Chapter – 2

Review of Literature

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2.1 Introduction:

Energy is a necessary requirement for economic as well as social development of any nation. The demand of energy is going to be increased with increasing industrial activities, population growth and agricultural developments in the country. During the last decade several new concepts including introduction of renewable energy sources have emerged. The increased energy demands are thus, met through the widely available natural renewable energy resources such as solar, wind, bioenergy and small hydropower and or helps in reducing gap in supply –demand so as to meet the future energy demand in India. This chapter provides a quick over view of various empirical literatures available on the subject of renewable energy potentials, renewable energy policies, regulations and constraint, cost competitiveness, SWOT analysis etc based on renewable energy projects particularly utility scale solar PV projects and wind power projects with emerging issues related to the development in the renewable energy sources, technologies and projects. The literature on the subject matter is very large and hence it has been delimited to review some important literatures to outline the core issues.

The literature review is a previous work in the field of present study, review the critical perspective on the relevant literature including conclusive findings on the related subjects. The in depth literature review helps in identifying the research gap that will attempt to address and established to determine the focused problem of study on which research is to be conducted.

The literature review is presented in three sections:

- Section one provides a emerging literature on renewable energy sources and renewable energy development relating to global, national and state,
- Section two provides a scan of National & global renewable energy policies and regulations, renewable energy projects investment, risk, barriers & constraint and
- Section three deals with a present picture of the Renewable energy development issues, challenges, cost competitiveness and analysis etc

(Section I)

2.2 Literature on renewable energy sources and renewable energy development relating to global, national and state

P. F. Rabia Ferroukhi (2018) studied provides insight into development options to support the renewable energies starting with scale up of renewables impulse by technological innovation, market competition, sharp cost reduction supported by enabling policies, updated status to achieve the global targets with remedial measures to integrate the variable nature of growing renewable production to the power grid considered the mature cost-effective technology, however certain market challenges hampered the development. Reported that the investments in the renewables relied by regulatory policies like quotas, obligations, financing instruments supported by fiscal and financial incentives & tradable renewable energy certificates but the stringent framework to monitor and penalize non-compliance, measures according to changing market conditions like reducing cost needs auction policy which tends to further reduce cost of utility solar & wind projects. The policy instruments based on specific country conditions, changing market status, technology, and objectives to achieve for respective country, emerging challenges for integration of grown variable renewable energy to operate the network in a cost-effective, reliable and safe manner which is technically feasible, financially attractive and recognized by all stakeholders is to be needed.

Mohamed (2018) studied the present situation of energy, future demands, the available renewable energy resources, challenges faced to tap the existing renewable energy potentials and strategy to meet the increased energy demand by increasing the total installed capacity of renewable energy by 2030. The supportive legal frame work is designed for development of renewable energy projects to increase generation capacity which sets the private investment with introduction of major innovations and opportunities for competition of renewable energy production and capacity to export the generated renewable energy.

IBEF (2018) reported that GoI looking to the huge potential of sunshine most of the year, aimed for achievement of ambitious target of 175 GW by 2022 as per the Paris Agreement and expect to overachieve target to meet 40 per cent of power demands by 2030 & 49 per cent by 2040 with recent increased competition, increased FDI inflows & adoption of competitive bidding through reverse auction strategy, tariff bring down record low of Rs2.43 (US$ 0.037) per unit in December 2017 for wind projects & Rs2.44 (US$ 0.04) per unit in May 2017 for solar projects, indicated that renewable sector turning to attractive from investor perspective, immense growth drives of favorable policies, incentives and initiatives of priority sector lending, soft loan from the government and improved market economics, results in second ranked in the Renewable Energy Attractiveness Index 2017, facilitates to tap the huge untapped commercially exploitable resources more than 900GW viz. Solar energy-750 GW & Wind power-102 GW.

Rakesh Shah (2016) presented the potential of about 750GW solar power with use of 3% wasteland area (NISE) and solar radiation of as high as 4.5-5.5Kwh/m2 in most of the area for more than 300 sunshine days, solar potential in Gujarat having 36 GW and more than 300GW of wind power, out of which only about 5GW solar projects & 25GW wind projects are achieved in India up to Dec 2015, indicates that huge untapped potential available to be harnessed. Reported that for achieving government target of 100GW solar projects, the Ministry has approved 33 solar parks in 21 states with aggregate capacity of about 20GW, planned Green Energy Corridor with strong grid interconnection scheme, utility scale renewable projects driven by policies & regulatory supports, REC, RPO/RGO, envisaged to promote solar wind hybrid MW scale projects to reduce cost of land, evacuation, grid stability however the challenges posed in the Renewable Energy developments includes capital & land regulation, approvals, development of domestic manufacturing capability, uncertain in policies, financing issues.

Savita Lolla (2015) studied the issue of seasonal scale resource intermittency in renewable energy projects which prevents large scale deployment of solar and wind resources as energy availability depends on meteorological and climatological conditions. However, author attempted to address the issue of intermittency by offsetting the variability of solar & wind project. The study concluded that the solar

power is available in all grid for most of the year while wind power is available in useful amount only in southern and western grid only for part of the year, the peak solar energy generates as early as march in the south grid but as late as July in northern grid while the peak wind energy generates during the monsoon due to strong southwesterly winds only in the southern & western grids. Finally concluded that the grid connected solar and wind energy projects potential to feed five regional power grids in India and the variability of generation for both solar & wind resources driven by the annual solar cycles and the southwestern monsoon however the offset is only viable in the northern grids, implied that both resources intermittency in the other grids addressed only by utilizing back-up power sources and operational challenges.

IRENA (2014) provides a roadmap for doubling the global share of renewables in the energy mix by 2030 and focus on five specific areas related to doubling the global share say, pathways based on the national plans global countries, Socio-economic impacts, Current situation & developments upto 2030 with implementation of all options, Improvement needed to improve the existing policy framework and opportunities for international co-operation of various governments. The report summarized the fallen of technology costs significantly and further continue to decline through technology innovation, competition growing markets, and regulatory policy streamlining. However, for transition beyond a doubling of the share of renewable power, it needs intensified research & development, quality control, technology co-operation and project development capacity.

Kolhare (2012) presented that the consumption of electricity increased rapidly due to social, technological & economic development, created huge gap between demand & supply that energy gap bridged by utilization of huge renewable energy sources available through research & development in the field of renewable energy technologies and implementation of renewable energy projects. It is highlighted that among the world, India is the only country to have exclusive ministry for renewable energy development realized the need since 1970s, established a Commission for Additional Sources of Energy (CASE) under the Department of Science and Technology, in 1981 to promote research and development activities in the field of renewable energy, further incorporated in 1982, with the newly created Department of Non-conventional Energy Sources (DNES) subsequently full-fledged Ministry for

Non-conventional Energy Sources (MNES) re-christened the Ministry of New and Renewable Energy (MNRE) in 2006 and encouraged the grid connected renewable energy projects by providing necessary regulatory and financial supports and facilitates stake holders for power purchase agreements. Finally, concluded that ``India can meet all energy needs with Renewable Energy Sources``.

Soni (2010) in their paper `Unleashing the Potential of Renewable Energy in India`` suggested a few implementable measures that India can consider to tap its vast unharnessed potential. The note shows the key legislation and increases in renewable energy capacity, 1993/94–2009/10. It states that there is a tangible impact of policy and regulatory initiatives on the renewable energy growth, however there is need for adequate capital cost benchmarks, periodic indexing of input prices, and harmonization of investment assumptions used to arrive at acceptable returns for renewable energy investors. The multiplicity of laws, regulations, and agencies governing the renewable energy sector makes integrated intervention difficult and undermines investor confidence. The note also focuses & categorizes barriers as financial viability issues, regulatory hurdles, and lack of support infrastructure.

(Section II)

2.3 National & global renewable energy policies and regulations, renewable energy projects investment, risk, barriers & constraint

Labanya Prakash Jena (2018) developed a business case for institutional investors to invest into the renewable energy sector in India. India needs to mobilize around ~USD 450 billion of financing capital over 2016-2040 to meet its national renewable energy target.

The paper identify the key drivers for renewable energy investments in India, explores the alignment of the investment criteria of institutional investors with renewable energy and finally discussed barriers to renewable energy investments as well as strategies to overcome these barriers. The key barriers identified for investors include off-taker risk, regulation, lack of adequate liquid financial securities, limited understanding of the renewable energy sector and currency risk, lack of adequate size of investments for foreign institutional investors. The paper outlined some initial potential solutions from the policy, regulatory, and investor perspectives, like creating a mandate to assign green ratings in addition to credit ratings for financial securities, developing risk management frameworks to manage climate risk, Invest in forward-looking, theme-based avenues and finally also suggested for further research.

Anand Kumar (2018) Ministry of New and Renewable Energy, GoI, said at a press conference in New Delhi, that India needs $125-billion investments to more than double its renewable energy to the targeted 175 gigawatts in four years as the nation looks to move to cleaner energy. The Indian renewable sector has been largely supported by private players and now the Government and state-run companies, public sector units like Coal India Ltd. and NTPC Ltd etc will also invest. The Government stated to engage in innovative ways of financing renewables as last year, raised $300 million through masala bonds and plan to do at least a similar number this year. To achieve the target of 175 GW by 2022, India will auction 30 GW each of solar capacity and 10 GW each of Wind in 2018-19 and 2019-20.

Tim Buckley (2018) study report ` Electricity Sector Transformation in India A Case Study of Tamil Nadu` provided an excellent study for the potential to transform a regional electricity system, progressively increasing reliance on renewables while

lowering average cost of electricity supply to meet the India`s ambitious plans for lower cost alternatives and doubles renewable energy installed capacity over the coming decade. Tamil Nadu renewable projects representing 35% of installed capacity as of March 2017 which is almost one fifth (18.5%) of India's total renewable energy generation in 2016/17. The report forecasts that total solar installed capacity increases six fold to reach 12 GW of utility scale by 2027 which is lower than reported targets to set up 500MW and more capacity of 25 solar parks totaling more than 20GW due to Discom`s financial distress and regulatory credibility lowered Investor Interest by not signing the PPAs of solar tender auction winners of Feb 2017 and force to reduce rate from the winning bid of Rs4.40/kWh to just Rs3.47/kWh, the rate tendered in the subsequent auction. There is risk of solar cost increases due to payment delays by TN Discom, Land Acquisition Risk, Lower Solar Radiation risk of acquired land for solar parks, the land acquisition responsibility lies on developers, causing undue time delay and increases capital risks, the lack of contractual protection from grid curtailment risks particularly for higher priced PPAs and non-implementation of must-run status for renewable projects. However as of March 2017, Tamil Nadu one of the largest states in the world in terms of operational wind farms of 7.85 GW and saw record low tariff of Rs3.42/kWh in Aug 2017 wind tender auction. The report models a near doubling to 15.0 GW of operational wind by 2026/27 by adopting latest technology 100/120 meter wind turbine, most-efficient corporate structures and procurement processes, including end-of-life wind renewable projects.

IRENA & NREA (2018) along with NREA Egypt studied the existing renewable energy policies, regulatory mechanism for the development of renewable projects, particularly for solar and wind projects and identified the challenges and limitations restricting the deployment of renewable projects also, recommended strategies to meet the identified target with least cost approach, large scale projects recommended to mitigate risk, ensure financially viability, cost competitiveness, streamlining of policies & regulations, empower the NREA (New Renewable Energy Authority) as a national level facilitator and "one-stop shop" to achieve the renewable energy project targets.

Jose(2018) focused on searching availability of waste space for power generation from the renewable sources such as solar & wind, identified the available unused potential of various renewable energy sources in different states of India, summarized the present status, policies, and various barriers & constraints of renewable projects. Though, India has high intensity and solar radiation at most part of the country with abundant, free potential of wind, only few percentage of renewable energy utilized, hence vast development & investment scopes but certain constraints prevent renewable projects such as environmental and ecological constraints, institutional barriers like lack of infrastructure, roads, grid connectivity, technology barriers, financial constraints, Political and policy barriers, credit availability, market related barriers, land acquisition etc. resist the growth of renewable projects, suggested simplified new project approval, common national policy, financial schemes & fiscal incentives, encouragement of research & development, training programs and indigenous technology development for accelerated development of renewable projects.

IBEF (2018) represented large scale government initiated expansion plans considering the robust growth of renewable energy by creating favorable policy environments by permitting 100 percentage FDI, creates attractive opportunities and results in arrival of ambitious renewable projects and increasing investment across the value chain, growth driver includes government policies like repowering policy, solar hybrid policy, schemes of solar parks for ultra-mega solar power projects, government initiated Zero import duty on capital equipment & raw materials, Low interest rates & Priority Sector Lending, Single window approval system, Tax exemption and capital subsidies, scheme for 25 years PPA/PSA. Analyzed the porter's five forces framework shows positive impact that due to relatively new sector competitors establishing, the renewable sector at immature stage of competition hence competitive rivalry is quite low but high negative impact that high threat of substitutes as long as other nonrenewable sources of energy remain cost-effective.

Dr. Arunabha Ghosh (2018) Studied the renewable energy sector from the view of investors perspective, evident increased attractiveness and declining risk perception of stockholders envisaged maturity stage as reflected by reverse auctions system of

tariff discovery and competition influenced by dynamic policies, waiver of interstate transmission charges, mitigate off taker risk by long term power purchase agreement & must run status, increased policy level interventions, facilitation in supporting infrastructures, however, analyzed that the renewable energy projects attractiveness varies from state to state due to different policy measures at State levels resulted in negative impact on investment, examined the evolving risk of policy & financial regulation on the renewable investment, the imposition of safe guard duty/anti-dumping duties on imported PV modules created uncertainty among the stakeholders and hinders the momentum of renewable project, risk of unavailability of transmission infrastructure or curtailment/ backing down, increased competition created the stage for with drawl of exemptions such as 'must run' status. Concluded that the renewable projects capacity increasing since, but still needs review of risk associated with projects and evolving in future to stimulate the growth of renewables projects enables to reach the ambitious target in time, risk mitigation through financial & policy regulations, Strengthening transmission and distribution infrastructure, developing scheduling and forecasting capabilities and highlighted the need for mobilizing finance through innovative instruments.

Veena Jha (2017) studied that the development of solar and wind industries largely depends up on the government policies & supports, manufacturing renewable projects equipment in developing European countries no longer a viable option, even countries with indigenous capacity like India & Brazil finds uneconomical for domestic content requirements (DCR) solar photovoltaic (PV) modules, other challenges includes the financing, inadequate grid connectivity due to decentralized renewable projects, DCR condition for loan in case of solar discourage the investment, however the same is encouraging in case of wind projects for lowering down the cost of projects evident that the policies promoting renewable projects creates conflict in trade development. Concluded & recommended that the countries frame the high but realistic, renewable energy targets with implementation plan supported by comprehensive set of consistent & un contradicted policies & regulatory mechanism in time bound phase wise manner,

Amit Kumar, Sapan Thapar (2017) studied to address the challenging land issues posed to both the policy makers as well as the project developers, for the development of utility scale renewable energy projects in India as till no comprehensive land utilization policy at national or state level leads to time consuming process for approval, lack of digitalization of records creates tedious procurement, state wise different land policies & land ceiling limits, being higher cost of land the best practice of lease option for private land and revenue land witnessed reduces cost for setting up solar/ wind project, also land requirement influenced by factors like wind speed, longer blade, topography, increased turbine capacity and hub-height technology for wind project and latitude of the location, solar insolation, topography, increase module wattage & upgraded technology means increased efficiency for solar projects tends to reduced land requirements for project. Concluded that land being constitutionally in state list holistic policy on land utilization to be developed by state governments, digitization of land records, development of model land lease policy, project commissioning within the stipulated period, or else land allocation to other developers, uses of brownfield lands, encouraging land neutral system, use of Limited Liability Partnership (LLP) business model where land-owners become stakeholders in the company to the extent of their land value contribution with commensurate returns, identification of waste / barren land to superimpose on the Solar and Wind Atlas to earmark areas for setting up of solar and wind projects to maximize use of waste/barren lands.

J. S. Rabia Ferroukhi (2017) focused on the rapid and continue increase of global renewable energy capacity and output at an unprecedented pace which set in motion a rethinking, or transformation, of the global energy system. It estimates that a doubling of the share of renewables to 36% by 2030 is technically feasible and economically viable, which can be reached with available policy, investment and innovation interventions. The report also focus 0n the latest developments in policy, finance and technology that collectively drive the energy transformation. By the end of 2015, 173 countries had established renewable energy targets at the national, state or provincial level and nearly 150 have enacted policies to catalyze investments in renewable energy. As the renewable energy sector matures and expands, policies trends are being gradually shifted to suit changing market conditions from tariff based to auction. At the end of 2016, at least 67 countries had held such auctions, up from only

six in 2005, resulted in record-low prices for both solar PV and wind power to the tune of USD 30 per megawatt-hour. For scaling up of investment, shift from traditional public financial instruments (e.g. grants and loans) toward risk mitigation instruments such as guarantees that cover political, currency and power-off take risks. New capital-market instruments such as Green bonds, Yield Company (yieldco), pension funds, particularly in Europe, are an instrument that helps to mobilize equity finance for renewable energy. New business models like leasing, energy service companies (ESCOs) are reducing financial and other long-term risks.

Manpreet Singh (2017) Assessment of Sri Lanka's Power Sector study contributes towards the realization of Sri Lanka's 100% electricity generation through renewable energy targets by 2050 of which Long Term Generation Expansion Plan (2018 - 2037) is developed by the Ceylon Electricity Board (CEB). The real challenge expressed lies in creating a de-risked policy environment, innovative financial models and practices to attract investment at scale in the renewable energy sector which needs to identify a holistic development pathway while aiming for a true paradigm shift. The estimated total investment to the tune of US$54-US$56 billion is needed with various risk involved as Off-taker risk, Evacuation risk, Currency risk, Regulatory/Policy risk, Return risk lack of renewable energy sector awareness, Lack of intermediaries, Lack of liquid instrument to invest in RE, Low credit rating of operational assets which required several financial instruments have to be designed to address the risk perceptions of investors. While Sri Lanka currently does have multiple financial policy interventions for the increased adoption of RE such as feed-in tariffs and net metering among others, which have been unable to garner the level of interest required to transition to a 100 percent RE sector however unattractive for potential investors. The plausible financial interventions needs to be introduced are Generation based Incentives (GBIs), Price Premiums, Generation Tax Credit (GTC), Investment Tax Credit (ITC), Interest Rate Subvention (IRS), Duty Exemptions, Capital Subsidy, Soft Loans, Competitive Bids and Auctions, Renewable Energy Certificates (RECs), Grant Programmes etc.

Rachit Srivastava (2016) in their research article `Solar Power – Current Status, Challenges and Policies in India` concluded that some extra effort is required in terms of reviews existing government act, regulatory policies support and subsidize for

development of solar projects. The authors pointed out their concern regarding various barriers and challenges as dependence of energy on weather conditions/ availability of solar radiation, huge land area required for utility-scale projects, energy sources is intermittent even though required huge investments to the tune of about $40 billion to achieve a capacity of 60 GW for utility scale projects by 2022,sourses of international funds too law, serious storage problem increases cost, less availability of power grid infrastructure for transmission smart supply and demand management.

IRENA (2016) Roadmap for a Renewable Energy Future, 2016 Edition described that the adoption of the Paris Agreement 2015, United Nations Climate Conference marks a turning point in the global energy transition to renewable energy, also shows how the world can double the share of renewable energy in the energy mix within this timeframe along with perspective on the opportunities and challenges that lie to achieve it. The year 2015 saw record highs in renewable energy investments, with solar photo voltaics (PV) and wind capacity additions at all-time highs as renewable energy today among the most cost-competitive options for power generation and prices for equipment and installation and project finance all continue to decline, simultaneously banking sector has recognized the reliability and low operational costs of renewables and has responded by offering interest rates at record lows. This roadmap provides a global assessment of different pathways to a secure and sustainable future through a positive, growth-oriented and economically beneficial energy transformation. . The Remap focuses on five critical areas, planning transition pathways for development of national plans and targets, creating an enabling business environment with energy prices that recover external costs, ensuring the smooth integration of renewables into existing infrastructure, creating and managing renewable energy knowledge, and promoting continuous innovation.

Angel Gurría (2016) studied the policy and market fragmentation constrained the financing and investment in renewable energy projects, in spite of increased cost competitiveness in renewable market makes scaling-up investment critical, hinders the growth of bankable projects and affects the risk-return profile of renewable energy projects. This report identified policy misalignments such as investment policy, competition policy and electricity market design, trade and financial markets policy and reviewed the market constraint in financing & investment with reference to

present trend in renewable projects and concluded that say inconsistent trade and investment policies hinders the cross-border trade and investment in solar & wind projects, domestic content requirement (DCR) effects the global value chain, fragmentation in transmission infrastructure barriers the integration of renewable energy, finally concluded that policy makers needs to address the investment obstacles in order to grow sustainably renewable projects.

Liz McDaid (2016) studied that the increasing opportunities for investing in Renewable Energy projects in Africa to enhanced energy security, the attractiveness of the renewable market driven by regulatory framework and market design scheme of "one stop shop" but reported that enabling incentives not required for solar PV project and onshore wind projects, even increased renewable portfolio leads to decreased pricing. 600MW "Scaling Solar" projects in Zambia, one of the initiatives taken by World Bank Services focused to boost viable markets for solar power projects. Concluded that in spite of opportunities, the challenges and barriers are risky investment with costly regulation and application procedures, in order to transform challenges into opportunities to promote investment in renewable projects, South African countries like Uganda and Tanzania addressed the risk mitigation guidelines under section "Must Know and Must Have" for investing in renewable projects.

Dickson, Cora (2016) reported that the renewable energy sector stands most vibrant, dynamics and transformative industry among the global evident by fast technological up gradation, dramatic cost reduction, large scale development of projects, global supply chain and fostered by global investment support drive investment in almost all global market including United States. Provided insights on key trends of eight case studied countries, scope of developmental opportunity, international export opportunities based on unique driving factors and key challenges for the investors, developers, exporters for effective participation in global market. Exhibited over all sector ranking with noteworthy changed is the emergence of India as an attractive market for solar however renewable energy projects is driven by policy hence any changes in policy have impact on cost competitive & attractiveness of market as happened with reverse auction process to bid lower rate by developers but provides a long term income from project.

Makwana (2016) analyzed the significant internal and external factors that have an impact on solar power production in the state of Gujarat, which blessed with 300 sunny days and high solar radiations encouraged solar power generation projects for socio-economic development, especially in the barren wasteland areas of backward regions helps in creating employment & livelihood for the local population and potential to transform into an 'Integrated Solar Generation Hub'. They studied the major concern of policy and infrastructure barrier as well as threat of hazardous waste material management and its recycling process issues in future.

Megha Kaladharan (2015) analyzed the existing constitutional and regulatory framework for the renewable power sector. The introduction of Electricity Act, 2003 marked paradigm shift in the Indian electricity sector provided several enabling provisions, with emphasis to promote accelerated development of renewable source based power generation & globally competitive model. The center set a five-fold increase in renewable energy targets of 175 GW by 2022. It is explained that the electricity being a concurrent subject under seventh schedule of constitutional structure, Entry 38 in List III, both Centre and states legislate power and have no clear judicial demarcation prevents the Centre from realizing its target without the support of the states and even can`t penalize non-compliance or implementation by the states. Lastly, concluded that the policy shift may be in real stake holder's interest by framing center & states power and the targets shall be based considering on state-specific realities with addressing of inefficiencies.

Daphne Mah , Jasper Ip (2014) in their working paper `a case study of the development of renewable energy in the Hong Kong-Guangdong region in China` studied how and to what extent Guangdong regional energy collaboration approach contributed to renewable energy development, examined the relationships between regional energy governance and technological innovation, identified three dimensions that affect technological innovation at a regional scale as the potential collaborative benefits, prioritized options and perceived critical barriers and knowledge gaps by adopting a bottom-up engagement approach, using data drawn from a desktop study provided generic background information for investigation and a series of stakeholder engagement activities focused on three prioritized options as technological options,

business and financing options, and policy and governance options relating to regional collaboration for renewable energy in the Hong Kong-Guangdong region. The analysis provided valuable insights into the perceptions of major stakeholders and offers policy recommendations to improve regional energy governance, recognized the prioritized areas for policy change as need to adopt a regional and systemic approach, a joint vision, more effective regional energy institutions, and a review of the existing regulatory frameworks particularly, electricity tariff reforms and market structures to fully realized the renewable energy potential.

Ina Meyer (2014) Concluded that the increased deployment of renewable energy projects into the energy mix of different countries indicates positive net effects of employment creation derived positive contribution to the labour market thereby reducing unemployment sound justified both, socially & economically for public engagement in renewable energy deployment. It is emphasized that European and overall world market facing rising youth unemployment issue. The direct job assessing methodology used was the supply chain approach & employment factor approach takes into account different phases of the life cycle, such as R&D, manufacturing, construction and installation and O&M, economies of scale and tend to decline with technology maturity, indicates the number of jobs created per unit say installed capacity or produced energy expressed as megawatts (MW) or megawatt-hours (MWh) for electricity generation, heat production or fuel supply, in case of wind energy the array of employment factors taken ranges from 8 jobs/MW to 13 jobs/MW. Study revealed that employment influenced by operation and management (O&M), the technological development, manufacturing facility, share of export & import, renewable energy potential in the market, investment strategies, and support mechanism.

Swami Prakash Srivastava (2013) concluded in their study that India's solar market could be worth billions of dollars over the next decade due to enough solar potential and improving support environment, forecasted a $6 billion to $7 billion capital-equipment market and close to $4 billion in annual revenues for grid-connected solar generators over the next decade, Project execution, financing, and localization are crucial as number of projects and players increases, procurement effectiveness with low-cost (and often innovative) financing required. Local players will dominate the

downstream side in the initial years which includes project development, installation, and distribution with the given uncertainties within the sector. Success in solar energy will require a long-term commitment and a sound understanding of local dynamics.

Echegaray (2013) research has been instrumental in developing the first large-scale public grid-connected Megawatt Solar PV project in Brazil, identified public's beliefs and level of acceptance for renewable energies, and eco-label scheme proposed. The study indicates that expectations for return on investment are affected by a sustainability penalty, as well as by price and adaptation barriers. It revealed that Brazil an ideal site for solar energy production (EPIA, 2010; IEA, 2010), has a large numbers of sunny days, optimal radiation intensity, and a wide geographic area with favorable decreased in solar equipment & installation costs and acceptance of corporate customers, stakeholders and opinion makers of business community both wind and sun power project.

Steve Sawyer, Nicolas Fichaux (2013) investigated, identified and reviewed the significance policy and regulatory framework that contributed for successful development of rapidly growing wind energy projects, providing both cost-effective and scalable projects in different sizes of twelve markets of Brazil, China, Denmark, Germany, Greece, India, Ireland, Italy, Portugal, Spain, the United Kingdom and the United States having various policy options and diverse market dynamics. It is reported that wind energy projects are characterized by large upfront costs and low operation costs, cost of capital & pricing mechanism, need to assess the financial viability of their projects over the whole project lifetime of 20-25 years, which defines the project's bankability, the successful support mechanisms include tax incentives (tax credits, production incentives, accelerated depreciation etc.), preferential tariff regimes, quota requirements and trading systems. India's wind energy project which identified the issues of grid integration, forecasting and scheduling, structural inefficiencies and reliability problems needs modernization of the transmission networks & grid integrity solution for absorbing variable kind of wind energy, besides a strong manufacturing capability & domestic demand of energy.

Mohsen Rezaei (2013) studied that the Iran's energy system by developing eight indicator and found that country is much out of sustainability there is indicator of ambient pollutant, emission and energy intensity with low share of renewable energy in the total energy electricity production even though there is tremendous potential & exceptional benefits of renewable energy and policy concept as well. In spite of huge potential of renewable energy projects, the rich & highly subsidized sources of oil & gas are the challenge. Concluded that the Iran's energy policy for promoting of renewable energy is not yet implemented and suggested actions are increasing public awareness, policies to be framed for manufacturers, framing of supporting policies rules & regulations for growth, purchase & consumption of renewable energy.

Ashish Khanna (2013) in their report `Paving the Way for a Transformational Future Lessons from Jawaharlal Nehru National Solar Mission Phase I` stated that India is blessed with abundant solar insolation and energy generation potential, recognizing which, the Government of India (GoI) launched the Jawaharlal Nehru National Solar Mission (JNNSM or National Solar Mission), The author focuses on the unique feature of JNNSM-I (2010-2013) as adopting of reverse auction method for price discovery of projects to qualified bidders thereby realized the declined cost in the global market ultimately resulted in Levelised tariffs discovered INR 12.12 per kilowatt hour (kWh) (US$0.20 per kWh) far lower than the CERC benchmark tariffs of Rs17.91/kwh (US$0.299 per kWh) and contributing around 500 MW within three years among total projects installed capacity increased from 30 MW to more than 2,000 MW. Proactive steps include implementation of Renewable Purchase Obligation (RPO) for solar power, instituting a Payment Security Scheme (PSS) and measures for promoting local manufacturing. Also studied and identified the key barriers and constraints such as Lack of financing by Scheduled Commercial Banks due to perceived risk in lending the projects particularly, in the absence of any risk-reducing mechanisms, persisted bottlenecks relate to land acquisition, delays in approvals and clearances at the state level, limited field-level data availability on solar irradiation, non-availability of support infrastructure pertaining to water and power evacuation, limited coordination between the central and state institutions, and the absence of a clear mapping of responsibilities of institutions in the public domain, mandatory regulations specifying RPOs imposing penalties for noncompliance by distribution utilities and pricing of solar Renewable Energy Certificates (RECs).

Sun-Joo Ahn and Dagmar Graczyk (2012) studied that with the introduction of Electricity Act 2003, the first regulatory framework open up the window to harness vast potential of renewable energy in India probably to attain "energy independence in the long run`` (PC, 2006), thus renewable energy no longer seen as an alternate energy source but a critical element in pursuit of key policy objectives (MNRE, 2011), triggered the growth with inclusion of preferential tariff for renewable-based electricity projects and mandatory renewable purchase obligation (RPO) for power utilities led to the introduction of the Renewable Energy Certificate (REC) in 2010 followed by National Electricity Policy 2005, National Tariff Policy 2006 to set the minimum percentage of RPO and preferential rate for power from renewable projects, key players included the world's first dedicated Ministry of New & renewable Energy (MNRE), Indian Renewable Energy Development Agency (IREDA), state commission (CERC & SERC), NTPC Vidyut Vyapar Nigam (NVVN), state government and private companies. Concluded with the barriers and challenges of limited transmission infrastructure, land acquisition, capital costs & financing issues for renewable projects across India.

Govinda R. Timilsina (2011) attempted to address the issue of smaller share of solar energy in the global energy supply, studied the key barriers which prevented large-scale development of solar projects in the nation, policy & regulatory mechanism to scale up the solar energy projects needed to be introduced to address the barriers include feed in tariffs (FIT), tax credits, capital subsidies and grants, renewable energy portfolio standards (RPS), financing investments and other financial incentives. Concluded that Germany and Spain facilitated with FIT policy for growth of solar project while in United States, a mix of policy portfolios including federal tax credits, subsidies and rebates, RPS, net metering and renewable energy certificates (REC) played an instrumental role however, the present development of solar energy driven by supportive policies which needs to be continued for deployment of solar energy projects in both developed and developing countries, to overcome the economic and technical barriers required substantial finance for applied research and development and absorb anticipated costs of initial investments in update-technology for commercial scale project capacity. Concluded that by overcoming these barriers and with the policy support, the solar energy share could substantially increase by 2050 in global energy mix.

IDFC (2010) studied on constraints, barriers and gaps prevalent in the current policy and regulatory system, summarized milestones in renewable energy sector, emphasized to review the existing policies in favor of scale up of RE, recommended on addressing existing barriers by adopting new mechanisms for the promotion of RE, also recommended to formulate a comprehensive policy and action plan for all-round development of the renewable project sector in consultation with respective governments, related to the Grid connectivity & transmission infrastructure requirements, fiscal incentives in the form on excise and customs duty reduction/exemption for RE equipment, Financing, establishment of subsidized manufacturing, capacity building initiatives, increase awareness & technical knowhow.

Ms. Claire Swadkin (2010) studied on perceptions regarding renewable energy's potential, barriers, policies, regulations, financing, found absence of effective national policy and regulatory support mechanism, though national energy plans and or government targets and feed in tariffs as regulatory tools perceived to be effective, that among all renewable sources, solar is found to be having the maximum potential for electricity generation. The perceived barriers include the financial crunch with high cost & non availability of finance, lack of government incentives, policy uncertainty, grid connectivity, insufficient skill and capacity constraints and in case of project financing, private sector – companies and commercial banks –as well as public sector funding seems strong.

Gevorg Sargsyan (2010) focused on the economic feasibility and suggested measures to tap the available unharnessed renewable energy (RE) potential. The authors analyzed the challenges and barriers consist the significant constraint of limited evacuation infrastructure and grid connectivity for the renewable energy projects, undeveloped indigenous supply chain, Ineffective regulations for renewable energy projects, land and resource acquisition and delays in regulatory clearances, financial viability and bankability issues, however, suggested the measure to streamline the bottlenecks issues like state wise enforcement of renewable purchase obligation (RPO) and renewable energy certificates (REC) made mandatory, explore new sources of funding from IREDA such as green bonds, new equity, and synthesized products, risk guarantee facility of renewable energy projects such as refinancing,

construction financing, off-take by utilities, resource availability, and technology. Lastly, the developing renewable energy park proposed as one of the quick win, thereby promoting RE projects by economies of scale and creating supportive value chains facilitates India`s journey towards unleashing of RE projects potential.

Sudhakar Reddy (2004) in their paper `Diffusion of renewable energy technologies— barriers and stakeholders perspectives` surveyed various stakeholders such as consumers, equipment manufacturers, energy developers and policy makers/experts in Maharashtra State and studied the barriers to the adoption of renewable energy technologies viz., solar and wind, systematic classified economic, technological, market and institutional barriers, ranked them based on the perceptions of various stakeholders, understand the stakeholders perspective and analyzed each barrier and described its mode of influence to develop policy measures to design innovative policy approaches to help realize the potential.

(Section III)

2.4 Renewable energy development issues, challenges, cost competitiveness and analysis etc

Barbara Buchner, Henning Wuester (2018) analyzed the renewable energy finance landscape, outlined key trends globally in 2013-2016, regionally and by technology, examined the differing roles and approaches of private and public finance, highlighted the important role of risk mitigation instruments, and provided an outlook for renewable energy finance in 2018 and beyond. Annual investment declined in 2016, however the capacity additions in the same year were up than 2015 partially due to declining costs of solar and wind power and policy changes to auction mechanisms instead of feed in tariff, contributed significantly hence each dollar of investment financed more capacity than in previous years. Mostly financing is through debt equity in the ratio of 70-30 % globally for Utility-scale solar PV and wind project with bulk of investment more than 90% in 2016 is financed from private sources and public sources, institutional investors like pension funds, insurance companies, sovereign wealth funds and others invested only less than 5% of new investments and play a key enabling role covering early stage project risk.

Mercom india (2018) forecasts that India will install about 8 to 9 GW of solar capacity during the running year 2018, cumulative large-scale solar capacity projects commissioned totaled 20.8 GW upto March 2018 with Karnataka was the leading state with over 5 GW of cumulative installed capacity, followed by Telangana, Rajasthan, Andhra Pradesh Tamil Nadu than Gujarat. During the Q1 2018, Utility-scale solar projects commissioned register around 3.2 GW of capacity which is 34 percent increase in comparison to 2.5 GW commissioned last Q4 2017. The lowest auction rate received in Q1 2018 was Rs.2.91 (~$0.043)/kWh quoted by ReNew Power for 300 MW project in the Pavagada Solar Park. The forecasted utility based solar power project cumulative installations in India about 65GW up to 2022.

Surbhi Singhvi, Vinay Rustagi (2018) reported that India's utility scale solar project total installed capacity reach to 17.5GW in the calendar year December, 2017, out of which 68% of total installed capacity is led by four southern states along with Rajasthan. The analysis for the year 2017, indicates that total capacity addition was

9.3 GW, up 94% over 2016, with around 9.60GW of utility solar projects under pipe lines majority in the state of Karnataka and Rajasthan around 1.60GW each. The developer wise project capacity commissioned is ReNew, maximum capacity (826MW), followed by Greenko (710MW) and NTPC (510MW). The market share of solar module suppliers are Trina Solar supplied the maximum DC capacity (1,586MW-16%), followed by Canadian Solar (1,116MW-12%) and JA Solar (965MW-10%) of which nine of the top ten module suppliers were Chinese. The market share of domestic module manufacturers are Mundra solar-28%, Vikram solar-21%, Waaree-11%, Tata soalr-10% The Market share of inverter suppliers are ABB –(1,749MW), followed by TMEIC (1,318MW) and SMA (1,242), Sun grow-(963MW) of which top ten inverter suppliers covers 93% market share. The market share of EPC contractors are Sterling & Wilson-(814 MW), followed by Tata Power (325MW), Vikram Solar (293MW) and Tata power (325MW). The lowest recorded auction results was INR 2.44/kWh in SECI Rajasthan Bhadla solar park 500 MW, May 2017 offered aggressively by Acme Solar, the auction were held for similar solar park during December 2007, discovered a rate of INR 2.47/KWh by Hero solar at marginally higher tariff than the previous tariff of INR 2.44/ kWh due to execution costs and increased risk significantly in the last 6 months owing to increase in costs of modules plus imposition of GST and custom duties.

Andrei Ilas (2018) in their citation on Renewable Power Generation Costs in 2017 states that the chief driver of renewable energy is its strong business case, offering increasingly exciting economic opportunities with rapidly falling renewable power generation costs as well as challenges arising from a scale-up of renewable energy. Such cost reductions are mainly driven by continuous technological improvements, including higher solar module efficiencies, competitive procurement & supply chains, economies of scale, larger wind turbines, string of record-low auction prices for solar PV & onshore wind, internationally experienced & expertise project developers, purchasing power and access to international financial markets driving down project costs and risks. The fall in electricity costs from utility-scale solar photovoltaic (PV) projects since 2010 has been remarkable. The fall in global weighted average levelised cost of electricity (LCOE[1]) of utility scale solar PV @ 73% since 2010, to USD 0.10/kWh for new projects commissioned in 2017 and continue through 2020 and beyond due to favorable regulatory and institutional framework, low off take and

country risks, favourable taxation regimes, low project development costs and excellent resources. Record low auction prices for solar PV in Dubai, Mexico, Peru, Chile, Abu Dhabi and Saudi Arabia in 2016 and 2017 confirm that the LCOE can be reduced to USD 0.03/kWh from 2018 onward, given the right conditions. Recent auctions in Brazil, Canada, Germany, India, Mexico and Morocco have resulted in onshore wind power LCOEs as low as USD 0.03/kWh.

[1]The LCOE of a given technology is the ratio of lifetime costs to lifetime electricity generation

Marcin Ścigan (2017) aimed to achieve at least 27% share of renewables in energy consumption by 2030. The Souh Eastern countries are still at an early stage or just started to take off however significant resource endowments, combined with falling technology costs and newfound cost-competitiveness leads that renewables is closer at hand than ever. The report clearly indicates that solar PV and wind energy are already viable options for the region. Most of the region's vast untapped renewable energy potential – equal to some 740 GW, wind energy (532 GW) and solar PV (120 GW) be exploitable in a cost-effective manner by 2030. At most suitable locations, characterised by good resource availability and proximity to the grid, LCOE can go below EUR 50/ MWh, with the highest cost-competitive potential in Bulgaria, Republic of Moldova, Romania and Ukraine for wind power and EUR 70/MWh in Albania, Bulgaria, Croatia and Romania for solar power. The major identified barriers include: the absence of a long-term strong and stable renewable energy policy environment in the region; inadequately designed Power Purchase Agreements (PPAs) that do not meet investor requirements; high administrative barriers, adding to transaction costs for businesses; and a lack of sufficiently attractive and consistent renewable energy support systems. In addition, several technical challenges exist, such as grid limitations and insufficient experience with the grid integration of variable renewables.

Hasret Balcioglu (2017) studied the viability of renewable energy projects by techno-economic analysis with various models for the Southeast Asian Nations and analyzed the different indicators involved in viability and financial decision making like payback analysis, annual energy generation to offset investment, Time Value of Money, annuity factor of present value, Net Present Value (NPV), Internal Rate of

Return (IRR), SWOT Analysis, Discounted Cash flow (DCF) Analysis, Levelised cost of energy (LCOE) and Breakeven Analysis. Concluded that with reduced payback period- the investment seems to be more economical, the higher discount rate-lowers the present value of the future cash flows hence determining discount rate is important for the project be profitable or not, positive NPV reflect the profitable project and negative NPV means loss in project, discount rates indicates the capital project cost and expected rate of return on investments, the different ratio used to compare the business performance of renewable energy industries, the LCOE model represent the projects life cycle renewable energy cost to that energy generated depends on the technologies used, life of the projects, cost of capital, projects scale of operation, the grid parity or breakeven used to evaluate the parity between cost of electricity purchased from the grid and cost of renewable solar PV/wind generated electricity, similarly SWOT analysis identified the current situation of the projects helps planning & identified the effective strategic policy for development of renewable energy projects .

Caneva (2017) studied the decelerated growth of renewable energy projects due to challenges in financing options in Europe, triggered the innovative financing concept of crowd funding RES (renewable Energy Source) mechanism involved renewable energy project developers, stakeholders/contributors and online crowd funding platform, an intermediaries between public & project developers unleash the RE deployment potentials by bridging the partial funding gap for RE projects, analyzed that involvement of public as a investors creates a sense of ownership ultimately improved perception towards renewable project development. Concluded that the challenges faced for crowd funding option reduced, revised guidelines in line with public experience, recommended policy & regulatory mechanism developed to promote the innovative funding concept.

Allana (2017) analyzed and studied the First Solar Inc, U.S. based solar energy industry by porters five force model to examine the competition among the solar energy industries and found increased competition due to subsidies, emerging technology, entry of new firms to renewable sources the element of bargaining power of suppliers higher side as the raw materials supplied through limited sources poses a threat 0f rising prices by suppliers however the bargaining power of buyers low due to

lesser solar energy suppliers while the substitutes includes the other renewable energy hence high. The studies of SWOT analysis reveal the strength of expertise in technology development, leading global solar materials providers, untapped solar industry and ability to expand the capacity leads to opportunity, weakness covers the dependency for materials and threat of substitutes and competitions

Donastorg (2017) explored on investigation of sources and current trends in financing Renewable Energy projects in developing countries by conducting a detail and in-depth literature review to understand the gaps and limitations. It is estimated that the renewable energy business is having 19-26 Trillion-dollar investment opportunity however faces challenge to grow the business and financing strategies to exploit renewable energy projects investment opportunities as it involves high level of understanding due to its specific characteristics such as dependence on the government legal framework policies and regulations, implementation of subsidies, grants, tradable certificates or tax credits, perceived long term project risk, improved technologies, competitions lowered down the cost & reduced levelized cost of electricity generation.

Adnan Z. Amin (2017) studied that globally accelerated renewable energy development happened due to technological innovation, enabling policies with impressive falling renewable power generation costs particularly for project commissioned after 2017, offers tremendous economic opportunities and challenges for scale up of renewable projects. Reported that the falling cost & corresponding reduction in LCOE for solar and wind power projects driven by continuous technology up gradation increased solar PV module efficiencies and higher capacity wind turbines at height, competitive bidding with reverse auction, economies of scale in manufacturing & procurement, global supply chain, reduced O&M cost, access to international financial markets, large scale project experienced, globally experienced project developers signals a real paradigm shift in the renewable energy market.

Jain (2017) studied present status and future needs for techno innovations and management skills for the deployment of solar energy projects, focused on SWOT analysis with strength of initiatives for number of solar projects approved by union

cabinet, Ultra mega solar power plants in various states accompanied under JNNSM, established solar technology, higher sunny days in almost regions, negligible cost of operation & maintenance, world bank loan & incentives for development against this the weakness consist of high up front cost of capital, land acquisition issues, inadequate transmission facility & grid interconnection issues, examined the opportunities of governments ambitious targets for solar projects, easy of statutory and clearances for projects, creation of jobs in market and threat of high risks of obsolescence, technological risk, effecting return during monsoon, non availability of experienced & trained.

Kószó (2016) studied the Porter's five forces analysis on new electricity market 2.0 era for the future scenario of renewable wind energy markets with ambitious targets for 2050 the `Energiewende` by Germany and highlighted that the competition in retail market is dominated & influenced by four strongest companies keeping oligopolistic position, leaving almost low or even no space for internal rivalry, the entry in renewable wind projects is challenging due to high upfront capital cost, however in future scale up of projects with improved technology, the entry cost likely to reduce, but the competitive market barriers the new entrant. Hence threat of entry remains low, the introduction of auctions system for renewable project creates competitions & reduces the participant benefiting four large players in renewable markets but suppliers power in retail segment prevails high, being a competitive renewable market the changeover to developers/ generators leading high buyers power.

Khatchadourian (2016) studied the Situational analysis of EU renewable energy legislation, Climate Policy and restructuring of renewable energy policies needed after 2020 to enhance the deployment of solar & wind projects by applying the situational analysis tool, identified internal strengths(S) and weaknesses (W) with the external threats (T) and opportunities (O) by considering the factors like political and regulatory, financial and market and technology and infrastructure factors and formed four combinations of strategy i.e SO, WO, ST, WT. The WT mini-mini aimed reducing the internal weaknesses and external threats, the ST maxi-mini strategy identified the internal present strengths available for handling external threats, WO (mini-maxi) strategy minimized the internal weaknesses and maximize the external

market opportunities, lastly SO (maxi-maxi) strategy maximize the outcomes from the present internal strengths so as to maximize gains from external opportunities.

Marlene Motyka (2015) studied and provided perspectives on the long-term growth trajectory for solar power in the US. The projected potential for continued exponential growth is worth consideration due to exponentially declining costs and rapidly improving efficiency of solar panels. With the increase in solar PV installation, the cost fallen sharply due to an experience curve observed in solar PV production commonly known as "Swanson's Law." States that since the 1970s, for every doubling of global shipments of PV cells, the module cost drops by about 20 percent. The author expressed their concern that `projecting solar power's growth trajectory is like predicting geomagnetic storms on the sun's surface, or any other weather phenomena`` hence it's far more challenging as it involves no's of factors which may constrain or support the solar power growth positively or negatively depending on how the issues evolve in the US, such as the cost of capital, enabling technologies, the rate of technological advances, grid integration, competition, addressable market, adoption level, cost for the evolution of policies such as fiscal incentives, utility rate reform, evolving financial structures, business models, and customer sentiment. Analysts pointed out that despite continuing cost declines, the intermittent nature of solar power leads to back down, add significant costs and decline cost depends heavily on incentive like investment tax credit, net metering, and other federal and state policies, some of which are scheduled to expire or are under review.

Bartłomiej Iglinski (2015) presented the current state of infancy, energy potential and future prospects for the development of renewable energy projects in the Wielkopolskie region, Poland and concluded that the development of the renewable energy sector largely depends on the proposed legal legislation & regulations, increased subsidies, introduction of guaranteed certificate prices and awareness of public, investors, developers and decision-makers. The SWOT analysis concluded the significant potential for development of renewable energy projects but potential varies greatly across the country due to local conditions, needs strategic planning based on detailed analysis, eliminating weaknesses and threats by propagating awareness, educational, and information/promotion campaigns targeted at the general public and

local authorities as well. Financial & legislation support mechanism need to be developed especially on the act & regulations on Renewable Energy Sources.

Grzegorz Piechota (2015) studied on the SWOT analysis on the existing state and growth prospectus of renewable energy sector Poland based on the questionnaire and survey primary literature data, legal acts and regulations, the deployment of renewable projects bestowed up on ‘‘The Energy Policy until 2030’’ (Ministry of Economy 2009), analyzed that windy regions is the potential source favoring the development, interested investors due to profitable investment, development of domestic wind turbine manufacturing with higher efficiency overrides with higher investment cost, environmental community & land scape issues, longer time for legal permission, undefined acts, connectivity infrastructure issues however recommended for simplifying permission, higher subsidies, public awareness programme. SWOT analysis Concluded that growth of renewable energy projects in Poland depended on framing of enabling policies & regulation, Renewable promotion policy, single window procedure for permission , financial support for new investments, guaranteed green certificate prices & increasing awareness among public, investors, decision-makers, developers etc.

Asok Rajkumar (2013) studied the evolution of renewable energy potential at global and national level as the sources are affordable, accessible and secured, expressed with 4E’s concept such as “Education, Engineering, Enforcement and Evaluation” , analyzed the strength, weakness, opportunities and threats (SWOT) of renewable energy sector in India, focused on the bottlenecks such as acquisition of lands, lack of renewable energy sources assessment, issues of funding the renewable energy project, insufficient transmission infrastructure, grants and subsidy, high upfront capital Project costs, financial barriers, support infrastructure and regulatory barriers to be addressed by MNRE, Over and above, authorities seeks from World Bank for financing & implementation of renewable energy parks and farms at feasible locations. Suggested effective and consultative forum to bring all key stakeholders such as Developers, Financing Institutions, Technology Providers, Manufacturers, Investors, Central & State Government Agencies, utilities, consumer groups and end

users on single platform towards Indian journey on renewable energy projects as the renewable energy sector has a value, only if its value, is valued.

David Nelson (2012) studied the challenges for framing national policy that attract the investment needed to scale up rapid development in renewable energy projects both, wind and solar at viable cost, also analyzed and concluded that the impact of policies on delivered cost/ Levelised cost of electricity (LCOE) for actual renewable energy projects i.e. wind and solar projects, without any incentives using project-level parameters i.e. debt-rate, tenor and hurdle rate with maximum debt denotes the lowest cost of electricity possible from the projects, with addition of various incentives in a stepped manner and recalculating LCOE, using the same method of debt maximization considering with accelerated depreciation for solar PV projects and the generation based incentive (GBI) for wind projects reduces the LCOE of respective solar PV and wind projects by 18% and 10%, respectively, the tentative impact of both income tax benefits and CDM turns out to be 5%, support of average power procurement cost (APPC) towards LCOE is 16% and 50% for solar PV and wind, respectively, impact of preferential tariffs supports on LCOE is to the tune of 67% and 40% for solar PV and wind projects respectively.

Votteler (2012) studied the adapted model of Porters' value chain & Porters' five forces analysis models for structural understanding, identifying business activities considering the external competitive environment of service providers in the South Africa & Western Cape solar industry, Although South Africa having high sun radiation level, economical to invest and developed supplier markets, the downstream is infant stage and rather difficult to accelerated use of renewable sources of energy, recommended to improve the service and marketing performance of solar service providers, trained the installers for project equipment installations, improve the business structure and activities in the interest of all stakeholders to Satisfy the energy demand in the 21st century

Ms Rita Roy Choudhury (2012) studied the future demand opportunities, key challenges faced by developers & manufacturer for solar supply chain, recommended to established secure & cost effective supply chain system by examining the views of stake holders related to solar value chain to enables job creation, controls the outgoing

foreign exchange, increased investment and long term sustainable growth of solar projects, identified the key issues and possible remedial approach for secure solar supply chain management, finally concluded that building a sustainable domestic supply chain in India needs financial investment supports both from domestic as well as global stockholders assistance, facilitates for research & development, call from international extensive technological support, understand global trade dynamics of supply chain, strategic government policy for domestic manufacturers to grab the opportunity of expanding and high demand domestic growing solar market.

Ahmed (1994) concluded that unit costs of renewable energy technologies significantly declines over the past two decades, further reductions in costs be expected with technological development, research & development in technology, incentives for further technical innovation in manufacturing extent of government interest, increased module efficiencies particularly with large-scale commercialization, market growth and economies of scale with large scale projects turns to reduction in uncertainties, ultimately reduction in cost of electricity. The reduction in cost of solar modules reduced to a factor of 10 over the past 15 years or so and a factor of over 50 since the early 1970s.

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