into US subsidies for the solar, wind and hydroelectric industries.[149] The China Chamber of Commerce for Import and Export of Machinery and Electronic Products, the Chinese Renewable Energy Industries Association and its National Development and Reform Commission have contested that Chinese firms benefit from economies of scale while US subsidies to its own firms are much larger, often in the hundreds of millions of dollars.[150]

Also in October 2011, the US notified to the WTO SCM Committee nearly 200 Chinese subsidy programmes, alleging that they violated trade rules. At a minimum, the Americans claimed that no updates of Chinese subsidies had been provided since 2001 while notifications were due every two years.[151]

The mutual dependence of the two countries in solar industry trade could either escalate or

mitigate an outright trade war. The US exports more than USD 800 million of polysilicon, a key ingredient in solar panels, to China annually. Some Chinese firms have already demanded anti-dumping measures against polysilicon imports from the US. But, within the US, firms dependent on Chinese components have formed a Coalition for Affordable Solar Energy (CASE) to oppose trade disputes with China.[152]

It should also be noted that subsidies for production are not prohibited outright, unless they have adverse effects on foreign firms in the domestic or other markets. US federal solar subsidies amounted to USD 1,134 billion in 2010, when it was only USD 179 million in 2009. But, the US claims that, since much of this production is for domestic use not exports (unlike China), the production subsidies should not violate WTO rules.[153] In the case of bioethanol exports, however, in October 2011 the European Commission initiated anti-dumping and countervailing duty investigations against US exports. This was due to a complaint from the European Producers Union of Renewable Ethanol Association (ePURE) that federal production subsidies to US firms had allowed them to export to the EU market, which and had an adverse impact on the European industry.[154]

However, not all subsidy-related concerns have resulted in legal disputes.[155] In October 2009, at the 20th meeting of the US-China Joint Commission on Commerce and Trade, China agreed to remove a provision for 70 percent LCR for wind projects (Brazil, India and Germany had also been affected by this measure). In June 2011, China terminated its policy of giving USD 6.7-22.5 million to wind turbine makers who substituted Chinese components for foreign ones. Some measures, of course, take a long time to be corrected. China had imposed anti-dumping duties on Korean polyester films (the main component in solar panels) in August 2000, a policy that was stopped only in December 2010.

4.5 Seeking Exceptions

Although the SCM Agreement restricts certain subsidies, GATT 1994 allows for certain exceptions to the rules under Article XX, which is particularly important in the case of measures related to the environment. It allows restrictions on trade to "protect human, animal or plant life or health" (Article XX(b)) and for the "conservation of exhaustible natural resources" (Article XX(g)), as long as the measures are applied in a non-discriminatory manner. It must be noted, however, that Article XX exceptions apply only to GATT 1994 and not to other WTO agreements, such as on SCM, intellectual property (TRIPS) or investment measures (TRIMS). There is no clear ruling on whether Article XX may be invoked to justify FiTs and other forms of government support directed to clean energy.[156] With a growing number of disputes surrounding subsidies as well as disputes related to process and production methods, some have called for widely applying Article XX exceptions, although there is no certainty how these justifications would be treated by WTO dispute settlement panels.[157]

But, even if Article XX exceptions were applied to clean energy access and generation, it is unlikely to justify exceptions for the primary purpose of equipment manufacture. Some might argue for supporting domestic equipment manufacturing on the grounds that in the long run it could result in lower costs and thus help the environment. But this depends on whether the subsidy is successful for which there is no guarantee. It is difficult to envisage that a WTO panel would admit such an argument for manufacturing subsidies (as they will need to be linked to the objectives of Article XX) and any country could claim such an exception to afford incentives to its domestic manufacturing sector.

In the case of subsidies aimed at increasing clean energy access, these measures could cause adverse effects for goods and services based on their *design* (and also perhaps for cross-border electricity exports) but even so it may be easier to provide an environmental justification here rather than for manufacturing subsidies. Once again, the motivation of the subsidy programme matters.

Article 8 of the SCM Agreement had included a specified list of subsidies, such as for R&D and for environmental protection, that would be non-actionable. But, this provision lapsed in 2008, and a new list of non-actionable

subsidies has not been agreed to this date. Nevertheless, the precedent suggests that it is indeed possible to add more specificity within the WTO SCM Agreement to give more clarity on the use of subsidies to promote clean energy.[158]

Existing energy markets have distribution and retail networks that favour fossil fuels.[159] Thus, as argued previously, clean energy subsidies for addressing climate change are interventions in markets that are otherwise distorted by subsidies to fossil fuels. If developing countries use clean energy support measures to bolster efforts at climate mitigation or increase energy access, the threat of trade sanctions for the use of such subsidies is inimical to climate goals.[160] This is one reason developing countries have opposed linking trade and climate issues.

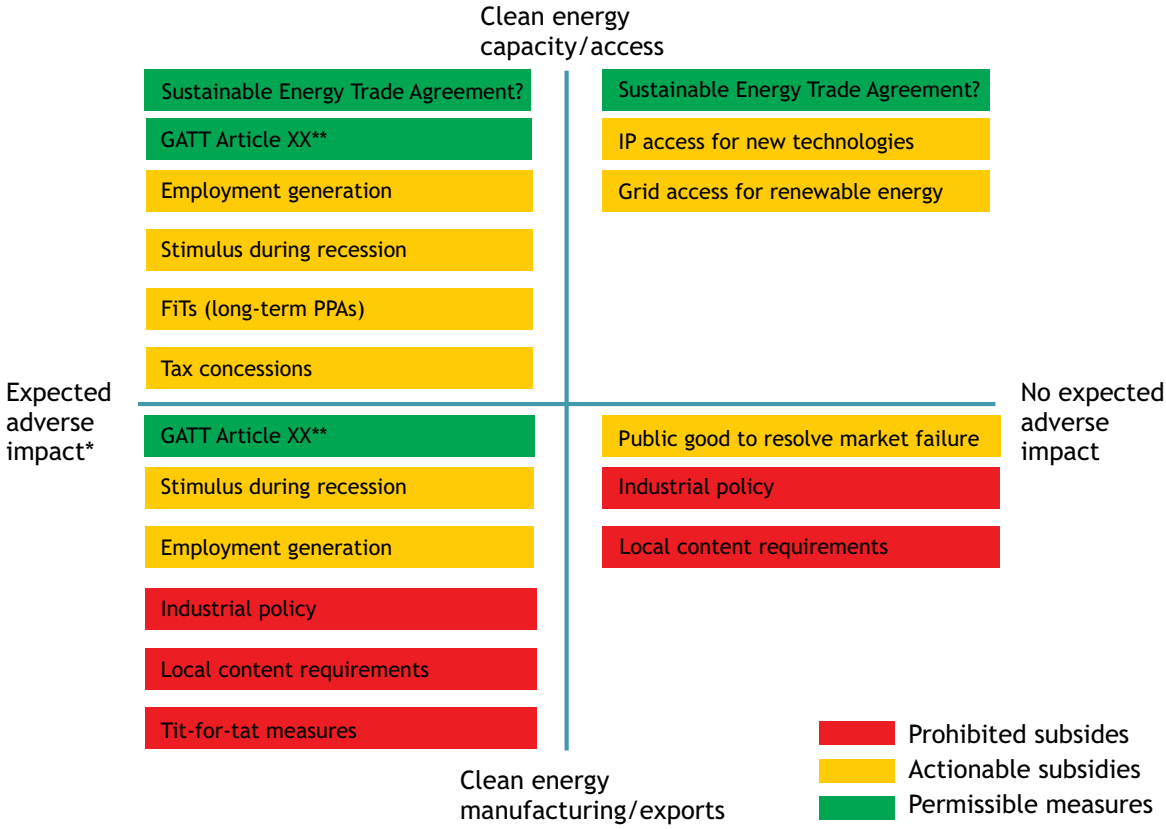
Another critical issue is the scale of the subsidy and whether it is used as a transitional measure. In India, low-carbon technology is targeted primarily for the purposes of addressing energy scarcity and providing access to unconnected households. In fact, rather than emphasise local manufacturing, India has focused on building solar capacity, which is why, in January 2011, it reduced import tariffs for components used to install solar projects to 5 percent. By contrast, China's low-carbon technology is driven by "a desire to become world leader in clean energy".[161] Thus, if subsidies are used to boost domestic manufacturing capacity, it is important to assess whether it is primarily for creating jobs and promoting exports, or whether it is to boost energy access and a transition to a low-carbon pathway. But, as argued above, existing provisions in the SCM Agreement do not explicitly allow for exceptions on environmental grounds. If such exceptions were to be introduced in a new agreement (see the case for a SETA below), it is unlikely that a largely jobs-creation imperative will suffice for permitting subsidy measures, even if the jobs were in clean energy sectors. Such clarifications on the justification and end use of subsidy measures are currently missing in existing legal provisions.

While debates continue at the multilateral level, regional agreements have also established some links between energy, trade and the environment. Ontario's FiT programme is already under threat of challenge under the North American Free Trade Agreement (NAFTA). Texas-based Mesa Power Group claimed that the policy violated NAFTA's government procurement provisions, which were stiffer than those of the WTO.[162] But, NAFTA also allows states to take measures to ensure that investments are "sensitive to environmental concerns" (Article 1114(1)). Both the Energy Charter Treaty and the ECOWAS Energy Protocol, while recognising state sovereignty over energy resources, expect parties to minimise harmful environmental impacts of energy related activities (Articles 18(1) and 19(1)). In addition, in 1994 the ECT introduced an associated Protocol on Energy Efficiency and Related Environmental Aspects (PEEREA), which lets a country hosting foreign investors and traders apply environmental conditions on grounds of "necessity". It can do so to protect its environment even if there is uncertainty about the future (say, with regard to the impacts of climate change).[163] These provisions could serve as a basis to subsidise domestic firms under regional agreements (but not under the WTO) in order to promote clean energy (and protect the environment from foreign entities with lower environmental standards). But, disputes will have to be adjudicated both on the basis of adverse trade impacts and the purpose of the measure. One could even argue that promoting costlier local manufacture could slow down the process of meeting environmental goals at a lower cost and sooner. But, there could also be a case that a low-cost and reliable domestic manufacturing base might be needed if a large clean energy infrastructure base has to be sustainable and well maintained over the long term.[164]

4.6 A New Framework for Trade Rules on Clean Energy Subsidies

The country cases, emerging disputes and lack of clarity with respect to exceptions to WTO rules underscore the tension between maintaining non-discriminatory trade practices (a primary objective of the trade regime) while also promoting greater and faster adoption of clean energy (a key strategy in response to climate change as well as deficits in energy access).

Figure 7: Clean energy subsidies have multiple rationales, impacts, and counteractive reactions



* As per WTO rules, adverse impacts could result from: injury; serious prejudice; or nullification or benefits
** Exceptions under Article XX of GATT 1994 are not applicable WTO SCM Agreement

Source: Author

Figure 7 captures the tension between maintaining non-discriminatory trade practices on the one hand, while promoting greater and faster adoption of clean energy, on the other hand. Along the horizontal axis is essentially the concern of the trade regime (in particular the WTO SCM Agreement, but GATT 1994 and other free trade agreements would also be applicable). Firms in the clean energy sector are worried about subsidies offered in other countries that are expected or not expected to have an adverse impact on their commercial interests. The vertical axis depicts the spectrum of rationales driving government support to clean energy. As discussed before, these include providing energy access, building clean energy generation capacity, creating a domestic manufacturing base or promoting exports of clean energy products and services.

Subsidies marked in red are clearly prohibited under WTO rules. Measures with the explicit purpose of promoting exports or sourcing local content are not permitted. They are already assumed to have adverse impacts on foreign trade interests. But, other subsidies – such as for providing a stimulus during recession, creating jobs or resolving market failure – may be actionable only if they are proved to have an adverse impact. Note that the subsidies listed in the four quadrants are neither an exhaustive list nor exclusive to specific quadrants in every case. Figure 7 is a schematic representation of how different types of subsidies for clean energy could have different rationales, impacts, and counteractive reactions from other countries.

In the bottom left quadrant, most of the measures that have clear mercantilist

purposes would be prohibited. In addition, measures found to have adverse impacts could invite challenges. In these cases, exceptions under GATT Article XX may be also invoked, although it is debatable whether its provisions can be applied for clean energy subsidies. Thus, in the top left quadrant, although energy access or capacity installation might be the motive (thereby invoking possible exceptions), the expectation of adverse impact would be problematic. This could happen if FiTs and tax breaks were found to be discriminatory or if stimulus during a recession (say in the form of producer subsidies) resulted in greater exports at the cost of other firms.

The bottom right quadrant is particularly interesting because, while promoting manufacturing or exports might seem mercantilist, not all measures need have an adverse impact. In fact, if the financial contribution is not greater than market value or if it only is a means to correct market failure, the measure is not automatically prohibited. Some might even argue that a domestic manufacturing base is a precursor to establishing robust capacity for generating clean energy. Of course, if industrial policy relies only on LCRs and export subsidies, it will be prohibited irrespective of the motive.

Finally, the top right quadrant suggests that motives for clean energy subsidies matter. If subsidies were used, for instance, for extending grid connections to RE sources (whether project developers were domestic or foreign), ideally they should not be challenged. Again, if subsidies were offered to acquire intellectual property for emerging clean energy technologies, no adverse impact is caused even as a country is able to expand its clean energy generation capacity. Currently, however, such exceptions are not explicitly permitted under WTO rules and until these issues are resolved, such policies might continue to attract trade disputes. Similarly, as discussed above, certain clean energy support measures might have adverse impacts even if their motive is to expand energy access (top left quadrant). With the current uncertainty over whether such policies could be contested, the incentives to invest in these sectors could be reduced.

Thus, there might be a case for clarifying rules under future trade-related initiatives for sustainable energy, including possibly a separate SETA, which could set out key principles for what would be permissible subsidies. If the measures are for non-mercantilist purposes, like increasing clean energy generation capacity or offering energy access, then a SETA could potentially carve out the policy space for countries to pursue such goals.

Conclusions and Policy Recommendations

Clean energy subsidies are complex instruments that reflect the multiple motivations of governments, industry and non-governmental actors. By emphasising the importance of motives, this report has extended the debate about subsidies beyond the realm of a legal interpretation of WTO law. Instead, it has provided a framework to understand who the supporters and opponents would be, depending on which rationales are used to offer the subsidies. This report has also developed a typology of subsidies, covering financial transfers, taxes, regulations, infrastructure and trade rules, that is broader than the definitions usually applied. This typology is further refined by categorising subsidies by their end use, whether to extend energy access, install capacity, develop manufacturing or promote exports. This study also describes major policies in some of the leading RE powers in the world. Since some of the policies have been in place for more than two decades, this approach improves our understanding of clean energy subsidies even though there are difficulties in cross-country comparisons. Finally, the report identifies gaps in existing trade law to argue that merely legal analyses would not be sufficient to deliver policy clarity and attract greater investments in this crucial sector. In short, if the two imperatives of expanding clean energy access and responding to the threat of climate change are to be taken seriously, trade law would have to respond to the challenges outlined in this report. If clean energy investments are encumbered by WTO law, due to restrictions on subsidy measures, other legal provisions would have to be developed.

What Can Be Done? Five Proposals for Policy and Legal Clarity

At least five aspects of the governance of clean energy subsidies need attention at the national and international levels. First, international institutions with rules governing trade, energy flows and climate change need greater coordination.[165] For the trade regime, subsidies are subsidies, whether for fossil fuel or for clean energy. From the climate perspective, there is a clear case for investing in clean energy sources, especially since fossil fuels developed on the back of government support as well. From the perspective of energy access and energy security, once again there is need to diversify sources while delivering energy to hundreds of millions of poor people who are not being served by the market. Correcting for these market failures does not mean that new subsidy programmes should be developed without considering trade discrimination, distortion and rent seeking. This is why coordination across regimes is warranted.

One way to accomplish such coordination is through various Sustainable Energy Trade Initiatives that can be pursued both multilaterally as well as in regional or bilateral settings, including through a new international agreement – a SETA – which would draw on rules from multilateral and regional trade, energy, environmental and climate-specific institutions. Proposals for a SETA have already emerged in recent months, with pros and cons for different architectures (plurilateral, within or outside the WTO, open membership and accession rules, etc.[166] Whatever the pathway for a SETA, the first step in the process must be to undertake legal and economic analyses to clarify existing rules for how clean energy subsidies might be treated. The interesting aspect of subsidies is that any reform a country might undertake autonomously or as part of any trade initiatives or agreement (even a restricted one) would usually affect all its trade and investment partners, whether or not they are party to the agreement or initiative. This is because tariffs could be tailored according to trading partners as part of a bilateral or regional agreement while domestic subsidy-related policies would have the same impact on all trading partners.

Second, common metrics to count subsidies can help to increase transparency. With trillions of dollars of projected investments in the clean energy sector, the time is ripe to develop a common country reporting format, establish frequency of reporting, and designate institutions or agencies that can collate and distribute the information (such as through an online portal). In the absence of reporting at the WTO, non-governmental sources (such as the Global Trade Alert, which serves as an independent information source for trade measures and their impact on countries) could fill the information gaps.[167] Unless clean energy subsidies are measured in a transparent manner, there would be greater danger of misinterpretation and potentially more trade disputes arising. Such a situation cannot bode well for a relatively fledgling industry.

The United Nations Sustainable Energy for All initiative is one possible route to bring together the relevant international and national agencies to develop the common definitions and metrics for clean energy subsidies. Among the involved international agencies would be the World Bank, since it manages many of the clean energy-related climate funds; the International Monetary Fund, since it reviews its member countries in terms of their subsidy policies and their fiscal impact; the Organisation for Economic Cooperation and Development (OECD), since it has developed the Rio Markers methodology for assessing development finance, which could have some relevance for measuring clean energy subsidies as well; the International Energy Agency, a part of the OECD that can integrate assessments of all sorts of energy support measures; regional development banks; the WTO; and other regional or plurilateral trade agreements (NAFTA, Energy Charter Treaty, etc.).

Third, the relationship between rationalising fossil-fuel subsidy programmes and the use of subsidies to promote clean energy sources should be further investigated. Without the former, promoting clean energy subsidy programmes would have little impact on the energy mix, especially where fossil-fuel electricity generation or consumer tariffs are subsidised. Instead, the programmes would take on a more mercantilist flavour, whereby subsidies would be used to promote manufacturing and exports rather than increase domestic uptake of renewable energy.

The G-20, which has already served as a forum for reviewing and suggesting reforms for fossil-fuel subsidies, would be an ideal location to discuss how the subsidies for clean energy compare and how they could benefit from subsidy rationalisation.

Fourth, there is a need to establish the purpose of government support. While retaining policy flexibility is important, subsidies to increase energy access or energy generation capacity would have different impacts from those geared primarily toward promoting manufacturing and exports. The pursuit of policy clarity would allow countries to review their policies and justify those that have limited mercantilist impacts.

Currently, no forum exists where governments could discuss their reasoning for clean energy support programmes. As a result, there is the risk that more trade and investment disputes might arise at the multilateral level or through bilateral arbitration channels. So long as subsidies for clean energy are viewed only as mercantilist instruments, rather than measures to promote energy access, countries will tend to dispute each others' policies. A forum for discussion could ensure that a host of countries are able to explain the purpose of their programmes. Combined with a Sustainable Energy Trade Agreement, these review sessions could potentially ease pressure on countries that are seeking to increase energy access rather than manufacturing or exports. The Rio+20 Sustainable Development Summit could have served as a platform for this conversation to begin, allowing governments to both describe and clarify their subsidy programmes, while enabling others to learn policy lessons (successful and unsuccessful) from each other's experiences. But, its limited outcomes mean that the quest for an appropriate forum will continue.

Therefore, fifth, independent assessments of alleged adverse impacts of subsidy policies

could reduce the threat of unilateral trade sanctions or other penalties. Establishing the adverse impact of subsidies cannot be left to national agencies alone. Even without raising disputes at the WTO DSM, it is conceivable that relevant WTO committees can debate the nature, purpose, scale and impact of different types of clean energy subsidies. Such debate could help clarify individual country measures – say, at the WTO Trade Policy Review (TPR) meetings – but they could also offer greater policy clarity for clean energy subsidies as a whole. This would reduce the chances of disputes and give investors more legal clarity than currently exists.

In addition to reviews at the WTO's TPR Body, the Committee on Regional Trade Agreements could include discussions on the impacts of clean energy subsidies, in terms of regional trade flows and even the integration of regional electricity networks. The United Nations Industrial Development Organization should also undertake an economic assessment of the scale and impact of subsidies in promoting clean energy research, development, deployment and commercialisation at scale. Independent country assessments could be undertaken by a host of trade and sustainable development-focused research institutions and think-tanks. The greater the research into clean energy subsidies, the deeper would be the understanding of their purpose and impacts and, therefore, the lesser would be the potential for dispute. If disputes are eventually linked to the purpose of the subsidy programmes, then the confidence of investors seeking to focus on energy access or generation capacity could also increase.

Investors, energy consumers, and government policymakers would all benefit from a more certain trade and investment environment for clean energy. The UN Year of Sustainable Energy for All is an ideal opportunity to focus international attention on the issue. If the transition to a low-carbon green economy is going to be a long-haul objective, the aim must be to offer policy and legal clarity regarding supporting measures over the long term.

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Annex I: Brazil

Table A.I.1: A typology of Brazil's clean energy support programmes

	Direct financial transfers	Preferential tax treatments	Regulation	Infra-structure support	Trade/ Investment restrictions
Clean energy access/ consumption	• Luz para Todos (Light for All) electrification programme (2003)	• Luz para Todos (Light for All) electrification programme (2003)	• Brazil National Climate Change Plan (2008) • Programme of Incentives for Alternative Electricity Sources – PROINFA (2002) • Ethanol use mandate (admixture content of 25% from 2007) • Mandatory biodiesel blending requirement (2008)		
Clean energy generation and capacity	• Long-term PPAs for wind power auctions (2009) • Long-term PPAs for biomass power auctions (2008) • Long-term PPAs under hydropower programme (2004) • National Program of Production & Use of Biodiesel (PNPB) (2003) • Regional Producer Subsidy for bioethanol (2010)	• Lower service and other taxes for ethanol & flex-fuel vehicles	• Programme of Incentives for Alternative Electricity Sources– PROINFA (2002) • 2010-2019 Plan for Energy Expansion (installed capacity increase)	• ZAE Cana: Sugar-cane Agri-eco-nomical Zoning (Septem-ber 2009)	

Table A.I.1: A typology of Brazil's clean energy support programmes

	Direct financial transfers	Preferential tax treatments	Regulation	Infra-structure support	Trade/Investment restrictions
Domestic clean energy equipment & services manufactu-ring/ production			• Mandatory biodiesel blending requirement (2008)		• Ethanol Import Tariff 20%, (recently eliminated) • PROINFA: 60% (Phase I) & 90% (Phase II) local content in equipment
Clean energy goods & services exports					

Note: Figures in brackets indicate year when programme was launched.

Source: Various, including GAIN, IEA, IRENA, UNEP

Annex II: China

Table A.II.1: A typology of China's clean energy support programmes

	Direct financial transfers	Preferential tax treatments	Regulation	Infra-structure support	Trade/ Investment restrictions
Clean energy access/ consumption	• Biomass subsidies (2007) • Agricultural Biological Mass Energy Industrial Development Program (2007-15) • Use of crop stalk as energy source (2007) • Electricity to Village projects (2002) • Golden Roofs Programme (2009)		• Grid connection mandate - Renewable Energy law (2009 update) • Mandatory Biodiesel Requirement (2008) • Medium and Long-term Energy Conservation Plan (2004) • Acceleration Plan for Bright Project (2002)	• Electricity delivered to Village project (2002)	
Clean energy generation and capacity	• FiT - Wind power Concession Programme 25-year PPA (2003-09) • Ethanol production subsidy (2006) • Biomass FiT production subsidy (2007) • Solar subsidies (2010) • Golden Sun Programme investment subsidy (2009)	• Tax credits - Renewable Energy law (2005, update 2009)		• Grid access: Golden Sun Program-me (2009) • Grid access: Rene-wable Energy law (2009 update)	

Table A.II.1: A typology of China's clean energy support programmes

	Direct financial transfers	Preferential tax treatments	Regulation	Infra-structure support	Trade/ Investment restrictions
Domestic clean energy equipment & services manufacturing/ production	• Solar subsidies (2010) • Govt. proposal for Solar Energy (Mar 2009). • Fiscal Support for Energy-saving Products (2009-10) • Biomass production subsidy (2007)	• Small hydro –VAT reduced to 3% from 6% • VAT rebates on wind equipment manufacture	• Renewable Energy Industrial Development plan (2000)		• Local Content Requirement: Wind Power Concession Programme (2003-09)
Clean energy goods & services exports					

Note: Figures in brackets indicate year when programme was launched.

Source: Various, including Congressional Research Service, IEA, Martinot and Junfeng (2010), Peidong et al. (2009), REEEP (2010)

Annex III: Germany

Table A.III.1: A typology of Germany's clean energy support programmes

	Direct financial transfers	Preferential tax treatments	Regulation	Infra-structure support	Trade/ Investment restrictions
Clean energy access/ consumption	• Investment subsidies for solar and biomass: Renewable Energies Heat Act	• Tax exemptions: Environment & Energy efficiency Programme, RE Act (2004)	• Renewable Energies Heat Act (2009)		
Clean energy generation and capacity	• RE Act (2004) • FiTs: Renewable Energy Source Act (2000-10), for solar, biomass, hydro and wind • Production subsidy: Market Incentive Programme (Concessional loans), (RE Act 2004)	• Tax credits for solar (via KfW)	• Renewable Energies Heat Act (2009)		
Domestic clean energy equipment & services manufactu-ring/ production		• Biofuel sustainability ordinance (2006) (mainly for transpor-tation)	• Mandatory targets for biodiesel and bioethanol: Biofuels Quota Law (mainly for transportation)		
Clean energy goods & services exports	• Export subsidy: Market Incentive Programme (RE Act 2004).				

Note: Figures in brackets indicate year when programme was launched.

Source: Various, including EREC; Federal Ministry for the Environment, Nature Conservation and Nuclear Safety

Annex IV: India

Table A.IV.1: A typology of India's clean energy support programmes

	Direct financial transfers	Preferential tax treatments	Regulation	Infrastructure support	Trade/ Investment restrictions
Clean energy access/ consumption		Tax benefits- • Tax exemptions, by IREDA under Min for Non-Conventional energy Sources.	• RPOs: Electricity Act (2003) • National Solar Mission (2010) • Grid connection: Rajasthan Solar Policy (2011)	• Solar cities Develop-ment Pro-gramme (2011)	
Clean energy generation and capacity	• Programme on Biomass Co-Generation (non-bagasse) in industry (2011-12) • Generation-based Incentives for wind and solar (2008) • FiTs and long-term PPAs under National Solar Mission (2010) • Preferential tariffs: for small hydro; solar; Gujarat Solar Power Policy (2009) • Central Financial Assistance (CFA) for Biogas Plants (2004) • Preferential loans under Wind Power Development (2002)	• Income Tax breaks • Accelerated depreciation for wind projects (2002)	• REC (2010) • National Tariff Policy (2006)	• Access to land: Solar Parks in Gujarat	• Duty-free import concessions

Table A.IV.1: A typology of India's clean energy support programmes

	Direct financial transfers	Preferential tax treatments	Regulation	Infrastructure support	Trade/ Investment restrictions
Domestic clean energy equipment & services manufactu-ring/ production		• Excise duty rebates for wind components		• Water resources: Rajasthan Solar Policy (2011) • Rajasthan Solar Policy (2011): RE Infrastructure Development Fund	• Ethanol Production (2007) • Customs duty rebates for wind components • LCR: National Solar Mission (2010)
Clean energy goods & services exports	• Export subsidy: Market Incentive Programme (RE Act 2004).				

Note: Figures in brackets indicate year when programme was launched.

Source: Various, including Global Energy Network Institute; IEA; Ministry of New and Renewable Energy; NREL

Annex V: Spain

Table A.V.1: A typology of Spain's clean energy support programmes

	Direct financial transfers	Preferential tax treatments	Regulation	Infrastructure support	Trade/ Investment restrictions
Clean energy access/ consumption	• Consumer subsidy for solar PV installation: Andalusia under PROSOL (2007) • Investment loan subsidy for application of solar thermal facilities: Renewable Energy Project Loan Programme (2008)	• Exemption from hydrocarbon tax for biofuels sales	• Mandatory use of biofuels in the transport sector (2008, 2009): ITC/2877/2008 • Mandatory use of RE in buildings in Catalonia: Decree 21/2006		
Clean energy generation and capacity	• Production subsidies for farmers for energy crops • FiTs for solar, biomass, hydro, wind, geothermal: Renewable Energy Sources under Special Regime, Royal Decree 661/2007, (2007) • Renewable Energy Project's Deposit Programme (2008) • Grants for installations: PROSOL (Program for Promotion of Solar Thermal Energy Installations, started in 1993). • Solar Thermal investmentsubsidies: REP (2005-2010) • Galicia's wind tariffs and regulations: Law 8/2009		• Energy efficiency, building codes & thermal installations: Royal Decrees 314/2006, 47/2007, 1027/2007 • Grid connection: Royal Decree 661/2007	• Grid access: Royal Decree 661/2007 & 1955/2000	

Table A.V.1: A typology of Spain's clean energy support programmes

	Direct financial transfers	Preferential tax treatments	Regulation	Infrastructure support	Trade/ Investment restrictions
Domestic clean energy equipment & services manufactu-ring/ production	• R&D subsidy for biodiesel and bioethanol	• Tax deductions for R&D and innovation in RE: Sustainable Economy Law (2011) • Deductions on company tax for biofuels production: Law 36/2003		• R&D centres: CIEMAT (Centre for Energy, Environment & Technology Research); CENER (National Renewable Energy Centre)	
Clean energy goods & services exports					

Note: Figures in brackets indicate year when programme was launched.

Source: Various, including European Renewable Energy Council; International Energy Agency; Ministry of Industry, Tourism and Commerce;

Annex VI: United States

Table A.VI.1: A typology of U.S. clean energy support programmes

	Direct financial transfers	Preferential tax treatments	Regu-lation	Infra-structure support	Trade/ Investment restrictions
Clean energy access/ consumption	• Federal solar, wind, hydro, geothermal, biomass & ethanol consumer subsidies (2006) • California solar water heating rebate: California Solar Initiative (2009) • California Self-generation Incentive Program (2001-16)	• Biodiesel income tax credits (expired 2011) • Residential RE Tax Credit (2006-2016)			
Clean energy generation and capacity	• Grants for rural small businesses & farmers: Rural Energy for America Program (2008) • DoEloan guarantee program for solar installations (expired 2011) • California FiT (2009) • Financial incentives: CaliforniaSolar Initiative (2009) • CSI affordable solar housing programs (2006) • Colorado:State Loan Program, • Federal solar subsidies (2006) • Renewable Energy Production Incentive (REPI) • SunShot Initiative	• Alternative Fuel infrastructure tax credit (2005-14) • Federal RE Production Tax Credit (1992) • Business energy Investment Tax Credit (ITC) (2008) • California: Property Tax exclusion for Solar Energy systems (2011-16) • Texas: Solar & Wind Energy Business Franchise Tax Deduction (1982) • Colorado:Sales Tax Incentive on sales and use tax for solar installation (2006) • Volumetric Ethanol Excise Tax credits (VEETC) (expired 2011) • VEETC Excise Tax Credit for Biodiesel (2008)			

Table A.VI.1: A typology of U.S. clean energy support programmes

	Direct financial transfers	Preferential tax treatments	Regu-lation	Infrastructure support	Trade/ Investment restrictions
Domestic clean energy equipment & services manufactu-ring/ production	• Federal biomass subsidies • Ethanol infrastructure grants & loans guarantees • SunShot Initiative • Deptt. of Treasury RE grants (2009-11) • Clean Renewable Energy Bonds (CREBs) (2010) • DOELoan Guarantee Program	• Alternative fuel mixture excise tax credits (expired 2011) • Biodiesel mixture excise tax credit (expired 2011) • Texas: Solar & Wind Energy Business Franchise Tax Exemption (1982)		• Deptt. of Defense R&D for solar • DoE R&D for biomass and biorefinery research • DoE R&D on wind and geothermal	• Tariff on ethanol imports from Brazil (2006) • Caribbean Based Initiative - no duties charged on ethanol imports
Clean energy goods & services exports					• Tariff on ethanol imports from Brazil (2006) • Caribbean Based Initiative - no duties charged on ethanol imports

Note: Figures in brackets indicate year when programme was launched.

Source: Various, including Congressional Research Service; Texas Comptroller of Public Accounts; U.S. Department of Energy