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Theme: FORMULATION OF PUBLIC POLICIES (FISCAL, ENERGY, INVESTMENT, RENEWABLE) TO SUPPORT TRANSITION TO GREEN ECONOMY IN DEVELOPING COUNTRIES (CASE STUDY FROM UZBEKISTAN)

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MASTERS DISSERTATION

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IMZONI TASDIQLAYMAN
KADRLAR BO'LIMI BOSHLIGI
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DEVONXONA

"The dissertation work is being reviewed and considered as working dissertation"

Head of the department of Economics: **Ruzmetov Sh.B.**

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CONTENT

Chapter 4. Renewable energy potential of developing countries: the drivers towards a green economy (a case study from Uzbekistan)

Introduction

Importance of the research topic.

Current master dissertation is essential to attract the scientific attention to solve environmental, energy related problems in social life in long term period and attract private and public investment to tackle negative effects of carbon emissions and directing finance to optimize utilization of renewable energy sources in developing nations. As the developed economies achieved endorsing results on green economy, it is time to economies in transition to apply the experience of counterparts and disseminate applicable methodologies, benchmarks, footprints in the third world countries as recommended by World Bank

Degree of scrutiny of the problem.

Obviously, the Dissertation cannot solve the global problems immediately, although, attempts to cover basic economic, energy, investment tools useful to guide the direction of financing sustainable development. In the case of developing countries, economic analysis of the developed nations provides foundation to build up effective and efficient public: fiscal, energy, investment and environment policies to support transition to green economy.

Connection of dissertation work with plans of research.

Referring to the attached table, planned and performed research activities can be compared. Due to the widening research network with foreign scientists, extra opportunities may occur respectively.

Target of the research

Unless, the emerging economies don`t analyze and learn the successful and ineffective fiscal policies of green economics, there is no guarantee for sustainable development in the third world. Importantly, mistakes must not be repeated as it causes alarming problems in a globalised world. Climate change, energy efficiency and preserving nature should be the first priority of fiscal policies in developing countries. In the case of ineffective fiscal approaches, these countries will be the first victim as they might have quite lower economic development and political instability compared with emerged economies. World Financial Crisis 2009 convinced many developing economies that there is only one path to get rid of the climate change, financial crisis and massive unemployment all around the world. So, renewable energy policies in energy, transport and employment sector are still being disseminated to achieve green sustainable growth globally.

Object of the research is to elaborate economic-energy modeling to developing countries, in the case of Uzbekistan towards leading the country to low carbon development path. UNDP project on “Supporting Uzbekistan in Transition to a Low-Emission Development Path” serves to provide practical guidance while UNEP, UNIDO, World Bank publications assures scientific background for data collection

Research questions:

An estimated US$ 194 billion in green stimulus funding had been allocated to support clean energy globally, including renewable energy technologies, energy-smart technologies, carbon capture and storage, and transport (UNEP SEFI 2011). Transition to the green economy involves no less than a technological revolution, and will have deep impacts on production structures as well as on consumption patterns. A study by Ocampo and Khor (2012) revealed that there are diverging estimates of the resources needed for the transition to green economy. Green Economy report proposes a $1.3 trillion (2% of world GDP) target for green (public plus private) investments (UNEP, 2012).

The proposed graduate research paper attempts to investigate the following questions:

1) How can transition period to green economics be optimized in developing countries via creating fiscal policy and energy-efficient economic models?

2) Which green fiscal methodologies can be learnt from developed nations to disseminate in emerging countries?

3) What is the successful case studies of developing countries on transition to green economy?

4) How to design public policies supporting transition to green economy in developing countries?

5) Which statistical/econometrics models to use to deliver ups and downs of developed economies` experiences?

6) Which elements of financial-fiscal policies applicable to emerging economies which have high economic growth rates?

7) Which procedures/mechanisms to implement to foster transition period of low-income countries?

8) How resource potential of the developing country can be identified before designing fiscal, energy, investment stimulus?

9) What is the opinion of leading economists on the topic?

10) How much time does it take to 100% transition to green economy in the third world?

Subject of the research is to give recommendations on socio-economic efficiency of public (energy, fiscal, environment and investment) policies of developing nations. Econometric softwares STATA, MATLAB supports the dissertation to build up econometric tools that can support Government to make effective and sustainable decisions on transition to Green Economy.

Theoretical-methodological basics of the research consist of conceptual policies of shifting to green economy in developing countries based on the reports, analysis of inter-governmental financial institutions (International Monetary Fund, World Bank, European Bank for Reconstruction and Development); various divisions of UN: United Nations Environment Program

(UNEP), United Nations Development Program (UNDP), United Nations Industrial Development Organization (UNIDO); Asian Development Bank and etc.

The level of academic novelty of the research's results consists of scientific-methodological learning aid and practical recommendations which are imposed by the author on transition to green economy among developing countries. Before the beginning of Global Financial Crisis 2008, many countries heavily relied on conventional "black" economic development which required resource depletion and utilization of fossil fuels leading to serious environmental pollution and ecological crisis. Consequently, green economy is now seen as a new vehicle for creating economic, social and environmental benefits. (CCICED, 2011). The phrase "Green Economy", which means the efficient application of natural resources, has evolved to refer to an economy which has reduced adverse impacts on global environment – air, water, biodiversity and climate (G.Mulgan and O.Salem). At its most basic level, green economy is the clean energy economy, consisting primarily of four sectors (K.Gordon and J.Hays):

- Renewable energy (e.g. solar, wind, geothermal);
- Green building and energy efficiency technology;
- Energy efficient infrastructure and transportation;
- Recycling and waste to energy.

Indeed, there is a public perception for accepting sustainable development and each Government should establish, implement effective and efficient public policies, mainly financial mechanisms and environmental policies that direct the economic decisions of each individual in society. Among all industries, finance is considered "blood of all spheres" for providing effective interaction among them. So, the fiscal mechanism, financial infrastructure and economic modelling of green economy assure complexity and integrity of all industries: agriculture, construction, transportation, energy tourism.

The importance of fiscal policy formulation is for state revenue optimization, controlling budget deficit and reducing debt-to-GDP ratio. Several countries appear to have recycled revenues from environmental taxes in order to reduce overall tax burdens and addressing social concerns. For example, Germany uses eco-tax revenues to reduce labor costs (i.e. pension contributions). And, revenue of environmental taxes are used to support low-income households to lessen social impacts or financing environmental projects (e.g. investment for green technology) (UNEP-IMF-GIZ, 2012). The paper reviews the practical experience and available modeling of selected developing countries towards formulation sample framework that should be foundation, basic material to all economies in transition.

Methodology and methods of the research. In this dissertation, methods of economic analysis, monographic observation, economic-statistic categorization, mathematic modeling, expert assessment and economic forecasting, energy auditing, cross-comparative country analysis are used.

Main results of performed work: 5 scientific articles and 2 project proposals are submitted as a dissemination of the dissertation

Structure and content of the work: Consist of introduction, 4 chapters, 18 seasons, summary to each section, overall conclusion, citation of references and enclosures, overall size of the work consists of 91 pages. 10 figures have been used in this research work.

Dissemination in the industry.

1) As a result of the Dissertation, Project Proposal to HORIZON2020 is submitted with the coordination of Professor Yi Wang (yi.wang-2@manchester.ac.uk) from Manchestor University on September 3, 2014. Participant Universities/Companies from Switzerland, France, Spain, UK as well as Uzbekistan are collaborated (Enclosure 1).

2) Furthermore, project proposal to "Uzbekenergo" SJSC is submitted on measures to increase energy efficiency as well as application of renewable energy technologies (Enclosure 2).

3) Economic-technical feasibility study is conducted on building 20MW solar power station in Khorezm region towards providing enhance energy economics in the regions of Uzbekistan; Commercial proposal is obtained from Suntech Co. (China); Proposal is sent to "Uzbekenergo" SJSC which approved and forwarded to Cabinet of Ministers of Uzbekistan. On its turn, the Cabinet of Ministers of Uzbekistan formally addressed (№06/120-0171 on 04.02.2015) to International Solar Energy Institute for detailed research of building solar power plant in Khorezm region (Enclosure 3)

The Dissertation aims to:

- prove that global ecological problems have a solution with Green Economy and fiscal-financial infrastructure functions to fasten the transition period to green economy;
- discuss, analyze successful dissemination of fiscal, energy policies on green economy among developed and emerging countries; lessen the knowledge, experience gap of green economy disseminations between developed and developing economies;
- develop green fiscal policy platform applicable and relevant to all third countries; provide recommendation to developing countries which have enormous resource to utilize, human resources to lead and society to follow.
- Strengthen "industry-education-science" triangle for sustainable development of societies in emerging economies with active enrolment of both public and private sector
- Disseminate renewable energy investment mechanisms that are being widely used in the countries stated by UNEP and IEA reports annually;

- Integrating fiscal policy with renewable energy projects; assuring energy efficiency of electricity supply in huge energy consuming – CIS countries with tax incentives applied in the leading countries of the industry (i.e. Singapore)
- In Uzbekistan, technical-economic analysis of building centralized solar stations (i.e. 100 MW Samarqand Solar Station) and enlarging the sacale of utilization of renewable energy sources in rural areas, too (i.e 20 MW solar station in Khorezm region)

The dissertation proposes practical guidance and economic models to economies in transition towards environmentally-friendly economic, social development. The paper reviews the practical experience and available modeling of selected countries towards formulation sample framework that should be foundation, basic material to all economies in transition.

CHAPTER 1. FORMULATION OF FISCAL POLICY SUPPORTING TRANSITION TO GREEN ECONOMY IN DEVELOPING COUNTRIES

1.1 Current status of Green Economy

While bankers have been vilified as the cause of one of the largest financial disasters, the renewable sector has been seen as the white horse for many governments looking to emerge stronger. Despite economic downturn, investment continued in the renewable sector largely in part to government stimulus programs that focused on developing green economies. Around the world, governments have allocated more than USD 430bn fiscal stimulus to key climate change investment themes. China and the United States lead the way (KPMG 2011).

According to the African Consensus Statement at RIO+20 (2011), the trigger point for the Green Economy is "The combined stream of economic, social, and environmental crises that have plagued the global economy in recent years to a need to reorient the current development models towards a more efficient, inclusive and sustainable economy by enhancing the resource efficiency of national economies, and decoupling economic activity from environmental degradation".

Figure 1. Allocation of developing economies

(Source: IMF, 2014)

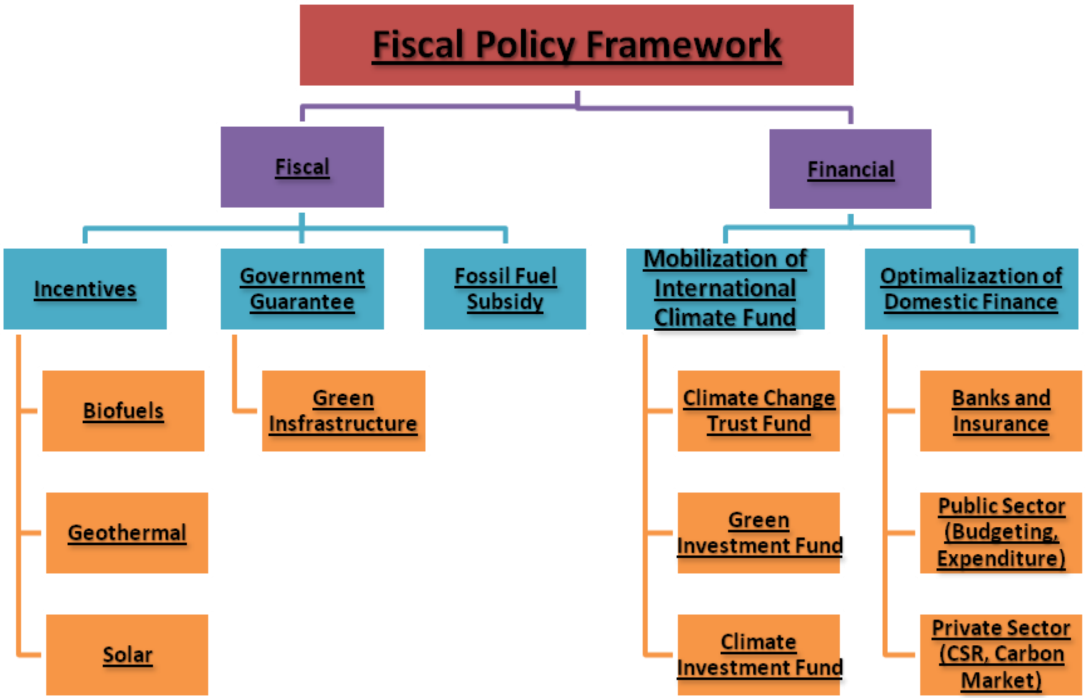
Accordingly, developing countries cover the majority proportion of the world geography, population and require the application of sustainable development while possessing the highest proportion of natural resources (gas, energy, gold). Evidently, the developed nations proved that green economy is vital in terms of environment and the process should be applied to economies with big territory and population. The fiscal model of green economy should be altered to the degree that matches the interest of bigger nation, perception and territories.

1.2 Research Methodology

Target of the masters dissertation is to achieve, to disseminate green economy assuring green growth around the globe. So that, no one would be the victim of climate change, environmental disasters and even, global financial crisis. To achieve the aim, methodology should be chosen in a right way.

Green stimulus measures are characteristically short-term, focusing on recovery from the crisis. Green policies on the other hand are to be understood more generally and often adopt a long-term perspective. In the countries the most common types of stimulus measures have been taxes (tax cuts) and subsidies, infrastructure investment, and special government spending programs, like scrappage payments. It is totally wrong to purport the fiscal policy framework of advanced economies to the developing countries, as the following aspects must be analyzed beforehand: political stability index, market development rate, social orientations, infrastructure of governing institutions and economic measurements. However, the cornerstone remains the same.

Figure 2. Framework of public financing



Source: UNEP-IMF-GIZ Workshop, 2012

Qualitative aspects (Year 1) - Particularly, successful case studies of developed nations (i.e. Spain, Germany, UK) are analyzed, then, the achievements of leader developing countries (i.e. China, India, Brazil) are investigated in detail in order to build up fiscal policy to support transition to green economy in 120 developing countries.

Quantitative aspects (Year 2) - Any dissertation is not considered as a mature academic work unless advanced econometrics, statistical models are applied. To enrich the quantitative sides, it is vital to refer MATLAB, STATA and other research-supporting softwares. Inputting data of leading countries creates development pathways, strategies for the rest of nations.

1.3 Sources of data

Main emphasis is given to the periodical reports of the Institutions that cover the research areas. The proposed dissertation topic is discussed widely among politicians, economists and mass media, however major contribution, data analysis is done by:

- World Bank, IMF project reports; United Nations Environment Program (UNEP) and United Nations Development Program (UNDP) research papers on the proposed topic
- Government reports on successful achievements for sustainable development, green growth
- Secondary data from researchers on conferences, seminars worldwide

As part of the expansion of public sector investment, governments have promoted investment in low-carbon energy power – renewable sources, including, geothermal, hydro, wind, solar and nuclear. Countries such as France, the Republic of Korea, and the U.S. along with the EU, have targeted renewable energy, which amounts to USD 43 billion or 8.2 percent of total green package (UNEP, 2013). Confronted with fiscally constrained world, fiscal reforms might appear to be a daunting challenge to a green economy transition.

Green fiscal policy reforms could provide multiple benefits. In Barbados, application of environmental taxes contributed to the provision of solar water heaters and in Germany, it contributed to a reduction in labor costs and creation of new jobs. Nevertheless, fiscal measures and reforms can have complex implications in economic and social spheres though. In particular, fiscal reforms tend to have distributional impacts on vulnerable groups (e.g., low-income households, pensioners, single-parent households). Therefore, distributional and social objectives need to be taken into account when formulating and applying fiscal measures, such as tax exemptions, reduced tax rates or other compensation measures that could contribute to the strengthening of social safety nets would not only increase social and political acceptability of fiscal reforms, but could also contribute to an equitable and fair transition to a green economy. The key to a successful green fiscal reform policy is reaching equilibrium between distributional impacts and cost-effectiveness, particularly in the prospective need for fiscal consolidation (UNEP, 2012)

For calculating mathematical outputs, statistical model of Simon and Blume (1994) attempts to identify the variables explaining the variance observed in green tax revenues in developed economies. Accordingly, the dependent variable is total revenue from environmentally related taxes, R_i,, with adjustments made for fuel taxes to be explained later. The pool of explanatory variables is composed of three vectors: the revenue generating potential of a certain country, G_i (measured by the Gross Domestic Product); the environmental quality vector, E_i (measured by the quality of health,12 H_i , the total quantity of carbon emissions in a given year C_i and its squared form C^2_i); the vector of industry pressure X_i (measured by the total goods exported in a given year, Exp_i , and the number of exemptions and rebates awarded to energy-intensive sectors, ExReb_i). Thus,

$$R_i = R_i\,(G_i, E_i, X_i),\ i = 1, \ldots, n \text{ (OECD country index) (1)}$$

Or, more specifically,

$$R_i = \alpha + \beta_1 \text{GDP}_i + \beta_2 H_i + \beta_3 C_i + \beta_4 C^2_i + \beta_5 \text{Exp}_i + \beta_6 \text{ExReb}_i + \varepsilon_i, \ (2)$$

where ε_i represents the error term, which is assumed normally distributed.

1.4 Effective fiscal approaches by countries:

1.4.1 China

The Government of China has implemented reduced Corporate Income Tax (CIT) rate as 15% for qualified advanced and new technology enterprises operating with solar, wind, biomaterial and geothermal energy. For further encouraging green technologies, “Three years` CIT exemption followed by another three years` 50 percent reduction of CIT rate” for income derived from specified Clean Development Mechanism (CDM) projects. Further, 150% of money spent for R&D purposes can be deducted on CIT computation. 50% refund of Value-added Tax (VAT) paid on sale of wind power is refunded while VAT paid on sale of produced from recycled materials or waste residuals is also refundable (KPMG, 2011).

1.4.2 Uzbekistan

Addressing to Inter-governmental organizations (World Bank, ADB) to fund proposed projects on priority industries brings fruitful results, because long-term credit with low interest rates enhances the development of renewable energy and energy efficiency as a fiscal aspect. For example, Samarqand solar power station with 100 MW electricity generation capacity received long term loan of 300 mln USD which is planned to enlarge to 2 GW station in the future (ADB, 2013). Technical assistance and grants of international financing institutions serve to enlarge stakeholder interests as well as supporting sustainable development of energy industry as a part of green inclusive economics.

1.4.3 Kenya

Feed-in Tariff (FIT) policy instrument was mandatory for energy companies and utility providers to purchase electricity from renewable energy resources at pre-determined prices in order to stimulate the flow of investments on renewable energy (UNEP, 2010). It is expected that FIT policy would bring extra 1300 MW electricity generation capacity with assurance of energy security by increasing reserve margins. As a result, the mechanism leads “triple-win” concept – enhancing the power of energy economics, green employment opportunities for poverty alleviation in rural areas and green business opportunities to privates sector.

1.5 **Cross-country analysis of tax incentives in Singapore and Uzbekistan**

Today, Singapore has become globally well-recognized and conducive place to work and live in. Its established network, multicultural and cosmopolitan nature has offered a conducive environment for creative and knowledge driven industries. Singapore is often looked upon as the leading example of countries that continues to reduce corporate income tax rates and introduce various tax incentives to attract and keep global investments. Singapore has a single-tier territorial based flat-rate corporate income tax system. Effective tax rates as one of the lowest in the world and the general “business friendliness” of Singapore are the two important factors contributing to its economic growth and foreign investment. This has brought about the international reputation for business excellence and has attracted many rich individuals and corporations to Singapore.

Taxation in Singapore has been very attractive to foreign investment. Corporate and personal income tax rates are low; there is no capital gains tax, no dividend tax, no inheritance tax, no foreign exchange controls, and no taxation on foreign income that is remitted to Singapore. Moreover, there are several tax incentives for various business industries and numerous Double Taxation Agreements with several major economies of the world.

In the last few years, taxation of Uzbekistan is being completely reformed to upgrade the level of competition in the market; tax rates for different industries are decreased in order to stimulate competent business environment for local entrepreneurs and foreign investor. Free Industrial Economic Zones (FIEZ) are created to raise economies of rural areas by appointing exemption from land and property tax.

The main objective of this paper is to analyze the major tax differences in Singapore and Uzbekistan and to find the tax reasons for Singapore’s success being Asian hub selected by multinational companies to run a business.

Opportunities to adopt the recent taxation methodologies are also evaluated to boost the economy to become viable for global business in Uzbekistan.

Singapore's taxation system is territorial. Companies in Singapore are subject to tax on income accruing in or derived from Singapore and foreign income received in Singapore from outside the country. From 1 June 2003, foreign sourced dividends, foreign branch profits and foreign-sourced service income received in Singapore by a person resident in Singapore is exempt from income tax if the following conditions are met:

- ✓ the income is subject to some form of income tax in the foreign country
- ✓ the income is remitted from a country with a headline tax rate of not less than 15%; and
- ✓ the Comptroller of Income Tax is satisfied that the tax exemption would be beneficial to the person resident in Singapore (Deloitte, 2012).

Singapore introduced a loss transfer system of group relief from the YA 2003. A group consists of a Singapore incorporated parent company and all its incorporated subsidiaries. Two Singapore incorporated companies could be members of the same group if one is 75% owned by the other or both are 75% owned by another Singapore incorporated company. The group companies must have the same accounting period to qualify for the relief. Group companies are allowed to transfer current year's tax losses and current year's unutilized capital allowances but cannot transfer investment allowances and foreign losses.

All businesses will be allowed a one year carry-back of current year unutilized capital allowances and trade losses (qualifying deductions) up to a cap of S$100,000 subject to meeting the requisite conditions. The loss carry-back relief system will be temporarily enhanced for YA 2009 and YA 2010. The qualifying deductions will be allowed to be carried back for up to three YAs and the maximum amount that may be carried back for each YA will be increased from $100,000 to $300,000. The one-tier corporate tax system replaced the imputation system from 1 January 2003. Under the one-tier system, corporate profits will be taxed at the corporate level. The corporate tax rate for YA 2009 is 18% (the rate is reduced to 17% from YA 2010). Under the one-tier system, the corporate tax paid is a final tax and Singapore dividends distributed from the corporate profits are tax exempt (World Bank, 2012). Singapore has an extensive range of tax incentives for companies. Two main categories of tax incentives are:

- ❖ those administered by the Economic Development Board under the authority of the Economic Expansion Incentives (Relief from Income Tax) Act and
- ❖ those granted under the Singapore Income Tax Act itself.

Companies (resident and non-resident) are subject to corporate tax rates after partial tax exemption on their normal chargeable income up to $300,000 (effective from YA 2008) as follows:

- Up to the first $10,000 of such income, 75% of the income or an amount to $7,500 shall be exempt from tax
- Up to the next $290,000 of such income, 50% of the income or an amount up to $145,000 shall be exempt from tax (Janus, 2012)

The exemption scheme does not apply to:

- income that is subject to tax at concessionary tax rates; and
- income earned by a non-resident company that is subject to a final withholding tax.

To encourage entrepreneurs to start up new companies to pursue their business ideas, qualifying
new startup companies are granted tax exemption on the first $300,000 (effective from YA 2008) of their chargeable income as follows:

- 100% tax exemption for the first $100,000 chargeable income

– 50% tax exemption for the next $200,000 chargeable income. (Sum Yee Loong, 2012)

The conditions to qualify for the start-up exemption are that the company must be a Singapore incorporated resident company with no more than 20 shareholders and of which at least one is an individual shareholder beneficially holding at least 10% of the total number of issued ordinary shares.

In the recent budget 2013, Singapore has offered certain grants to position itself as an electronic commerce hub. They are:

- 10% tax rate on incremental income from qualifying e-commerce transactions;
- Investment allowance of up to 50% of the cost of qualifying new fixed capital expenditure (e.g. investments in server farms); and
- Full or partial exemption of withholding tax on qualifying payments (e.g. royalties, licence fees).

In the YA2013, YA2014 and YA2015, it is also granting a 30% corporate tax rebate capped at $30,000 for each year of assessment to its resident companies. In the case of Uzbekistan, entities are exempt from land tax, property tax, tax on profit improvement and development of social infrastructure, single tax (for small businesses), compulsory contributions to the Republican Road Fund and Republican School Fund in the amount of direct investments from 3 million to 10 million Euros for 7 years, from 10 million to 30 million euros for 10 years, more than 30 million Euros for 15 years. Companies investing in mining sectors (oil and gas, etc.) could get 7 year tax holiday under special governmental acts. Companies, employing more than 50% of handicaps, are exempt from corporate tax.

Figure 3. Analysis and comparisons triggering the success

	Singapore	Uzbekistan
Rank on Cost of doing business (World Bank Statistics)	1	154
Home currency	SGD	UZS
Home currency/USD (on March 21,2013)	0.9	2000
Number of days to begin business	1	7-30 (depending on the complexity of business)
GDP (As for 2012)	US$ 239,7 billion	US$ 52 billion
GDP growth rate	1,8%	8,1%
Corporate tax rate	17%	9%
Initial payment to form business	$ 350	5 Minimal Monthly Wage
FDI to the country	S$ 12 billion (2010)	$ 3 billion (2011)

Source: www.guidemesingapore.com and www.uzinfoinvest.uz

Why do the Commonwealth Independent States, especially Uzbekistan, should learn from Singapore experience? The answer is quite simple: to attract more investment by learning taxation methodologies that can attract potential investors in the local place. In the case of Uzbekistan, tax exemptions can be implemented in Free Industrial Economic Zones (FIEZ) like Navoi, Angren and recently formed Djizzax . The main reason is that logistics and supply of resources are better organized. In comparison with Central Asian countries, Uzbekistan attracts more FDI inflow after Kazakhstan and industry based incentives are here to support the weak industries.

In Uzbekistan, several types of tax incentives can be implemented considering the relevance to each industry. For example, tax holidays can be given to the industry when it has a lower turnover; export-oriented entities may be given volume-based incentives; loss carry forwarding might stimulate companies which are facing insolvency; warehousing and servicing tax incentives might stimulate the logistics service to re-build The Great Silk Road which crossed from the territory of ancient Uzbekistan.

Conclusion of Chapter 1

Unless, the emerging economies don`t analyze and learn the successful and ineffective fiscal policies of green economics, there is no guarantee for sustainable development in third countries. Importantly, mistakes must not be repeated as it causes alarming problems in a globalised world. Climate change, energy efficiency and preserving nature should be the first priority of fiscal policies in developing countries. In the case of ineffective fiscal approaches, these countries will be the first victim as they might have quite lower economic development and political instability compared with emerged economies.

Tax incentives are well-managed to attract FDI to Singapore and we see the developing business environment in Uzbekistan. As the corporate tax, seemed very much lower than the tax imposed in Singapore for corporations, tax incentives could be given to certain companies, mainly working on renewable energy sector. These companies could play a part to drive the Uzbekistan's economy. Especially, knowledge-based industries, innovation based spheres should be attracted with tax incentives while having enough resources. Modern industries with a weak competition (e.g. recycling, food processing) can be offered periodical tax exemptions to upgrade the business environment, however in competent industries (e.g. logistics, tourism, financial institutions), tax incentives lead to create business hub in the territory of Uzbekistan.

CHAPTER 2. ESTABLISHMENT OF ENERGY POLICY SUPPORTING GREEN ECONOMY FOR ECONOMIES IS TRANSITION

2.1 Energy policy in Uzbekistan

The Energy Information Administration of the US Government forecasted a 49% increase in global primary energy consumption from 2007 to 2035 under a 'business as usual' scenario (EIA, 2010). Further projections indicate that energy consumption in member countries of the Organization for Economic Cooperation and Development (OECD) are expected to rise by 14% while non-OECD countries require 84% more energy by 2035 compared to that in 2007. Furthermore, it is expected that the liquid hydrocarbons will keep their dominant position followed by a growing share of coal, whereas the natural gas consumption growth rate will keep its pace till 2020, but will decline thereafter (EIA, 2010). This anticipated decline will affect all top-ten natural gas producers, including the non-OECD member country Uzbekistan in Central Asia. The presently-known natural gas reserves in Uzbekistan have an estimated lifespan of 28 years (or less) under the current level of production, which is at most half the lifespan of the known natural gas reserves of neighboring Kazakhstan, Turkmenistan and also Russia (Eshchanov, 2006).

Uzbekistan, as many other countries, will thus be challenged in meeting its rapidly growing energy demand in the very near future. Natural gas in Uzbekistan covers ca. 88% of the total energy production including the gas for generating electric power (IEA, 2010). Hence like all countries worldwide, Uzbekistan is also challenged to revise its present natural gas-based energy policy. Any redirection should however be backed by socio-economic considerations e.g. indicating how to increase the overall efficiency of the current uses or estimating the potential of alternative sources of energy or others, but with an overarching aim to develop an improved, adapted, and sustainable energy policy.

First of all, a comparative analysis of the end-use natural gas prices in OECD countries with Uzbekistan revealed that the industrial and residential natural gas price in Uzbekistan is one of the lowest in the world. For instance, in 2005, the ratio between the per capita GNI (PPP method) and residential natural gas price ranged from 27 tcm in Portugal (thus with high gas prices) to 129 tcm in the US, compared to 135 tcm in Uzbekistan. The relatively low price of natural gas in Uzbekistan is a heritage from the past. During the Soviet Union period, fossil fuels were considered as a common wealth of the nation and their price setting included only expenses related to mining, processing and for running and updating the energy sector (Kenisarin and Kenisarina, 2007). This price-setting policy has barely been altered after independence in 1991 thus underestimating considerably the true costs of natural gas (Kenisarin and Kenisarina, 2007).

Secondly, although the prices for natural gas and electricity have been increased in Uzbekistan since independence, the pace of increase is not target-oriented (e.g. obtaining price recovery levels) nor is it in line with the current rapid economic growth experienced in the country (World Bank, 2003). There is no information available about the break-down of the price which can show the production, generation and distribution costs. This information could also reveal what other costs price includes, if any. This study therefore aimed at evaluating the current energy pricing policy in Uzbekistan and identifying the role of the main energy sources - natural gas and electricity - in overall economic development.

2.2 Energy demand modeling

The well-documented models of energy demand are based on a wide range of valuation methods including bottom-up, input-output, econometric, linear and non-linear models (Bohi, 1981; Dahl, 1994). Each method has its own purpose, is suited to different levels of analysis (i.e., local, regional or national scale) and has advantages and disadvantages. Empirical energy demand modeling usually is based on secondary data (Fisher and Kaysen, 1962; Halvorsen, 1975). Basic aggregate demand modeling is based on the microeconomic demand function determined by the average price of energy (natural gas, electricity or oil) and income – representative of economic growth (Medlock III, 2009). The first, well-known example of such a demand inquiry was applied by Fisher and Kaysen (1962) for estimating electricity demand in the US.

Acaravci and Ozturk examined long-run relationship and causality issues between the electricity consumption and economic growth in 15 transition economies (Uzbekistan omitted) by using the Pedroni panel cointegration method for the 1990–2006 period (Acaravci and Ozturk, 2010). Since electricity consumers need a longer time period for adapting to price and/or income related changes, the authors assumed that price and income (economic growth) changes in the previous year affect the energy consumption of the following year. Howeverm the Pedroni panel cointegration tests did not confirm a long-term equilibrium relationship between per capita electricity consumption and real GDP. The authors argued that electricity consumption related policies in transition countries have no, or only very limited effect on the level of electricity consumption in the long run.

A major shortcoming of energy demand modeling in transition economies is the not perfectly elastic supply caused by e.g. energy shortages and supply side limitations, while the demand models assume it to be perfectly elastic (Bohi, 1981; Green, 1987; Atakhanova and Howie, (2007). This violates thus the assumption that energy is continuously available (Bhattacharyya and Timilsina, 2010). It should however be realized that the usually reported energy consumption data do not represent the actual demand (Bhattacharyya and Timilsina, 2010), but rather the consumption only. The cut-offs due to ill-conditions of the distribution infrastructure, maintenance processes or energy shortages usually are not considered in modeling, which may obviously bias the value of the obtained estimates.

This study attempts to estimate the aggregate electricity and natural gas consumption elasticities in Uzbekistan assuming that the supply side is perfectly elastic. Driven by the suggestions from Acaravci and Ozturk (2010) the delayed impact of price and income changes on energy demand were included. In accordance with Atakhanova and Howie (2007), gross regional product (GRP) was used instead of gross national product (GNP) to draw a better picture of the relationship between the energy demand and economic activities over the provinces.

2.3 Methodology for demand calculation

According to theory, price and income have a belated effect on energy demand, because consumers are unable to react to price and income changes immediately (Bhattacharyya and Timilsina, 2010). Therefore, in accordance with Acaravci and Oztuk (2010), the previous year's price and income values were used to understand the current year's energy demand.

Another problem in energy demand research with short-term data is that of the existence of severe heteroskedasticity which makes the results of fixed and random effect panel data regression biased. In case of the existence of a severe heteroskedasticity, the fixed GLS regression coefficients are estimated to obtain more precise estimates (Atakhanova and Howie, 2007). According to Gujarati (2002) the fixed GLS method compels to obtain more precise coefficients estimates through iterations.

The aggregate energy demand functional forms are adapted from Atakhanova and Howie (2007). For estimating the aggregate natural gas demand, the functional form is as follows:

$$\ln \text{GAS DEMAND}_{it} = \beta_0 + \beta_1 \ln \text{PRICE GAS}_{it} + \beta_2 \ln \text{GRP}_{it} + \varepsilon_{it}$$

Where:

$GAS\ DEMAND_{it}$ - the aggregate natural gas demand (in tcm);

$PRICE_{it}$ - the real natural gas price (in Uzbekistan Soum per tcm, UZS/tcm);

GRP_{it} - the real GRP (in UZS);

and ε_{it} - the error term.

For estimating aggregate electricity demand, the functional form is rearranged accordingly as:

$$\ln ELECTRICITY\ DEMAND_{it} = \beta_0 + \beta_1 \ln PRICE\ ELECTRICITY_{it} + \beta_2 \ln GRP_{it} + \varepsilon_{it}$$

Where:

$ELECTRICITY\ DEMAND_{it}$ - the aggregate electricity demand (in MWh);

$PRICE_{it}$ - the real electricity price (in UZS/kWh);

GRP_{it} - the real GRProduct (in UZS);

and ε_{it} - the error term.

Data on supplied natural gas and electricity were obtained from the State Joint Stock Company, “UzbekEnergo” and the National Holding Company “UzbekNefteGaz” respectively. The natural gas supply data (in *tcm*) for all cases came from UzbekNefteGaz. The real prices of electricity and natural gas were calculated based on the GDP deflator method.

GRP is used as a proxy for economic growth and development to find out how GRP impacts on aggregate energy demand. The data on GRP were obtained from UzStat whereas the real GRP was calculated based on a GDP deflator method. The GDP deflator indicator was obtained from the World Bank online database.

Following the creation of an extended database two dependent variables were used: (i) aggregate electricity consumption and (ii) aggregate natural gas consumption. The two explanatory variables for each independent variable were (i) price and (ii) real GRP. The database consists of total 112 observations (8 years period for 14 regions).

2.4 Discussion of Results

Figures 4.1 and 4.2 below provide the coefficient estimates, standard errors and diagnostic statistics of the regressions estimated by STATA. The Fixed and Random effect regression models for both natural gas and electricity, produce low F or Wald statistics values, revealing that model misspecification is present in the regressions of natural gas and electricity demand models (columns 1, 2, 5 and 6, Figures 4.1 and 4.2).

In Random and Fixed Effects models, the within, between and overall goodness of fit of the regressions (1) and (2) and only within goodness of fit of regressions (5) and (6) were very low, indicating that the explanatory variables selected were not sufficient for modeling the current demand. The intercept coefficients of these models (1, 2, 5 and 6) are however high for both fixed and random effect models, implying that fixed effects were high.

Hausman's specification tests revealed that Random Effects regressions were valid for electricity demand models while Fixed Effects regressions were valid for the natural gas demand models. None of the explanatory variables have statistically significant coefficients for the aggregate natural gas demand regressions (1) and (2). Heteroskedasticity and autocorrelation were present in Fixed and Random Effect regressions for regressions (1), (2), (5) and (6).

Moreover, the Wald chi-squared value of the Prais-Winsten regression for natural gas was found to be not statistically significant, implying that model misspecification or measurement error is present in the regression (3). The fixed generalized least squares (FGLS) regression for the natural gas demand model produced a statistically insignificant -0.18 price and 0.63 income elasticity.

In general, price elasticity of natural gas demand is known to be higher than the price elasticity of electricity demand (Erdogdu, 2010). However, in the case of Uzbekistan, where electricity is mainly produced from natural gas, electricity seems to have higher price elasticity than natural gas.

Figure 4.1 **Results of aggregate natural gas demand models for Uzbekistan, 2000-2007**

Dependent variable: ln NATURAL GAS DEMAND	FE	RE	PRAIS WINSTEN REGRESSION	FGLS
	(1)	(2)	(3)	(4)
ln GAS PRICE	-0.07	-0.08	0.00	-0.18**
	(0.06)	(0.06)	(0.07)	(0.07)
ln GRP	-0.01	0.04	0.26*	0.63**
	(0.13)	(0.13)	(0.12)	(0.05)
CONSTANT	8.24**	8.06**	6.32**	5.73**
	(0.65)	(0.66)	(0.85)	(0.56)
F/Wald statistics	0.91	1.91	4.74	156.85**
Within R^2	0.02	0.02		
Between R^2	0.10	0.10		
Overall R^2	0.00	0.06	0.97	
No. of observations	112	112	112	112
Hausman's specification test probability	0.26			

Figure 4.2 **Results of aggregate electricity demand models for Uzbekistan, 2000-2007**

Dependent variable: ln ELECTRICITY DEMAND	FE	RE	PRAIS WINSTEN REGRESSION	FGLS
	(5)	(6)	(7)	(8)
ln ELECTRICITY PRICE	-0.07**	-0.12**	-0.28**	-0.20**
	(0.03)	(0.03)	(0.13)	(0.03)
ln GRP	0.12	0.28**	0.84**	0.80**
	(0.09)	(0.09)	(0.10)	(0.02)
CONSTANT	7.35**	6.54**	3.88**	3.78**
	(0.47)	(0.47)	(0.58)	(0.12)
F/Wald statistics	2.65	12.56**	71.23**	1690.47**
Within R^2	0.05	0.04		
Between R^2	0.69	0.69		
Overall R^2	0.63	0.66	0.98	
No. of observations	112	112	112	112
Hausman's specification test probability	0.00			

Findings of the FGLS regressions (columns (4) and (8), Figures 4.1 and 4.2) for electricity and natural gas demand models revealed that the price and income elasticity value were found to be statistically insignificant for natural gas model in regression (3) while all coefficients were statistically significant for the electricity demand model. The results obtained confirmed that Prais-Winsten regression estimates are valid for the aggregate electricity demand, demonstrating that price and income have a higher effect after one year. Further results of the Prais-Winsten regression (7) for electricity demand and the FGLS regressions (columns 4 and 8) can be considered as valid results.

Aggregate natural gas demand:

Although the natural gas price has steadily been growing, the current pricing policy seems to play an extremely small role as an instrument of demand control in promoting efficient consumption and fostering loss reduction. Hence aggregate natural gas demand seems to be less responsive to income in comparison with the Erdogdu (2010) study. However, with the background of decreasing production potential and increasing demand due to structural change and high economic growth, this coefficient already suggests a possible shortage in the natural gas supply in the next 1-2 years, bearing in mind that Uzbekistan's average annual economic growth is predicted as 5-6% during the next 3 years (UN, 2012). Therefore, it is hereby suggested to introduce progressive pricing policy. Introduction of alternative energy sources that enable meeting the growing energy demand on a timely manner should serve as a target.

The conversion factor of the most up-to-date gas turbines is around 70% while the worldwide average rate in the natural gas based TES is 50-55%. The average conversion factor in the natural gas based TES of Uzbekistan corresponds to 33-34% (Eshchanov, 2006), thus 15-20% lower than the world average. Including the cost of refurbishment of these turbines should be a target when calculating the cost-recovery prices. Another dimension in these policies is the time dimension; hence, the refurbishment projects should have a feasible target of replacing the current turbines in the closest possible future. The costs and benefits of the possible decrease in the transportation and distribution losses of natural gas should also be revised in this regard.

Aggregate electricity demand:

In aggregate electricity demand, price is found to be inelastic (-0.28) with the previous year's price. This coefficient is higher than the previously reported World Bank (2004) study, where price elasticity of aggregate electricity demand was found to be -0.10. The price seems to have a five times higher elasticity coefficient in comparison with case in Kazakhstan, where the excess capacity of generation is present (Atakhanova and Howie, 2007). The price of electricity has a belated effect on consumption, which is relevant for the electricity demand model and should be taken into consideration when pricing policy is being reviewed.

The income elasticity of electricity demand again confirms that electricity remains as the engine of economic growth. Consumption efficiency is not increasing despite the increase in the real electricity price. Unless measures that promote efficient electricity consumption will be taken, electricity demand will keep rising with the current trends, increasing the electricity shortage risk. Electricity shortages (Komilov, 2002) have already demonstrated that the country needs to (i) increase the price of electricity to a level where the price becomes an effective mechanism for the promotion of efficient electricity consumption, (ii) expand the electricity generation capacities with higher paces; (ii) diversify the sources of electricity generation.

The loss reduction and efficiency improvements should also serve as a target when defining the cost-recovery price. Uzbekistan is known for its one of the highest worldwide rate of electricity distribution losses of 17%, while the world average rate for electricity distribution losses is 7%. Bringing this indicator to the world average rate during a specific time period could serve as a pricing policy target.

Furthermore, inclusion of renewable energy sources in the supply chain, such as solar, wind energy or cogeneration of biomass in the electricity generation process would create a basis for a wider introduction of these renewable energy sources. However, to be able to sustain the predicted 5-6% average annual economic growth (UN, 2012), authorities should diversify the energy sources by including more promising energy sources such as renewables (Eshchanov, 2006) in the energy mix.

The vastly available coal reserves, mainly found in the open surface mines in Uzbekistan are known to have high sulfur content and low energetic value. Therefore, increasing the share of coal resources in the energy balance will further escalate the environmental degradation. On the other hand, modern technologies have been developed to bypass this hurdle and which could render this option also feasible for Uzbekistan once the financial consequences would become known.

Conclusion of Chapter 2

The price of natural gas and electricity should be increased significantly to foster loss reduction and efficient energy consumption. The loss reduction and efficiency improvement policies should serve as a target when defining the new cost-recovery prices. Hence, the price of natural gas could include the expenses of modernizing the turbines of the TESs that would save 15-20% of the natural gas which is being spent on electricity generation. The price of electricity could be increased to a level where the overall electricity loss of 17% will be decreased at least to the world average rate of 7%. The fact that price related changes have a belated effect should also be taken into account when applying these measures.

For more precise estimates, a disaggregated demand study needs to be carried out with the aim of identifying the properties of each energy consumer groups. The inclusion of different traditional/primitive sources would add more value to the study. Last, but not the least, the issue of supply side being not perfectly elastic in the transition and developing economies should be inquired further.

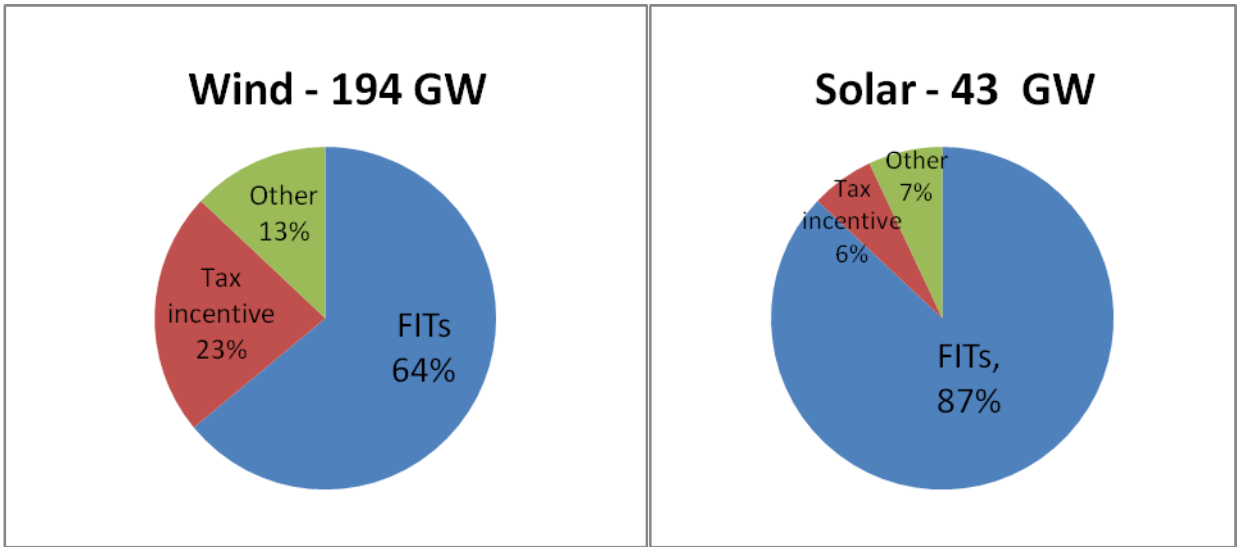
CHAPTER 3. CHALLENGES AND OPTIMIZATION STRATEGY FOR FEED-IN TARIFFS OF RENEWABLE ENERGY IN DEVELOPING COUNTRIES

3.1 Essence of stimulus mechanism: Feed-in tariff (FIT)

Modern life is convincing us that renewable energy technologies, policies, strategies should be disseminated all around the world to provide sustainable development. As the mature economies have already succeeded competitive results on renewable, it is high time for economies in transition to foster the green development infrastructure. Probably, feed-in tariffs of renewable energy should be designed considering public finance opportunities, buying power of consumers in order to tackle administrative barriers as an optimization strategy. The paper provides evidence from leading countries in the industry, explores ongoing challenges in the application of feed-in tariff policies, analyses the optimal methodologies to give recommendations to stakeholders.

Over the past decade, feed-in tariffs (FITs) have been a major instrument to promote the generation of electricity by means of renewable energy sources. However, feed-in tariffs have been criticized for being costly, inefficient, distortive of competitive pricing and, hence, in the long run not compatible with the creation of a single, liberalized electricity market in which renewable energy sources account for a major share in total power production (Sijm, 2002). Accordingly, FITs have driven 64% of global wind and 87% of global photovoltaic capacity. However, the majority of these installations have been installed in developed countries (UNEP, 2012).

Figure 5. Global installed capacity by incentive type



Source: Tringas, 2011

The concept of "feed-in tariff" refers to the regulatory, minimum guaranteed price per kWh that an electricity utility has to pay to a private, independent producer of renewable power fed into the grid (Huber et al., 2001). For example, green energy producers received 90% of the average electricity utility rate in Germany. So, if consumers had paid, on average 10 €ct/kWh in 1993, farmer using wind turbine received 9 €ct/kWh for every kWh fed into the grids in 1995 (IWR, 1999).

The core argument to apply feed-in tariffs is that they offer a high level of investment certainty to independent (risk-averse) producers of renewable electricity by guaranteeing a fixed price for each kWh of power fed into the grid over a certain period (i.e. 5-15 years) as wells as encouraging RET capacity installation (Sijm, 2002).

3.2 FIT Challenges in developing economies

Increasingly, feed-in tariffs (FITs), rather than minimum percentage requirements for RETs used in the USA and Great Britain, have been argued to be a superior policy approach for promoting RETs (Rowlands, 2007). Germany, for example, has been especially aggressive about FIT implementation while total generation by RETs increased annually to over 20 terawatt-hours by 2002 which encourages RET capacity installation (Mitchell et al., 2006).

FITs encompass both short term and long-term goals. In the short term, FITs are designed to encourage penetration of currently available RETs, even though they are not mature enough to be directly competitive against "traditional" generation technologies. Over the long term, FITs are designed to promote the technological advancement of RETs so that they can compete directly without the need for subsidies or prescribed quotas (Lesser.J and Su.X, 2008).

Figure 6. Feed In Tariff Policy

Investment Risks	Effectiveness/Efficiency	Complexity
• Low price, volume and balancing risks • In spot market transactions, balancing risk may arise (this risk can be minimized introducing a "per area" mechanism) • Designed to create stable investment environment (although successive FITP design adjustments may decrease investors' confidence) • Predictable revenue streams • Help increase debt financing	• Effectiveness in terms of market growth is high (subject to compliance with RPO) • Sophisticated FIT design can reduce inframarginal rents • Allows for strategic support of different types of RE • No incentive for cost reductions (entire supply chain) • Overall cost of FITP may be high (depends on FITP design and market conditions)	• Effectiveness in terms of market growth is high (subject to compliance with RPO) • Sophisticated FIT design can reduce inframarginal rents • Allows for strategic support of different types of RE • No incentive for cost reductions (entire supply chain) • Overall cost of FITP may be high (depends on FITP design and market conditions)

Source: World Bank, 2011

Policy cost is a critical issue for renewable energy law drafters, but particularly so in developing countries. FITs have a reputation for being inherently "expensive" policies, largely as a result of the large volume of renewable energy capacity that has been built in Europe under FITs. In 2009, Germany spent approximately Euro 13 billion for electricity from FITs, of which close to 5 billion represented incremental costs above average wholesale prices (Van Mark, 2010).

Some developing countries may have appetite to try to follow Germany`s example. China, for example, has emerges as a leading international wind market and has installed more renewable energy capacity per unit of GDP than the US, Germany and Spain (Gordon et al., 2010). So, each government adopts radically different FIT designs to reflect their different policy goals, renewable energy targets and national circumstances (UNEP, 2012). Potential challenges of FIT policy must be considered before the approval.

- Firstly, administrative requirement: detailed analysis is required to properly set the payment level. Detailed analysis is required to properly set the payment level at the outset. The payment level must ensure revenues will be adequate to cover project costs. If the FIT payments are set too low, then little new RE development will result. And if set too high, the FIT may provide unwarranted profits to developers. To achieve the right balance across a wide range of technologies and project sizes, many levels of differentiation are used. As costs change and markets shift due to technological innovation and increasing market maturity, the FIT policy needs periodic revision to reflect evolving costs and market conditions (Karlynn et.al,. 2009).

- Secondly, FITs do not decrease a developer`s up-front costs, despite offering financial incentives for renewables. Policy makers enact investment tax credits, grants and rebates to reduce the high, up-front capital costs of RE installations that become integral part of market penetration. However, these mechanisms may not be effective at spurring broad market adoption, and they failed to provide stable conditions for market growth (Lantz and Dori, 2009).

- Thirdly, frequent updates to the FIT program structure can lead to policy uncertainty. The more uncertain the policy structure, even after few years, the riskier the RE investment is to the project financier. Consequently, investor mal leave the RE market and choose to invest in something else with less exposure to policy risk (Chadbourne & Parke, 2009)

FITs are difficult to define in a single sentence because they are a "package" of different regulatory and incentive policies, rather than just a single, stand-alone policy such as a tax credit or a rebate (Rickerson et al., 2011).

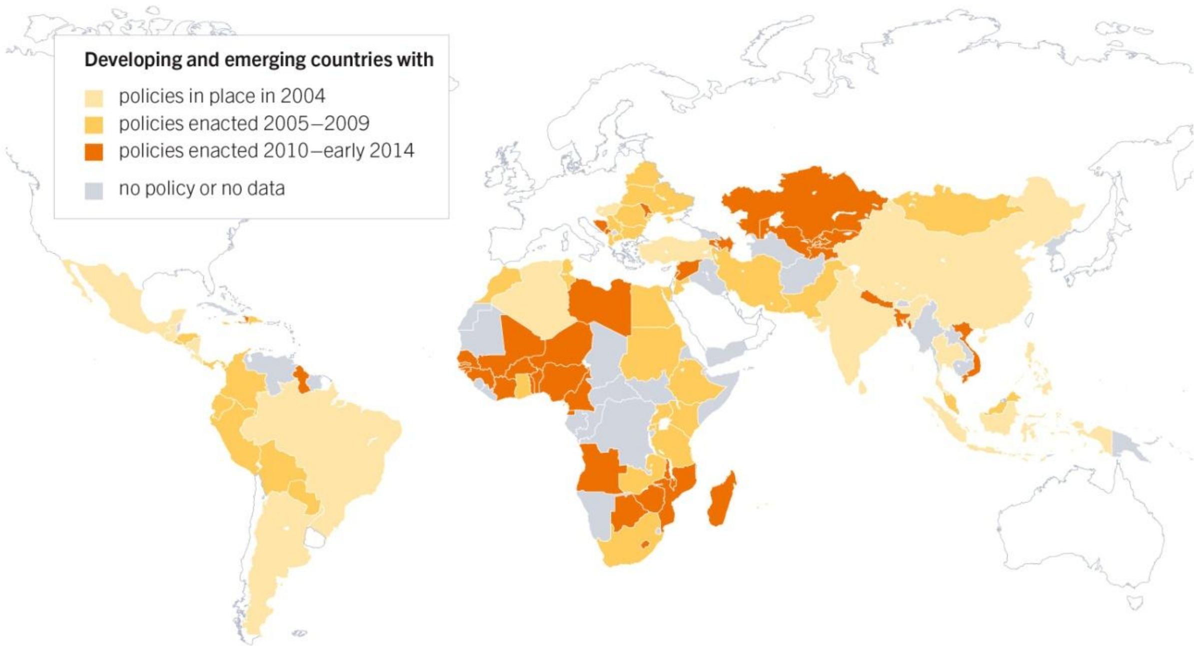
3.3 Current FIT methodology in emerging economies

When designing feed-in tariffs, it is important for policy makers to consider the interaction between the FIT and the existing market structure (UNEP, 2012). Developing countries represent a broad range of different electricity market structures, including state-owned monopoly utilities (e.g. in much of the Caribbean), single buyers that purchase power from IPPs (e.g. eastern European countries), and countries where wholesale power markets have been introduced (e.g. Argentian and Chile) (Besant-Jones, 2006). All actions oriented to renewable energy development end up with creation of FIT environment. Even cash premium of FIT can be reduced to zero – by technology improvements or the usage of other public financing mechanisms – the implementation of a strong enabling regulatory environment will remain a critical success factor. Analyzing various public financing mechanisms, we believe that non-manageable risks such as political risk or the counterparty risk can be a major hurdle for a positive investment decision from international investors (Deutsche Bank, 2011). In this case, countries will target providing financial incentives to make the renewable energy business models economically viable, rather than capital mobilization of huge investments.

While bankers have been vilified as the cause of one of the largest financial disasters, the renewable sector has been seen as the white horse for many governments looking to emerge stronger. Despite economic downturn, investment continued in the renewable sector largely in part to government stimulus programs that focused on developing green economies. Around the world, governments have allocated more than USD 430bn fiscal stimulus to key climate change investment themes. China and the United States lead the way (KPMG 2011).

Unless, countries set a governing regulations about achieving RE targets, it is hard to accomplish progress on sustainable development. World Financial Crisis 2009 convinced many developing economies that there is only one path to get rid of the climate change, financial crisis and massive unemployment all around the world. So, renewable energy policies are still being disseminated globally.

Figure 7. Developing and Emerging countries with Renewable Energy Policies



Source: REN21, 2014

- **Indonesia Feed-in Tariff Fund** which was developed by FMO and Agency of Netherlands to support geothermal development in Indonesia as the country possesses the world`s largest geothermal resources. The fund would seek to invest private equity in the form of $/kWh payments to geothermal developers. The payment would be structured to "close the gap" between the PPA contracts that the generators are awarded and the rates they need to meet their return expectations. As fossil fuel prices rise over time, the $/kWh amount paid to the generator would eventually exceed the fixed flat guaranteed by the fund. The generator would then repay to the Fund as a return on investment (Rickerson et al., 2011).

- **Global Energy Transfer Feed-in Tariff (GET FiT)** is the initiative of Deutsche Bank in response to a request from the UN Secretary General`s High Level Advisory Group on Climate Change Financing. The GET FiT concept outlines potential structures under which public sector resources can be used to "de-risk" renewable energy investments in developing countries (Deutsche Bank, 2011). The GET FiT concept envisions a flexible framework within which a range of different types of support could be provided to developing countries.

3.4 Feed-in tariff Optimization strategies

Ultimately, a low carbon development growth in the developing world depends on the availability of resources to finance the solutions that exhibit incremental costs while assuring FIT policy interacts and harmonizes with other regulatory mechanisms (World Bank, 2011).

a) The issue of cost recovery remains a critical issue for law makers in developing countries as they need to determine the most appropriate way to balance the potential cost of the policy against their capability to absorb them domestically. Currently, international climate finance is undergoing a transition while emergence of **new public private partnership** models might create new opportunities for developing countries as a rapid energy scale-up (UNEP, 2012).

b) Prof. M.M.Elmissiry states that nothing is more effective in the development of a renewable energy policy than learning from those countries that went through the same exercise, and to access their lessons learned and experiences gained (World Future Council, 2013). Accordingly, the FIT development scenario is the same but the design and pathways can be different. To optimize, **professional knowledge exchange, networking** is vital in order not to repeat the one´s mistake that might bring negative consequences in the volatile global economy.

c) In developing economies, investors mostly about hesitate about input technologies after the political matters. As the financial institutions focus on the FIT attractiveness, it is more effective to think about decreasing the investment-technology costs which makes the first impression of local market to investors.

Conclusion of Chapter 3

All stakeholders of renewable energy industry ranging from final customers to technology producers should be ready to take risk as regulatory issues are on the hand of Government. Spanish experience on cancelling FITs makes investors, business units to consider all ups and downs of budget related issues all around the world. Exploring new renewable energy markets can have more benefits compared to mature markets which have tendency to cancel all FIT incentives.

In the dissertation, FIT mechanisms of EU member countries are analyses as they have investment the highest amount globally. In my opinion, after several years, developed economies might learn from the experience of developing countries (i.e. China, India, Brazil) where the economy is not based on hedging and huge credits without guarantee.

CHAPTER 4. RENEWABLE ENERGY POTENTIAL OF DEVELOPING COUNTRIES: THE DRIVERS TOWARDS GREEN ECONOMY (A CASE STUDY FROM UZBEKISTAN)

4.1 Renewable energy for a green economy

Nowadays, the world is challenged by global warming, with some nations facing financial crisis, whilst other countries food scarcity. If this trend continues, the well off will become better off and the badly off will become even poorer. Therefore, we contend that the solution to this problem is the ‘green economy’. The majority of problems could be solved in developing countries with abundant natural resources, human capacity to lead and society following. For practical purposes, some core features of the green economy are completely reliant on renewable energy sources for:

1 greening the transportation system (i.e. hybrid cars);
2 greening the way of generating energy (i.e. solar PVs);
3 greening the job opportunities (i.e. creating environmentally friendly jobs).

If the geographic locations of developing countries are analysed, the majority are situated at high and medium solar radiation altitudes and the application of renewable energy technologies would return excellent results.

4.2 Economic benefits of green energy

The greening of the energy sector will require improvements to energy efficiency and a much greater supply of energy services from renewable sources, both of which will lead to a reduction in Greenhouse Gas (GHG) emissions and other types of pollutions in the long run. In most instances, improvements in energy efficiency provide net economic benefits. Global energy demand is simultaneously increasing in line with growing populations, income levels and technologies.

Greening the sector also could bring an end to 'energy poverty' for an estimated 1.4 billion people who currently lack access to electricity. Moreover, 2.7 billion people who depend on traditional biomass for cooking need healthier and more sustainable energy sources (IEA, 2010). Modern renewables offer considerable potential to enhance energy security at the global, national and local levels. In order to secure all these benefits, enabling policies are required to ensure that the investments are made for greening the energy sector.

4.3 Investment on renewable energy

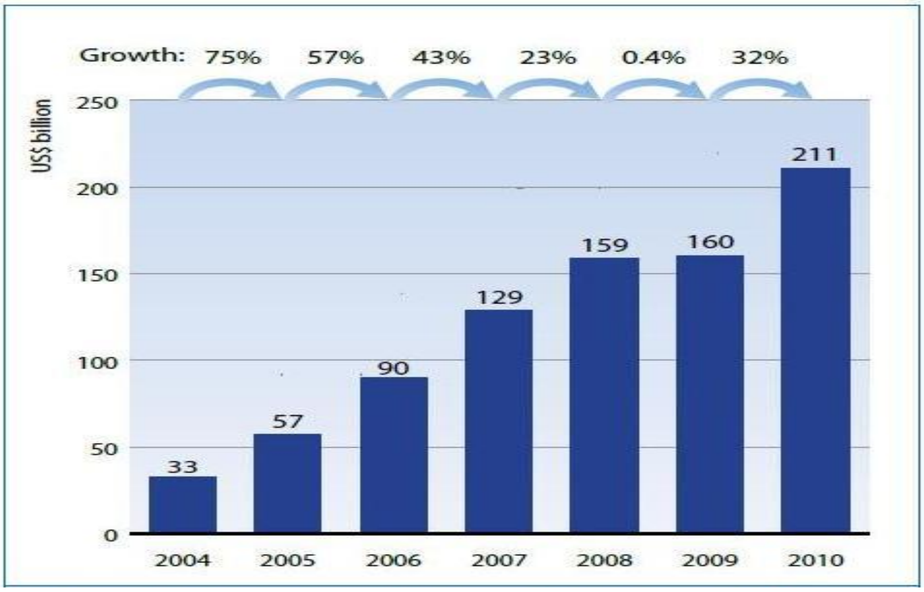
Some countries launched stimulus packages provided by discretionary fiscal packages to support the renewable energy industry in 2008 and 2009 (HSBC, 2009) . In the USA, for example, there were two separate packages, with a total of around US$ 32 billion allocated to renewable energy. South Korea and China also included renewable energy investments in their stimulus spending programmes. An estimated US$ 194 billion in green stimulus funding had been allocated to support clean energy globally, including renewable energy technologies, energy-smart technologies, carbon capture and storage, and transport (UNEP SEFI, 2011).

The investments in renewable energy in emerging economies have been growing rapidly since 2005 and the OECD countries accounted for almost 77% of the global investment in renewable energy. By 2007, however, the share of non-OECD countries had risen to 29% and further increased to 40% (Bloomberg New Energy Finance, 2011). In 2008, for example, China was the second largest country in terms of renewable energy investments after Spain, with the USA coming third. Brazil was ranked fourth, while India was much lower at the seventh position. China assumed the lead in 2009, maintaining this position in 2010, with US$ 49 billion in new investments in renewable energy. Overall, from 2005 to 2008, investments in renewable energy assets grew by more than 200% in OECD countries, but by more than 500% in non-OECD countries. In 2010, new financial investments in renewable energy by developing countries, at US$ 72 billion, edged past the amount invested by developed countries, at US$ 70.5 billion (UNEP SEFI, 2011). This recent rapid growth has led to predictions that the developing economies may well soon have larger installed renewable energy generating capacity than the OECD countries (ITIF, 2009).

Among developing countries, by far the largest share of investments in renewable energy has been in the three large emerging economies of Brazil, China and India, who together account for almost US$ 60 billion, or 90%. Other developing countries, while representing only 10% of the total, are also experiencing accelerated growth, with investments in Latin America (excluding Brazil) almost tripling, Asia increasing by almost a third and Africa fivefold in 2010 (UNEP SEFI, 2011). However, these investments tend to be concentrated in a limited number of countries. For renewable energy investments to expand on a large scale in other developing countries, major efforts are needed to develop infrastructure including transmission and distribution systems, improving the functioning of financial markets and other institutions, and providing a supportive incentive framework.

In addition, to installing significant renewable energy capacity, fast-growing emerging markets have also built up large equipment manufacturing industries in the sector, both for export to the global market and for local use. China has, for example, become the world’s largest producer of solar PV panels and solar water heaters. The government has supported investments in manufacturing capacity for renewable energies, for example, by establishing preferential electricity tariffs for the solar industry (IRENA, 2012).

Figure 8. Global New investment in renewable energy in $US Dollars



Source: UNEP-SEFI (2011)

Future economic growth is expected to be driven by emerging countries, led by China and India. However, they are expected to shift away from their current emphasis on export-oriented growth to more domestic demand-driven growth, as the growth of the labour force and rural–urban migration slows, leading to wage increases and as social safety nets are put in place or strengthened (UNEP, 2013). Increased consumption relative to savings will reduce global imbalances, but their GDP growth rates will also slow. The greatest resource-efficiency effort is required in the weaker developing country economies, where most of the population increases will take place, and where the economic and social impacts of resource scarcity and commodity price volatility will probably be most severe.

4.4 Renewable energy target of developing countries

A shift from fossil fuels to renewable energy can contribute to achieving ambitious emissions-reduction targets, together with significant improvements in energy efficiency. To reduce emissions to a level that would keep the concentration of GHGs at 450 ppm in 2050, the IEA projects that renewable energy would need to account for 27% of the required CO_2 reductions, while the remaining part would result primarily from energy efficiency and alternative mitigation options such as Carbon Capture and Sequestration (CCS) (IEA, 2010). A major part of the CO_2 reductions resulting from the promotion of renewable energy technologies would take place in developing countries.

The use of fossil and traditional energy sources in both developed and developing countries also impacts global biodiversity and ecosystems through deforestation, decreased water quality and availability, acidification of water bodies and increased introduction of hazardous substances into the biosphere (UNEP, 2012b). The impacts also reduce the natural capabilities of the planet to respond to climate change.

Figure 9. Renewable energy targets of emerging economies

	Brazil	China	Ghana	India	Indonesia	Morocco	South Africa	Tunisia	Thailand	Uzbekistan
General RE Target for 2020 (excluding large hydro power)	16%	15%	10%	14%	15%	20%	20%	25%	14%	20% (for 2030)
Current share of RES in electricity (for 2010)	86,3%	17,0%	68,8%	15,5%	8,8%	15,4%	5,0%	1,6%	7,8%	11,0%
Mainly: Hydro	121,6 GW	430 GW	2,3 GW	54,6 GW	0,5 GW	2 GW	7,7 GW	S/A	S/A	1,7 GW
Wind	11,5 GW	200GW	0,05 GW	17,6 GW	0,25 GW	2 GW	9,2 GW	2,7 GW	1,2 GW	0,1 GW
Solar	6,4 GW	50 GW	S/A*	20 GW	0,87 GW	2 GW	9,6 GW	1,7 GW	2 GW	2 GW

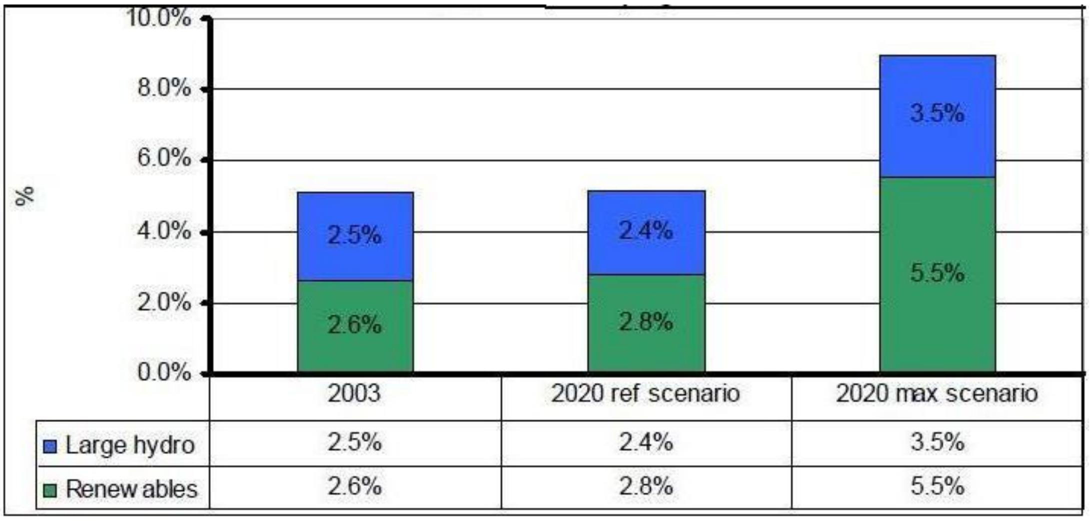
*S/A (Small Amount) - less than 0,01 GW

Source: GIZ (2012)

As can be seen, countries are forecasting future targets based on their resource capabilities. To achieve the targets for 2020, solar grid expansion method is applied as the lowest cost option in urban areas and more densely populated rural areas. Successful expansion has been achieved recently on a large scale in China, South Africa and Vietnam. Grid expansion at a regional level in Africa could facilitate hydropower trading among countries, thereby supplying low-cost power while reducing the continent's vulnerability to varying oil prices and its carbon emissions (World Bank, 2009).

An estimated US$ 194 billion in green stimulus funding had been allocated to support clean energy globally, including renewable energy technologies, energy-smart technologies, carbon capture and storage, and transport (UNEP SEFI, 2011). The transition to the green economy involves no less than a technological revolution and will have deep impacts on production structures as well as on consumption patterns.

Figure 10. Renewable energy and large hydro as a % of primary energy supply in 114 emerging and developing countries



Source: RECIPES (2007)

In all cases, given the fact that most developing countries will be technology followers, there is a need to develop global institutional arrangements that increase international cooperation and collaboration on research and development in all areas relevant for green growth, and accelerate the spread of those technologies to developing countries.

4.5 Development of renewable energy technologies in Uzbekistan

During the independence years, Uzbekistan has garnered a sufficient experience in the use of alternative sources of energy, particularly in solar, because the number of sunny days a year there amounts to 320, while the annual potential of solar power exceeds 51 billion tons of oil equivalent (UzA, 2013). According to the Decree 'On Measures to Bolster Alternative Energy Sources", several international economic ties have been established to 'green' the way energy is generated. This provides job opportunities and is a platform for transition to green economy.

With the support of ADB, the International Solar Energy Institute has been launched in Uzbekistan in order to boost the scientific research activities and to create a science hub for energy sciences in Central Asia (ADB, 2013). Tax incentives and stimulus packages for different industries encourage the flow of foreign investment and upgrading the local business climate mainly for innovation-based spheres. Hence, this economic policy serves to successfully disseminate innovations created at the Solar Energy Institute.

We propose that the government of Uzbekistan, however, has a strong interest in rapidly introducing alternative energy sources for a number of reasons:
The problem of hydrocarbon resources will grow after 2020 and will pose a threat to

- the country's energy security and its economic security as a whole by 2030 (an estimated 4.5 million tons of oil equivalent in 2030).
- According to the most pessimistic scenario, after 2020, Uzbekistan's production of natural gas will stop growing, and, further, based on rising domestic consumption, it will also require a cut in exports by 10 billion cubic metres in 2030 as compared with 2020.
- After 2030, in order to provide energy stability, Uzbekistan will have to substitute at least 12–13 million tons of oil equivalent a year (21% of the current energy balance) with alternative energy sources.

- The introduction of the widespread use of alternative energy sources will create thousands of jobs in high-tech industries.
- Solar energy will reduce carbon emissions and improve environmental conditions (Center for Economic Research, 2011).

When the current situation is assessed, the Shindong Enerkom company is completing the construction of a second plant for the production of silicon capacity of 5000 tons per year in the Angren Special Industrial Zone. Production of photovoltaic panels has been launched by the Navoi FIEZ, an Uzbek-Chinese company, and will start producing solar thermal collectors in Jizzakh Special Industril Zone. According to experts, the implementation of these measures will reduce the load on the grid by 2 billion kWh, to ensure local production of about 2 million Gcal of heat energy, which together will provide energy savings equivalent to more than US$250 million (Uzbekistan Today, 2013). The Russian oil giant Lukoil, in cooperation with the Asian Development Bank, is planning the construction of a 100 MW solar facility in Samarqand, which is expected to be enlarged to 1 GW (Business Insider, 2011).

Figure 11. Assessment of the prospects of transition to a 'green' economy

Direction of "greening"	Losses due to the lack of "green economy" in the sector	Proposed areas for investment	Desired level of annual investment	Payback period equipment	Benefit from the introduction of "green" technologies
Development of renewable energy sources	Losses due to missed opportunities to export natural gas = $ 4.664 billion Losses due to missed opportunities for additional financial resources through the sale of carbon credits under the CDM = $ 625.8 million	Installation of photovoltaic cells in the rural areas	$ 2,45 mln/year	2 years	- Providing electricity to remote rural settlements - The production of electricity and save the corresponding volumes of natural gas - Creating more "green" employment 175,000 jobs by 2020 and 270,000 by 2050
		The creation of large photovoltaic power plants in the energy sector	$ 40 mln/year	9 years	
		Introduction of solar consoles in boiler heating system	$ 22,5 mln/year	10 years	

The Center for Economic Research (2011) recommends the following actions to foster low-carbon, resource-efficient economy in Uzbekistan as a solution to current challenges of the industry:

- There is a focus on the three alternative energy sources that have the greatest potential, considering the conditions in Uzbekistan: solar energy; the hydraulic energy of small rivers, canals and reservoirs; use of alternative fuels (liquefied gas and electric energy) for motor vehicles.

- Adopting the government programme to stimulate and introduce alternative energy for the period 2012–2030. The programme is recommended to suggest the main milestones and targets for the share of alternative energy sources of 3–7% in 2020 and 21% in 2030.

- Providing legislative, institutional, financial and information support for the significant implementation of the selected alternative energy sources.

- Establishing a special government body under the ministry of the economy to be responsible for the implementation of alternative energy sources in Uzbekistan.

A study by Ocampo and Khor (2011) revealed that there are diverging estimates of the resources needed for the transition to green economy. The Green Economy Report proposes a $1.3 trillion (2% of world GDP) target for green (public plus private) investments (UNEP, 2012a).

For this reason, an investment-based strategy is essential to manage the transition to the green economy in the case of developing countries. Two pillars of the strategy include public investment and production sector (industrial) policies, aimed at encouraging in both cases a strong private-sector response. The latter should include a strong technology policy with a focus on adaptation and dissemination of green technologies and the treatment of green economy activities as ‘infant industries’ that require appropriate support (time bound subsidies and/or protection), and government procurement policies that mainstream environmental criteria. The former should include public sector investments that support these industrial policy efforts and build the necessary public sector infrastructure, as well as access targets for basic energy services among underdeveloped nations.

Conclusion of Chapter 4

The substantial potential of renewable energy sources could make a major contribution for enhancing the green economy in developing countries. As the economic potential of developing nations is increasing, the platform, mechanism and infrastructure could be shared in order to stimulate the use of renewable energy technologies in both the public and the private sectors.

Furthermore, it is essential that priority is given to public sector infrastructure investments which are critical to the transition to the green economy, mainly for electricity as it is required by all infrastructure companies. Several countries may prefer to keep the control of these sectors under the government rather than as public–private partnerships or as a fully private property. International allocation of funds should fully respect national decisions in this area. Infrastructure investments are, of course, critical for directing private sector investments in the desirable direction ('crowding-in' private investments and 'locking' them in the direction of green investments). They may also demand a specific time profile, requiring in particular major upfront investments. If there is a decision to undertake these investments by the private sector, due account should be made of the allocation of risks. In Uzbekistan, the infrastructure and legislation of renewable energy market is developing, and the risk and return should be considered for maintaining long-run sustainable development in renewable energy in order to ensure an effective transition to a green economy.

Overall conclusion

Based on the empirical research methodology and cross-country analysis on the research questions leads me to summarize that econometric tools gained after application of STATA, MATLAB are very essential on decision making to each country. When it comes to choose country for identifying exact, precise “green” direction, several macroeconomic (i.e. employment, GDP) and microeconomic factors (i.e. price per capita) should be accounted. Unless, the emerging economies don`t analyze and learn the successful and ineffective fiscal policies of green economics, there is no guarantee for sustainable development in third countries. Importantly, mistakes must not be repeated as it causes alarming problems in a globalised world. Climate change, energy efficiency and preserving nature should be the first priority of fiscal policies in developing countries. In the case of ineffective fiscal approaches, these countries will be the first victim as they might have quite lower economic development and political instability compared with emerged economies.

Based on the experience of Singapore, many tax incentives, stimulus packages should be provided to renewable sector that leads to diversification of energy supply process as well as providing energy security in developing countries. Modern industries with a weak competition (e.g. recycling, food processing) can be offered periodical tax exemptions to upgrade the business environment, however in competent industries (e.g. logistics, tourism, financial institutions), tax incentives lead to create business hub in the territory of Uzbekistan.

The price of natural gas and electricity should be increased significantly to foster loss reduction and efficient energy consumption. The loss reduction and efficiency improvement policies should serve as a target when defining the new cost-recovery prices. Hence, the price of natural gas could include the expenses of modernizing the turbines of the TESs that would save 15-20% of the natural gas which is being spent on electricity generation. The price of electricity could be increased to a level where the overall electricity loss of 17% will be decreased at least to the world average rate of 7%. The fact that price related changes have a belated effect should also be taken into account when applying these measures.

For more precise estimates, a disaggregated demand study needs to be carried out with the aim of identifying the properties of each energy consumer groups. The inclusion of different traditional/primitive sources would add more value to the study. Last, but not the least, the issue of supply side being not perfectly elastic in the transition and developing economies should be inquired further.

To encourage, support new participant in renewable energy market of developing countries, various mechanisms are vital: Feed-in tariff, Quota obligations, Tradable renewable energy certificates, Premiums, carbon taxation green banking and so on. All stakeholders of renewable energy industry ranging from final customers to technology producers should be ready to take risk as regulatory issues are on the hand of Government. Spanish experience on cancelling FITs makes investors, business units to consider all ups and downs of budget related issues all around the world. Exploring new renewable energy markets can have more benefits compared to mature markets which have tendency to cancel all FIT incentives.

In the dissertation, FIT mechanisms of EU member countries are analyses as they have investment the highest amount globally. In my opinion, after several years, developed economies might learn from the experience of developing countries (i.e. China, India, Brazil) where the economy is not based on hedging and huge credits without guarantee.

The substantial potential of renewable energy sources could make a major contribution for enhancing the green economy in developing countries. As the economic potential of developing nations is increasing, the platform, mechanism and infrastructure could be shared in order to stimulate the use of renewable energy technologies in both the public and the private sectors.

Furthermore, it is essential that priority is given to public sector infrastructure investments which are critical to the transition to the green economy, mainly for electricity as it is required by all infrastructure companies. Several countries may prefer to keep the control of these sectors under the government rather than as public–private partnerships or as a fully private property. International allocation of funds should fully respect national decisions in this area. Infrastructure investments are, of course, critical for directing private sector investments in the desirable direction (‘crowding-in’ private investments and ‘locking’ them in the direction of green investments). They may also demand a specific time profile, requiring in particular major upfront investments. If there is a decision to undertake these investments by the private sector, due account should be made of the allocation of risks. In Uzbekistan, the infrastructure and legislation of renewable energy market is developing, and the risk and return should be considered for maintaining long-run sustainable development in renewable energy in order to ensure an effective transition to a green economy.

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