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REGULATORY IMPACT ASSESSMENT ON LOCAL CONTENT REQUIREMENTS IN RENEWABLE ENERGY INDUSTRY IN GEORGIA

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ACRONYMS

ATC	Aero-structure Technologies Cyclone
CAGR	Compounded Annual Growth Rate
CAPEX	Capital Expenditure
CFO	Chief Financial Officer
CMG	Caucasus Metal Group
DSO	Distribution System Operator
EBRD	European Bank for Reconstruction and Development
EnC	Energy Community
EP	Enterprise Georgia
EU	European Union
FDI	Foreign Direct Investment
FiP	Feed-in Premium
FiT	Feed-in Tariff
FIZ	Free Industrial Zones
GATT	General Agreement on Tariffs and Trade
GDP	Gross Domestic Product
GEDF	Georgian Energy Development Fund
GEL	Georgian Lari
GNERC	Georgian National Energy and Water Supply Regulatory Commission
GoG	Government of Georgia
GSE	Georgian State Electrosystem
GW	Gigawatt
IFI	International Financial Institution
IMF	International Monetary Fund
IRENA	International Renewable Energy Agency
KAMP	Kutaisi Auto Mechanical Plant
kW	Kilowatt
kWh	Kilowatt Hour
LCOE	Levelized Cost of Electricity
LCR	Local Content Requirement
LEPL	Legal Entity of Public Law
MoESD	Ministry of Economy and Sustainable Development of Georgia
MoF	Ministry of Finance of Georgia
MW	Megawatt
NPV	Net Present Value
OECD	Organization for Economic Co-operation and Development
PPA	Power Purchase Agreement
RES	Renewable Energy Sources
RIA	Regulatory Impact Assessment
SNA	System of National Accounts
SoW	Scope of Work
TEİAŞ	Transmission System Operator in Turkey
TSO	Transmission System Operator
TWh	Terawatt Hour

TYNDP	Ten Year Network Development Plan
UNCTAD	United Nations Conference on Trade and Development
USAID	United States Agency for International Development
USD	United States Dollar
VRE	Variable Renewable Energy
VRES	Variable Renewable Energy Sources
WTO	World Trade Organization

CONTENTS

1. EXECUTIVE SUMMARY

The present study aimed to analyze the introduction of the Local Content Requirement (LCR) to the renewable energy sector in Georgia in terms of its possible outcome. For that purpose, under the Scope of Work (SoW) renewable energy is defined as solar Photovoltaic (PV) for both residential and grid-connected (distributed generation), solar thermal for heat applications, biomass and wind projects.

The study revealed Optional LCR as the best alternative for Georgia. The paper compares four alternatives of LCR: the business as usual scenario providing no incentives for LCR (No-LCR scenario), Optional LCR- when LCR is an additional benefit offered to Variable Renewable Energy Sources (VRES) developers for using local components, obligatory LCR – when using local components is an obligation from the state and finally, tax incentives.

If implemented appropriately, LCR can boost the development of VRES. On the other hand, if the policy is executed imperfectly, it might be a barrier and increase costs. Therefore, **it is critical to have all stakeholders engaged in the design of the LCR policy.** The mandatory LCR, as seen in case studies, is a burden for the business and increases World Trade Organization (WTO) concerns and may even affect the country's reputation, whereas optional LCR unveiled benefits.

In the absence of promotional mechanisms for Renewable Energy Sources (RES) in Georgia, LCR might be a valid justification for such incentives. Currently, the VRES is under development and therefore the industry needs incentives. On the other hand, the LCR may contribute to the development of manufacturing sector. In a country with a high unemployment rate, the creation of jobs with above-average salaries is critical. Also, keeping a part of capital-intensive energy sector investments in Georgia, instead of spending it on imported products, will benefit the development of Georgia's GDP.

The stakeholder interviews revealed that **tax incentives** could be applied to only those factories operating in Free Industrial Zones (FIZ). The investors do not otherwise feel the burden of the tax regime as it is already favorable compared to most of the European economies.

The case studies included one closer to home - Turkey, as well as a cautionary tale from India and the success story of Canada. India's case demonstrates mandatory LCR: it underscores the negative effects of mandatory LCR, like low quality, high costs, and problems with supply chain management and with the WTO. Canada's case demonstrated the positive aspects of optional LCR and its impact on renewable energy development as well as on the development of the manufacturing sector. And finally, Turkey is the best example of combined policies showing the impact of investment promotion policies on the market and the overall energy mix. The case studies support optional LCR as the most suitable alternative, particularly when coupled with other incentives, like Feed-in Tariffs (FITs).

Stakeholder interviews and supply chain analysis revealed the local capacity for the production of VRES parts. Given Georgia's experience, which is consistent with the global practice and production specifications, towers for wind turbines, mountain brackets for solar PVs, distributed scale wind turbines and solar PVs can be produced locally. Local companies have the capacity to add new production lines however, this is hinged on the technology and knowledge transfer from experienced manufacturers. The key is to choose technology sensibly, without hampering turbine generators on the market.

The economic benefits of LCR depend on the offered benefits. Mandatory LCR is not a choice for Georgia due to WTO restrictions. However, in case of the Optional LCR, its effective application will be contingent on benefits and the price of local components. The Research Team made rough calculations for optional LCR and its economic benefits. Based on the assumptions, with USc/kWh 2.0 tariff incentive for using local component(s), the wind and solar capacity are expected to reach c. 2.0 GW, creating over 1500 jobs and generating over 5 TWh annually by 2030. The less incentivizing tariff premiums, like USc/kWh 0.5 or 1.0, also showed positive Net Present Value (NPV), although it is assumed to have much fewer capacity additions and consequently job creations.

2. INTRODUCTION AND METHODOLOGY

The purpose of the study was to analyze the potential outcomes of the LCR introduction to the renewable energy sector in Georgia. One of the critical aspects of the study was to identify the different modalities of local content requirement, and how LCR requirements should be defined, enforced and structured in Georgia.

For the study purpose, the renewable energy was defined in the SoW as solar PV for both residential and grid-connected (distributed generation), solar thermal for heat applications, biomass, and wind projects. The SoW describes the local content requirement for renewable energy as the "*legal requirement for renewable energy projects in Georgia above certain must use, in the procurement of goods and services to build the project, some combination of local equipment, local labor, and/or local subcontractors. This requirement is done in order to build up the local economy*."

Based on the SoW of the study, the final report contains the following elements, inter alia:

- Different modalities of local content requirement; how the requirement might be defined, enforced, structured in Georgia;
- Other countries' practice in dealing with local content requirements; leading practices;
- What elements of the renewable and energy supply chain can be realized in Georgia; the existing skills, available subcontractors; their capabilities and financial strength, considering the requirements for construction financing such as bonding, performance guarantees, and spare parts;
- A projection of the potential new jobs related to renewable energy under different local content requirement regimes;
- The alternatives to a local content requirement for job creation and economic development, including the absence of local content requirement, the availability of better subsectors of the economy than renewable energy (such as housing, IT, education, health care) in which a local content requirement can mobilize jobs and economic development?
- The possible detriment or impact of the local content requirement on investment or on the cost of energy generating from renewable energy projects?
- Qualitative cost-benefit analyses of different modalities of LCR.

The work done within the scope comprised of the desk research, the analyses of the best practices worldwide, stakeholder interviews and qualitative analyses of gathered data. The methodology of the study focused on three main directions: 1) literature review and information gathering, including case studies 2) Stakeholders' interviews and 3) collected data analysis, including cost-benefit analysis.

Desk research combined the collection, revision and analysis of relevant documents. The Research Team solicited the documents from open sources. The information gathering focused both on the international and local markets with the aim to identify the best practices of LCR and answer the most pivotal questions: whether there is a need and technical capability for LCR in Georgia. The same questions were later directed to stakeholders. The countries selected for case studies are Canada, Turkey and India, all having radically different modalities of LCR. The analysis of the cases enabled the Research Team to identify different modalities of LCR, possible negative effects of different actions, and an understanding of cause-effect relationships for different actions.

Stakeholder interviews crated better understanding of Georgia's readiness to implement LCR with possible barriers, as well as the social, political, economic, and environmental context in which the policy will be adopted. Stakeholder perspectives also exposed certain constraints and opportunities to be considered in the policy formation and provided clear insights on who should be engaged at which stage of the policy design and implementation for an efficient outcome. Interviews were conducted with the selected stakeholders for the engagement with policymakers and private sector representatives.

The open-ended, in depth interviews set up the stage for the Research Team to analyze the socio-economic and political environment, to evaluate the key stakeholders' interest level and influence, as well as their perspectives, priorities and values.

Interviews with the stakeholders lasted for about an hour, which contributed to the development of the influence-interest matrix. A list of conducted interviews is presented in stakeholder's engagement chapter.

Measuring impact of the local content requirement includes evaluating the benefits from renewable energy development as well as from the development of the manufacturing business, investments and jobs creation etc. The social welfare of the LCR is calculated as an overall benefit the society will gain from the LCR and manufacturing development. The manufacturing capabilities and the cost-benefits for the project development were analyzed based on the desk research and stakeholder interviews.

Initial findings were presented to the United States Agency for International Development (USAID) Energy Program team in the form of a presentation and major concerns were considered in the final report.

Figure 1: The Main Phases of the Project

This study will give an initial assessment of the application, effectiveness and legality of LCRs for green policies. The principle outcome is to set the stage for deliberations and encourage further scientific research quantifying the costs and benefits. A well-developed policy framework would require further research outside the scope of this study, including a rigorous compliance analysis of proposed changes in conjunction with the WTO trade laws and agreements.

3. PROBLEM DEFINITION AND BACKGROUND

The problems that might be addressed by a local content requirement are:

1. LCR should stimulate the development of local generation capacities, thus reduce the risk of import dependency.
2. LCR policies are mainly designed to improve local economic activity, increase employment and protect local production from global competitors. However, there is a risk that a mandatory LCR policy might reduce renewable energy development. Therefore, proper LCR policy should be designed that will not hamper renewable energy development in exchange to short-term local social-economic improvements. Proper LCR should stimulate the development of renewable energy, thus assist Georgia in meeting its 2030 goal, undertaken by newly adopted Law on Promotion of the Production and Use of Energy from Renewable Sources. The goal is to increase the share of renewable energy in total energy consumption from 29.5% in 2019 to 35% by 2030.
3. LCR will stimulate the GDP growth of the country. LCR involves having local, high-tech factories that will promote the transfer of knowledge and technology in the country, affecting the overall GDP. Local production of the factories will be additional in-house GDP contributors, through the development of the heavy industry.
4. LCR will reduce unemployment rate. LCR will create additional jobs in factories producing the components in the renewable energy sites during construction and operation; policy administrators, etc.

INCREASED IMPORT DEPENDENCE AND RENEWABLE ENERGY GOAL OF 2030

Georgia's current generation capacities are deficient to satisfy the growing demand for electricity. The growth of electricity consumption exceeded the generation capacity over the last decade, hence rising the import dependency of the country. Electricity consumption in Georgia witnessed an average Compounded Annual Growth Rate (CAGR) of 4.4% from 2008 -2018. The demand has grown 1.6-fold in the last decade and is expected to double by 2030, reaching 24.5 TWh from 13.7 TWh in 2018. On the supply side, the generation growth was insufficient to fully satisfy the increased demand on electricity, despite the 25.3% growth of installed capacity between 2012-2019. As a result, electricity imports increased by a 14.9% CAGR over 2012-2019, deepening the trade deficit of the sector by 4.9x to $69 mn. USD in 2019. As the economy continues to grow at a steady pace, non-residential consumers are expected to be the main contributor to consumption growth.

Stable growth of electricity consumption increases the need for new generation capacities. Electricity consumption is highly correlated with GDP and the economic development of the country. According to different studies, growth in consumption in recent years has been driven by the non-residential sector, increasing its share in overall consumption from 53% in 2013 to 60% in 2018. This growth is expected to continue, and the non-residential sector is expected to be the main driver. Without any new generation capacities, the import dependency of energy sector will increase or become a barrier for economic development.

Georgia has an impressive pipeline of power plants, but its full implementation is uncertain due to varying investment environment. Investments in the electricity sector have been encouraged by the Government of Georgia (GoG) since the early 2000s. The GoG, with the assistance of donor organizations, has screened and identified potential power plant projects, developed an investment promotion strategy and actively promoted investment in the sector. One of the most important tools for the government in attracting investors in the energy sector were Power Purchase Agreements (PPA), which coupled with export opportunities mainly to Turkey boosted the investors' interest for the energy sector and resulted in an impressive pipeline of power plants. Perspective investor's interest in the energy sector increased by the end of 2000s and was at its peak from 2012-2016.

The investment climate for power plant developers has radically changed since 2016 when Government set a moratorium on PPA, followed by legislative changes eliminating the PPA in 2017. There were several reasons behind the decision such as: PPA was considered as disruption to competitive markets; International Monetary Fund (IMF) raised concerns on building PPA liability for the government and related fiscal risks; the PPA procedure was deemed as non-transparent by the market players due to frequent changes in PPA application procedures and award practices. In addition to the PPA policy change, the prices on export markets went down, including the average price on Turkish market almost halved over 2012-2018, decreasing from USc/kWh 8.7 in 2012 to USc/kWh 4.8 in 2018.

Georgia anticipates radical changes in the legislation and market environment. By signing the Energy Community (EnC) charter in October 2016, ratified by the Parliament in the spring of 2017, Georgia took obligations to harmonize the legislation in the energy sector with European Union (EU) standards within the set deadlines. This implies a fundamental reorganization of the energy sector which will lead to new market model, new goals, and new measures for renewable energy, new investment promotion mechanisms, etc.

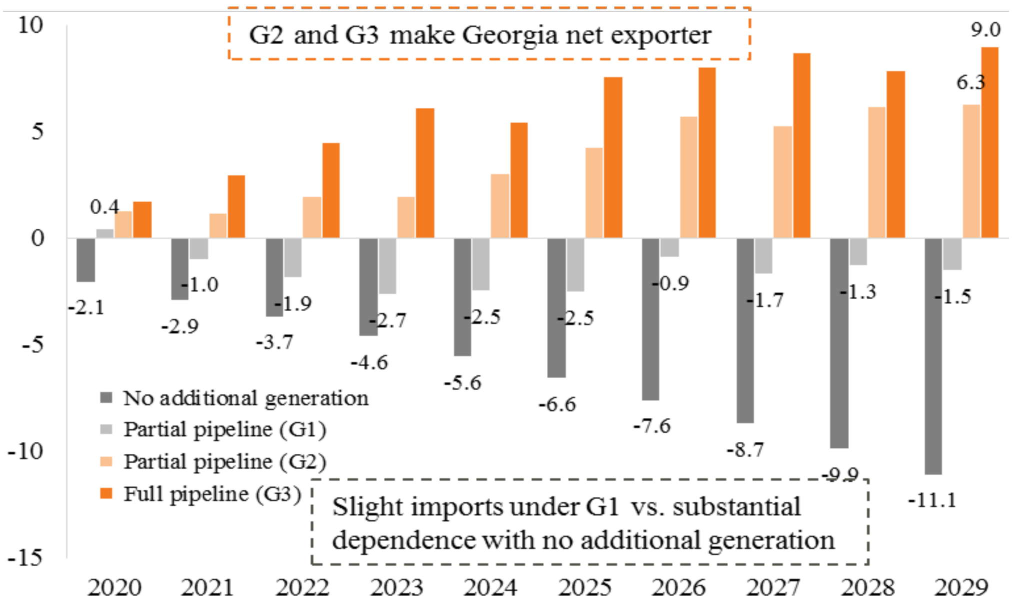
Without a clear picture of future market prices, investors tent to delay their decisions. Without proper PPA and export potential, power plant developers are unable to predict their selling price, thus cannot properly calculate the revenues of the project and consequently the investment rationale.

Since the abolishment of PPA's, power plant developers are expecting the enforcement of the market reform, as market deregulation, renewable energy promotion mechanisms, and unbundling of supply and distribution will likely stimulate the industry.

Without a clear picture of the future market rules and guaranteed tariff, it is impossible to predict the future. As a consequence of a vague future, most of the power plants are expecting the government's decisions in order to evaluate the economic feasibility of their projects. As a result, only a few power plants have progressed from the feasibility stage to construction during 2017-2019. Unfortunately, exact statistics of the memorandum deadlines extension, as well as the history of each project, are not publicly available.

The pipeline of generation does not guarantee energy independence. The projected annual growth of electricity consumption is 5-7% which will double the electricity consumption and reach 24.5 TWh by 2030. This, in turn, intensifies the need for new generation capacities. The pipeline of power plants in Georgia contains circa140 ongoing renewable energy projects (installed capacity 4.0 GW) and 3 thermal power plants at various stages of development. Galt & Taggart research states that, in case of no additional capacity and predicted 5.7% annual growth of consumption, the trade deficit in the county will widen to 11 TWh by 2030. In the case of 25% implementation of the pipeline, the trade deficit will average at 2 TWh, which will be a significant outflow of currency for the economy of Georgia.

Figure 1: Forecast of Net Export / Import Based on Different Generation Scenarios



Source: Galt & Taggart research

According to the newly adopted Law on Promotion of the Production and Use of Energy from Renewable Sources, **Georgia should increase its share of renewable energy in total energy consumption from 29.5% (to 2019) to 35% by 2030.** The draft law on the promotion of renewable energy sources allows the introduction of incentive mechanisms. Incentives can be implemented in a variety of ways, including: tax reliefs, direct price support schemes, fixed and variable premium payments, including feed-in tariffs, contract for differences, green certificates, auctions, etc. The government is given one-year deadline for the approval of the precise list of incentives and implementation conditions; And for other related bylaws, the government, the Ministry of Economy and Sustainable Development of Georgia (MoESD) and the Georgian National Energy and Water Supply Regulatory Commission (GNERC) are given up to two years.

The local content requirement can be one of the mechanisms the state can offer to the power plant developers in order to boost the capacity, reduce the energy dependency of the country and reach its target goal 35% by 2030.

The document thereby addressed the aspects of LCR to be considered during its implementation and the different modalities of LCR. The study aimed to identify whether LCR could help Georgia reduce the gap between generation and consumption and reach its 2030 goals. Another aim of the study was to identify the best modality of LCR for Georgia.

GDP AND UNEMPLOYMENT RATE

The unemployment rate in Georgia is 12.7% as of 2018. Despite the economic growth of the country, the average monthly salary in Georgia is still very low - 1100 GEL, or c. 380 USD per month. Only 8% of the population is employed in industry, with the average salary slightly (1%) above the business sector average. The development of qualified workforce has a potential to boost the average salary of the industry on account of better quality performance.

Services dominate the GDP of Georgia, with 77.6% share in total. The industry, including manufacturing businesses - starting from food manufacturers to heavy industries, like metal melting- altogether accounted for 14.6% of GDP in 2018 (based on new methodology - System of National Accounts (SNA) 2008). Although this sector is top provider of GDP, its share is c.1.5x times lower compared to the EU average.

The real GDP grew at 4.8% over 2017 and 2018 is expected to remain in a range of 4.5%-5.0% in 2019-2020 as well. The Georgian economy needs a boost, that enable local producers facilitate the overall economic growth with the available technologies.

Based on the research results, LCR has two crucial values – domestic job creation and economic stimulus for the selected industries. In the local context, it might be renewables and heavy industry. In addition, LCR for Georgia will enhance the transfer of technology from prominent international companies to the domestic sector. It is worth noting, that Georgia has great experience with technology transfer through sector stimulation.

Following the GoG Resolution N107 “State Program – Renewable Energy 2008” that deregulated hydropower construction, the sector has experienced a rapid advancement in the past decade. As a result, Georgia hosts multiple international and local engineering companies proficient in hydropower.

With the implementation of LCR initiative, the government tend to achieve the following objectives: job creation, transfer of technology, and enhancement of Georgia as the renewable hub of the Southern Caucasus.

DEFINITION OF ALTERNATIVES

The Local content requirements are policy measures that require foreign or domestic investors to source a certain percentage of intermediate goods from local manufacturers or producers. These local producers can be either domestic firms or localized foreign-owned enterprises. The policy measure is by definition a performance requirement that can be enacted at the state, sub-state or regional level. Often, the legislation foresees a gradual increase of the percentage of inputs that needs to be sourced locally. The overall objective of content requirements is seldom explicitly defined, however, mostly it aims at developing local competitive industries and job creation.

Local content requirements are often linked to other, positive policy measures. In the case of renewable energy development, the eligibility for state support is sometimes conditioned upon an LCR. Some countries use LCR’s as a precondition for renewable energy projects in their procurement tenders. In other cases, content requirements are used as a condition for receiving a tariff rebate on other inputs, preferential electricity tariffs or tax treatment. LCR’s are often used to complement such incentive schemes to benefit the local economy. Incentive schemes alone are difficult for policy makers to sell, especially in times of fiscal restraint, without at least some arguments that the environmental benefits will also be accompanied by economic benefits.

LCR can stimulate one industry and promote the creation of another industry in the country. The following characteristics can be appealing: 1. Domestic job creation rather than overseas and 2. Channeling businesses to domestic, rather than foreign firms (Peterson Institute for International Economics).

With local content policies two approaches are available – one is prescriptive, narrowed down to procurement to certain extent. On the other hand, there are policies that are more enticing and motivating, however, they are optional, rather than obligatory or prescriptive.

On face value, it is perfectly normal for the local content policies to be a requirement. However, in the globalized environment, the localization of the entire industry might fail to deliver value.

Given that Georgia is a pioneer in the production of renewable energy content locally, hence is less likely to meet the industry requirements, the outright prescriptive policies might not be fully feasible. However, the political environment is usually demanding as the local content is a way to use energy resources for economic development.

In the present study, the Research Team described and analyzed the following alternatives:

1. **No-LCR** scenario foresees no changes on the market and leaves the current status quo. This is used as base case scenario for further comparisons;
2. **Optional LCR** when LCR is an encouragement rather than obligation from the state;
3. **Mandatory LCR** when state obliges all developers to use the local components;
4. **Tax incentives** or any other source of local content encouragement.

While analyzing the case studies and the application in the Georgian context, the following factor should be considered, inter alia:

- LCR is a vehicle to motivate behavioral change of investors, however requires more efforts to meet the end goal;
- Benefits accrued to the community vs benefits accrued to the nation state – tax base for the community vs. tax base for nation state – determine the fair split;
- Managing expectations is a good way to start implementing policy changes. Expectations vs reality – people anticipate the new law to cause immediate improvements. However, the reality is detached from expectations. The first recommended action is to manage expectations credibly;
- Aspirations – there will be more constructive and realistic debates on the value of the local content and related expectations;
- Governments should be selective of the challenge by identifying the key obstacles and better understanding how local content laws or other laws, intended to stimulate one sector or the other, will be addressing these challenges;
- The law should regulate the established processes, challenge the existing practices in procurement, engineering, and technology to comply with the local specificities;
- If properly implemented, LCR will create jobs – both direct and indirect. Spin-off benefits – the renewable energy sector does not involve massive direct employment however, indirect benefits are anticipated as well;
- Things to be considered: which government agencies will be accountable for ensuring the implementation of the law in full compliance with the intention of the Law, how to measure the benefits, what are the measurement tools?
- What is the lead time from the Law to actual implementation?
- Which part of renewable energy can be produced locally?
- Certification of the local content is a separate issue. Any regulator dealing with this process shall understand the encountered bureaucracy and evaluate its impact on the project development;
- The government lacks the production capacity, therefore respective capacity building is high importance. In this respect, the Government should be realistic and fair in terms of assessing the existing capabilities. This will avoid assigning companies with commitments inconsistent with the existing competences;
- Developers vs. Operations. Launching a dialogue between different components of investors;

- Monitoring and evaluation components are critical in following the policy and understanding policy success and gaps. This is the area where government engagement is critical, so the question for Georgia is: Is there enough capacity or not?
- Building of the local content capabilities, also requires more clarification for investors in terms of their planning and activities;
- Flexibility and realism – it is crucial to set realistic goals for the share of local content. There is a huge difference between the 80% local content vs. 20% local content, thus careful analysis of the required LCR share should be performed.

MAIN FINDINGS – COMPARISON OF ALTERNATIVES

The present chapter aimed to explore whether LCR was a good option for Georgia and which of the selected alternatives were more appropriate in the local context – optional or obligatory? In search of the answer, the Research Team analyzed the cases of different countries, followed by the evaluation of perspectives. One of the focal points of the study was the to identify the parts to be produced locally, as well as quantifications required for the industry.

GLOBAL TRENDS AND CASE STUDIES - LESSONS FROM GLOBAL LCR EXPERIENCE

This report offers three country-specific case studies to illustrate the LCR policy administration upon the government's decision to stimulate infant renewable energy related sectors or otherwise stimulate the growth of renewables' share in the country's energy mix. The purpose of case studies was to illustrate how different countries administered the local content policy, the expected VS actual outcomes, and the drawbacks of the policy. Based on international experience, the policy analysis intends to offer "lessons learned" for countries like Georgia that are contemplating the LCR deployment. The case studies do not represent hard economic findings, rather they provide the context and qualitative features of the policy deployment and its outcomes.

Case sub-chapters are sorted based on geographic proximity to Georgia, starting from Turkey, followed by India and Canada.

CLOSER TO HOME: TURKEY

Economic and population growth in Turkey led to increased energy needs in the country. According to the Organization for Economic Co-operation and Development (OECD), Turkey had experienced the fastest growth in energy demand among its member countries. Turkey is expected to double its energy demand by 2030. The Turkish government has identified the need for the energy and, considering that over 2/3 of its energy comes from imported sources, decided to stimulate renewable energy development.

Feed-in tariffs were first introduced in 2005, but yielded no real results, according to the United Nations Conference on Trade and Development (UNCTAD). The policies were further revised in the next decade. To boost the energy independence and attract companies for a long-term settlement in Turkey, the government adopted a law (Law no. 5346) that provides local content support for domestically manufactured equipment used in renewable energy projects, including wind, solar, residential solar, geothermal and hydropower.

The Turkish government noticed a particularly significant potential for wind power in Turkey. The technical potential was estimated at 150 GW and the market was estimated to grow 30% annually through the next decade. While the government has assigned relatively low feed-in tariffs to wind, USc/kWh 7.3, the LCR bonuses defined by the new law based on the percentage of the local components can go as high as USc/kWh 11.

Local content contributions are described by the industries defined in the schedule below. The developer can bundle the local content in any given renewable development project and increase the feed-in tariff offered to the project initially.

Figure 3. Local Content Schedule (hydro, wind and PV solar), Turkey

SCHEDULE II (Provision of the law dated 29/12/2010 and numbered 6094)		
Type of Facility	**Local Production**	**Local Content Contribution (US Dollar cent/kWh)**
A-Hydroelectric production facility	1- Turbine	1.3
	2- Generator and power electronics	1.0
B- Wind power based production facility	1- Blade	0.8
	2- Generator and power electronics	1.0
	3- Turbine tower	0.6
	4- All of the mechanical equipment in rotor and nacelle groups (excluding payments made for the blade group and the generator and power electronics).	1.3
C- Photovoltaic solar power based production facility	1- PV panel integration and solar structural mechanics production	0.8
	2- PV modules	1.3
	3- Cells forming the PV module	3.5
	4- Invertor	0.6
	5- Material focusing the solar rays onto the PV module	0.5
D- Intensified solar power based production facility	1- Radiation collection tube	2.4
	2- Reflective surface plate	0.6
	3- Sun tracking system	0.6
	4-Mechanical accessories of the heat energy storage system	1.3
	5-Mechanical accessories of steam production system that collects the sun rays on the tower	2.4
	6- Stirling engine	1.3
	7- Panel integration and solar panel structural mechanics	0.6
E- Biomass power based production facility	1- Fluid bed steam tank	0.8
	2- Liquid or gas fuel steam tank	0.4
	3- Gasification and gas cleaning group	0.6
	4- Steam or gas turbine	2.0
	5- Internal combustion engine or stirling engine	0.9
	6- Generator and power electronics	0.5
	7-Cogeneration system	0.4
F- Geothermal power based production facility	1- Steam or gas turbine	1.3
	2- Generator and power electronics	0.7
	3- Steam injector or vacuum compressor	0.7

Source: UNCTAD

Based on Turkey's renewable-friendly policies and the government's commitment to generate 1/5 of its total electricity from wind and solar in the next decade, the additions for renewables have been marked by a tremendous growth in recent years. 2017 saw a significant increase in the Variable Renewable Energy (VRE) (wind/solar) grid integration. 1.8 GW was added to the grid by PV solar alone, which tripled the results compared to the previous year. The additions of 2017 made Turkey one of the largest markets for solar PV in Europe. According to Wind Europe (2018), Turkey added

467 MW of wind to reach a total of 7.4 GW installed capacity and generation from wind and solar represented 7% of Turkey's total electricity output. Almost 1/3 of the total target of 20%. Furthermore, growth is likely to continue before the targets are reached. Notably, Turkey has the advantage of a strong and stable central grid, meaning, the renewable target of 20% generation from wind and solar can be reached without negatively impacting transmission system and planning, as per assessment of TEİAŞ – the transmission system operator in Turkey.

To summarize, Turkey's success can be attributed to several factors, including but not limited to the LCR policies introduced by the government. One of the most significant contributors to the growth of renewable development is the significant decline of renewable technology costs that have initiated the renewable revolution globally sector wide. Turkey is no exception to this phenomenon. Renewable energy is already growing twice as much in Turkey as coal and gas combined, calculated in net terms, as per data of 2016. However, the positive results cannot solely be attributed to the effective LCR policy. The combination of renewable technology circumstances, favorable market conditions (growth of demand) and the definite policy direction of the government to support the renewables, have made the sector attractive for investors. Notably, some of the auctions have even come in below the feed-in tariffs, with around USc/kWh 4 for wind and USc/kWh 7 for solar PV. Following the renewable stimulation, the market has become attractive for the suppliers and developers leading to a subsequent decrease in price. Although, the market conditions in terms of demand and absolute quantities of Turkey and Georgia differ, Georgia could use Turkey's example as the way to chart its renewable path towards more energy independence through clear rules of the game and evident stimulation efforts.

CAUTIONARY TALE: INDIA

India started subsidizing its renewable energy sector in line with the renewable energy targets set out by G-20. The aim of the renewable stimulation program was to promote sustainable growth and energy security. Decentralized energy generation came as a priority, as the grid in rural and some urban areas was not sustainable enough for the existing large population especially considering the growing population.

India set out the policy goals in the directions of cost reduction, increased installed capacity, and technological advancement that would make India South East Asia´s renewable energy components manufacturing hub, with the overall objective of subsequently becoming a world leader in the solar cell industry. To ensure the attainment of the policy goals, India obligated solar developers to use solar cells and modules manufactured locally. Out of seven key components of the solar PV systems, India chose to secure the building blocks of the system as a local component. The LCR policy did make an exception for solar film developers, a technology different from solar PV, deeming that the industry was not ready to manufacture solar film as well. This made a crucial difference in the development of the country's solar market. In addition to local content requirements, the Jawaharlal Nehru National Solar Mission – the program to stimulate local solar PV production – has deployed bn.s of dollars of solar subsidies.

Despite the efforts, the solar market in India did not get stimulated as expected by the Solar Mission. India's LCR has significantly distorted the solar market. Instead of generating ever-growing demand for locally manufactured solar PV systems, India national developers opted for importing cheaper thin-film alternative and deploying thin-film solar. Worldwide, thin film solar is slightly over 10% of the total solar energy, however, in India, this number went up to 89%.

The LCR policy, eventually ended up stimulating the thin film production in the United States far more than its intended outcome to stimulate local PV systems. India-manufactured crystalline silicon failed to achieve the economies of scale that was necessary for beating the global prices and even prices of globally more expensive thin film solar, landing the Indian solar market in a significantly distorted stage, as well as putting the country´s reputation for fair trade practices under question as United States disputed that India has violated the terms of General Agreement on Tariffs and Trade (GATT).

The reasons for India not achieving the results it envisioned through LCR are multifaceted. Access to finance was more limited to Indian companies than those of the competitive manufacturers of thin film in the US. International financial institutions based their risk assessment on past projects and exercised caution when disbursing finance. Lack of the economies of scale was another major contributor to its inability to compete. As per Peterson Institute of International Economics, economies of scale for solar PV globally is achieved at the optimal production level at 75 MW of capacity per line. In contrast, Indian manufacturers manufactured 10 to 20 MW, never achieving the optimal economies of scale. In addition to this, all parts, other than solar cells, needed to be imported for the module manufacturing and since the scale was not there, India ended up being a price taker. Thus, India is entering an extremely competitive market with no bargaining power, sub-optimal economies of scale, and a steep learning curve ahead is unable to compete with the manufacturing technologies of more experienced rivals such as China.

SUCCESS STORY: CANADA

Canada´s LCR modality of choice is quantitative percentages and the policy motivation lies in local job creation and support of the infant industry. According to multiple sources, in 2018 Canada was one of the top 10 wind energy producers, generating 12.8 GW of wind power currently, compared to 2.4 GW just a decade ago, in 2008. Canada used a feed-in tariff and request for proposal incentive schemes paired with LCR to increase investment in its local renewable energy sector.

Ontario and Quebec, the two largest provinces, have different approaches to implementing LCR. Ontario had obligatory LCR requirements for developers in terms of quantitative percentages. As of 2012, for wind farms over 10 kW, the required minimum local content had to be 50% of the total project cost. LCR for wind farms was introduced in 2009 and until 2011, the LCR quantitative percentage remained at 25% of the project, thus allowing the manufacturers to catch up with the demand generated by project load. A similar system was applied to solar and other RE projects, with the latter two currently having a 60% local content requirement assigned to them. The quantitative percentages show the percentages that can be claimed for certain designated activities for the developers to be eligible for FiT. Examples include turbine towers, steel and local labor. Turbine towers manufactured by Canadian companies grant manufacturers 4% credit, while local labor grants as much as 20%. The credits add up and the developer accordingly qualifies for the FiT.

As expected, the LCRs used by Canadian provinces were eventually reflected in higher prices of about $386 USD extra per kWh of installed capacity (Hufbauer & Schott, 2013). Payoff in increased wind capacity was seen but Canada still has enormous potential to explore, and while ranking 8th in total installed capacity of wind power, per capita wind generation still lags behind. It has been speculated that Canada has not exploited its full potential due to LCR as investors shy away from expensive local content components and making development sluggish.

OUTCOME OF MAIN ASPECTS FROM CASE STUDY

- **The best LCR policy for Georgia is Optional, not Obligatory.** Investors should have the option to use local content and get additional benefit for it. The obligatory requirement during auctions, as is the case in Turkey, looks like a less optimal solution for Georgia due to limited number of projects and moreover concerns that might arise with the WTO;
- The Turkish experience shows that the attractiveness of the sector will generate increased interest in securing the spots of renewable development, eventually bringing down the market prices for electricity to its market level. However, the dimensional difference between the Georgian and Turkish markets might result in discrepancies;
- Georgia should not even attempt solar LCR other than for extremely low-tech parts such as mounting brackets, which are not even 10% of the cost of solar PV systems. However, this harbors the potential for market distortion as wind power being favored over solar and hydro might develop faster than the market would otherwise allow;
- System stability to favor the integration of additional renewable power will be a crucial element in deploying additional installed capacity in the form of wind and solar;
- Economies of scale for wind tower and blade production is important.

STAKEHOLDER ENGAGEMENT

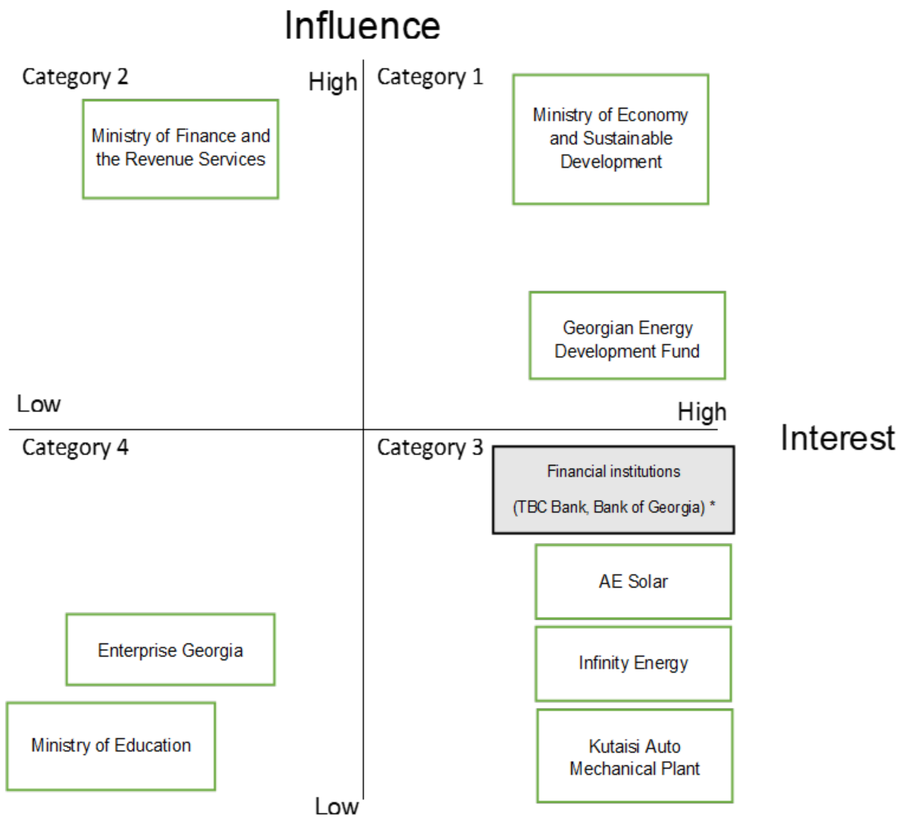
Understanding the priorities and perspectives of different actors are an important part of policy-making. Stakeholder interviews aided in understanding a social, political, economic, and environmental background where new policy will be adopted. Stakeholders’ viewpoints exhibited possible constraints and opportunities to be considered in the policy formation and gave a better understating of who should be engaged at which point of the policy design and implementation.

Interviews were conducted with the selected stakeholders for the purpose of their engagement with policymakers and private sector representatives.

The open-ended, in depth interviews set up the stage for the Research Team to analyze the socio-economic and political environment, evaluate the key stakeholders' interest level and influence, as well as their perspectives, priorities and values for their engagement. Interviews with the stakeholders lasted for about an hour, following which the influence-interest matrix was designed.

The influence-interest matrix is based on the best practice of "USAID stakeholder engagement" that enabled to group stakeholders in four categories. The matrix classifies the stakeholders into influential and interested, influential but less interested, interested but with no or little influence and stakeholders with some affiliation with the subject, however with no or little interest and influence. The MoESD, for example, is the most influential party with great interest in making policies that advance renewable energy development and reduce Georgia's dependence on foreign energy sources. The interviews are summarized below the matrix and are numbered according to their category: e.g. 1-a: The MoESD – an influential and interested party.

Figure 5. Influence-Interest Matrix for Stakeholders



Note: The financial institutions were not interviewed face-to-face and in-depth. Their interest and influence were evaluated based on their past actions, general strategy direction, commitment to the energy sector (based on the size of their portfolio) and telephone conversations at several separate occasions.

Category 1: Highly influential and interested parties

The Ministry of Economy and Sustainable Development is committed to increasing the share of renewable energy in the grid and is interested in the introduction of policies suiting this purpose. The MoESD, the main policy-maker in the energy sector, has been working towards an optimal policy to stimulate the renewable energy sector. The main constraint that the MoESD has to consider is the commitment to fiscal sustainability that Georgia took in 2017 following the evaluation from the IMF. The IMF concluded that the policy of PPA, practiced by the MoESD to stimulate the renewable energy plant construction, was not a fiscally sustainable policy as it was classified as the state obligation towards investors and increased the leverage of the county. Based on this evaluation and pressure from the Ministry of Finance of Georgia (MoF) to reduce the financial burden of the commitments, the GoG has exercised a temporary standstill on the PPA. The number of projects to be financed and implemented has decreased following the standstill and remains so even today. The MoESD has been continuously working on finding a policy that would continue stimulating the sector without compromising the fiscal sustainability and the policies have yet to be designed. Thus, the MoESD's interest in sustainable and effective policies is considerable.

The interviewee from the MoESD shared the possible steps that the ministry might take, however, none of the directions are explored beyond research and consultations. According to the MoESD, the Ministry is considering resuscitating the effort to stimulate the energy sector through either FiT, Feed-in Premiums (FiP), Green Certificates or Contracts for Differences, however details need be determined. In general, the MoESD is open for further consultations on the policy design that will contribute to increasing the share of renewables in the energy mix - an obligation taken up as part of the EU third energy package.

The private sector participants active in the renewables sector are highly dependent on the policy to be determined by the MoESD, however, they continue to prepare for a rapid takeoff. AE Solar – a German company manufacturing solar panels in the Kutaisi FIZ has been active on the market for the past few years and is generally concentrating on export markets. The company exports the panels with a "MADE IN GEORGIA" label to the Philippines, South Africa, and Thailand, among others. The company expressed interest in expanding their operations in Georgia, as part of residential as well as utility-scale solar projects, however, they also stressed the role of the government in its company's decision-making. The AE Solar respondent referred to imported, cheaper panels as the major threat to their operations and expansion domestically. From the perspective of the company, the government should not only sharpen its policy and identify the renewable support schemes as soon as possible, but also enact protective market measures against imported solar panels, specifically from China. The company was not well aware that the protectionist measures are against the WTO rules and MoF and the Revenue Services completely exclude protectionism per Georgia's current commitments internationally, including to the WTO. The respondent also mentioned that the FIZ tax legislation should be clearly outlined for investors and the government should further stimulate the production site construction in Georgia.

AE Solar's operations mainly rely on local human capital. The company believes that the available skillset is well paired with motivation in Georgia, that creates opportunities for retraining and headhunting. Respondent underlined the importance of retraining the local staff as they are highly motivated to acquire new skills, however this perspective on human capital is not universally shared within the industry. AE Solar is determined to be part of the policy formation process and is willing to be one of the first-movers in the solarization of Georgia. Their plant has the readiness and capacity, to supply local projects, both residential and utility-scale, with high quality solar panels.

Infinity Energy, a private sector representative, planning to get up to 300 MW of wind power operating by 2025, has interest in purchasing local content if the prices match the international competitors or if they are compensated fairly through the renewable support schemes. In general, the private sector is concentrated on the efficiency and speed of project implementation. Infinity Energy expressed readiness to cooperate with local suppliers, however had concerns over the price premiums they would have to pay if they were obliged to use local content in their projects, such as locally manufactured wind towers. Apart from this concern on price premium, the company is ready to collaborate further for supporting the local market development when it comes to supplying materials for project construction. Infinity Energy has empathized the importance of a government policy in support of renewable sector development for the next 10 to 20 years.

ATC – Aero-structure Technologies Cyclone – is a Georgian-Israeli joint venture that produces parts for Boeing airplanes in Georgia. The reason for interviewing ATC is that they represent the first and the only producer that effectively pairs Georgia's investor friendly climate, cheap and trainable labor force, and its complex hi-tech manufacturing which is a result of multiple trainings and technology transfer. The joint venture is partly supported by the Partnership Fund. The Research Team interviewed Mr. Mikheil Begiashvili, - the Chief Financial Officer (CFO) of the company. Mr. Begiashvili elaborated on the company's drawbacks, working process, and success stories. He named access to finance as one of the key obstacles. Even though the company had a considerable cash capital at hand and contracts from Boeing on the acquisition of products, Mr. Begiashvili noted that due to the novelty involved in the financing process, the bank employees were unable to evaluate risks and rewards within the industry, thus, made the financing process more complicated. Mr. Begiashvili is optimistic about the workforce in Georgia and is confident that with the right skills training, the production sites can have reasonably proficient technicians and engineers at hand. He stressed out the importance of preparation process and noted that ATC spent three years for training and preparation before the launch of production. According to Mr. Begiashvili Land transfer and bureaucracy are the key reasons for hindered the production until next year.

The preparation process and unexpected bottlenecks were alleviated by the equity, injected into the joint venture. Overall, ATC's experience was rather positive in operating in Georgia and the company is securing future contracts, promising to increase the turnover and employment in the future. Currently, ATC employees up to 100 people, 80% of which are variable skilled technicians or engineers. Mr. Begiashvili stressed that the structural model of ACT - the joint venture formed in collaboration with already existing company specializing in manufacturing specific parts - is a must when launching a hi-tech plant in Georgia. This aspect in combination with the capital availability were the crucial steps on the path to success for ATC.

For understanding local capacity and skills, Kutaisi Auto Mechanical Plant (KAMP) and Ministry of Education, Science, Culture, and Sport (afterwards Ministry of Education) were interviewed. Technical capabilities were surveyed in an interview with KAMP, based on their experience of engineers and technicians operating within the industry. The Ministry of Education was interviewed to find out the capacities of the government in supporting short, medium, and long-term education and retraining efforts by the private companies and/or Legal Entity of Public Law (LEPL).

KAMP is certain that the local manpower and skillset will easily handle intermediary good production necessary for renewable energy projects. Main line for KAMP involves metallurgy, including non-ferrous metals, mechanical processing and laboratory services for measuring the metal strength. The management is extremely interested in becoming a part of the growing renewable industry and one of the main suppliers of intermediary goods, e.g. mounting brackets for solar panels. The company is prepared to work with larger parts, such as wind towers, manufactured locally and all the spare parts that are made of metal, based on the best international practices. The KAMP representative explained that Georgia would benefit in short- and medium-term by focusing on stimulating the production of intermediary goods for renewables made of metal, as they are cost-efficient to manufacture locally, and do not require decades of mechanical and electrical engineering knowledge pool (e.g. turbines, motors, rotors, etc.). According to the company the metal parts, manufactured based on the existing blueprints at a cheaper price, can be produced immediately. The company is prepared to further collaborate on the policy development and share their expertise, opportunities, and bottlenecks with the local production processes.

The Ministry of Education, as of now, has no skill-enhancing training programs but has adopted a policy, according to which private companies can register as educators and possibly gain government funding for designing training programs. The potential exists for operational and future companies to set up trade schools to suit their needs, acquire an official education institution status for short- and medium-term (up to six months) educational programs. This way, the ministry hopes to stimulate skill-building based on market demand and ensure that the educated manpower will have the possibility to get on-the-job training and further employment in a company that will train them. Through directing the policy and part of funding to companies involved in supplying intermediary goods for renewables, a possible effect could be opening up the companies to unskilled labor to be re-trained, increasing the employable labor pool.

Quasi-governmental organizations responsible for providing a support infrastructure for industry and business development, such as Enterprise Georgia (EP) and Georgian Energy Development Fund (GEDF), are prepared to engage at a later stage. Enterprise Georgia had expressed little interest in being the part of the policy design, however has issued assurance that they are prepared to finance locally produced intermediary and spare parts that will be used for renewables, as renewable energy financing is one of their priority sectors. The production business should make financial sense, as per EP, and clear the first step of screening with financial institutions, such as commercial banks. EP has little or no influence on the policy-making process but is prepared to engage (at a later stage of financing) the enterprises that will be upgrading or designing new plants to supply the sector with locally-produced goods.

GEDF, as a trustworthy mediator between the investors and Georgia's renewable sector, is dedicated to expanding the local base for intermediary renewable goods, however sees this as a challenging task due to the lead time required to prepare the local skill pool to be up to the challenge. GEDF is the only company so far to have executed a wind power plant of 20 MW in Georgia. They are familiar with the demands that international wind turbine producers have in terms of safety and reliability and have expressed concerns that Georgia might not be prepared to handle the challenge. However, they have encouraged open dialogue between the policy-maker (MoESD) and international production giants (e.g. Nordex, Vestas) in figuring out what parts and intermediary items could be produced in Georgia for a competitive price. According to GEDF, the small size of the Georgian market, less suitable for multiple producers, creates risk of forming less competitive market.

Funding prospects are available from various sources, starting from Commercial banks to international donors. However, those units interested in the investment will carefully study the sector, investment climate, government policy and the respective business plans.

Financial institutions were not interviewed in the scope of this report. However, acquired experience in combination with the ecosystem of renewable energy financing, based on the portfolios of local commercial banks and International Financial Institutions (IFIs), enables to state that (IFIs) reveals high interest in the sector.

TBC Bank and Bank of Georgia have been active in financing renewable energy projects with millions of dollars invested in the sector. The commercial banks are not suffering losses or delinquencies from the borrowing parties and the projects that have been financed are able to cover the interest payments, thus, motivating the commercial banks to loan to the sector further. As for the IFIs, European Bank for Reconstruction and Development (EBRD) and International Financial Corporation (IFC) have been very active in the sector and are dedicated to financing renewables further, as long as the projects are financially stable. The IFIs, unlike the local commercial banks who are prepared to take the local market risk, are seeking a higher level of security through financing projects with sovereign guarantees, such as PPA and are less likely to take the local market risk without a solid policy in place for supporting the renewables.

THE MAIN FINDINGS FROM STAKEHOLDER INTERVIEWS

- Georgia can produce at least mountain brackets and towers for wind turbines locally. Georgian metal manufacturers are ready to cooperate;
- Combining strengths in the form of a joint venture with an international partner, experienced in the production of hi-tech parts, is crucial to success;
- AE Solar produces small scale solar panels in Georgian FIZ. They are mainly concentrated on export but have the capacity to sell locally as well;
- Local workforce is ready for new technologies and new production lines. The companies declare that Georgians are keen on studying and expanding their knowledge. Therefore, with updated skills in metallurgy (c. 10ths people) and appropriate trainings, the local staff can easily operate in any new factory;
- The financing for new factories working on local components for RE can come from state-owned programs, like Enterprise Georgia, commercial banks, either locals or IFIs, and both local and foreign investors will be keen to make equity investments;
- Equity and availability of working capital during product development is a must;
- Having skilled bankers who can assess risk and reward in new industries will speed up the process;
- Construction of production line for a specific part of a power plant can be challenging, as it must match other parts of the plant, like turbine & generator. Thus, any plant would need pre-qualification from turbine suppliers, or even more, the full technology transfer from them. It is important that local factories for PP parts have universal production, not linked to only one specific turbine manufacturer but can be applied by others;
- Government considers different renewable energy investment promotion mechanisms and LCR might be one of them;
- Tax regime in Georgia is already very investor-friendly, however, there is a room for improvement for companies in FIZ for sales to Georgia. This aspect needs additional study of FIZ regulations.

THE VALUE CHAIN ANALYSIS OF VRES

The comprehensive analysis of LCR, required closer look at renewable energy value chain in order to identify the potential of producing certain components locally, followed by cost analysis of each version. In this chapter, the Research Team focused on industrial scale VRES projects, mainly onshore wind and solar projects.

Generally, Capital Expenditure (CAPEX) costs for both wind and solar power plants can be split into two main categories: equipment and construction, where 70% of cost comes on equipment and the rest on transportation, construction, land acquisition, and engineering works. The construction work varies based on project, its landscape, distance from the grid connection point, availability of road, etc., while equipment costs have less variations.

The size of power plant highly impacts the cost per MW as some costs, like construction of roads and transmission lines is more linked to the number of turbines rather that overall capacity of the power plant.

To simplify the process, the Research Team analyzed 20 MW power plants for both wind and solar power plants. The rationale for choosing the 20 MW as a sample case derives from the existing example of wind power plant and scale of some on-going VRES projects.

GLOBAL TRENDS OF VRES DEVELOPMENT

Variable renewable energy was considered as one of the most expensive energy resources both in terms of CAPEX and operational costs. However, the cost of wind turbines and solar panels have dropped over the past decade due to technological developments and high interest in VRES investments.

The further price decrease is expected worldwide due to technological advancements. The capacity factor is another aspect of technological development and subject of constant improvement. The Levelized Cost of Electricity (LCOE) is a more important factor to look at when discussing the global trends on renewable energy. The LCOE is a factor combining the capacity factor and capital expenses, enabling comparison of different types of renewable energy projects.

Figure 6: Global Weighted Solar and Wind Power Investment Costs, Capacity Factors and LCOEs, 2015 and 2025[1]

	Global weighted average data								
	Investment costs (2015 USD/kW)		Percent change	Capacity factor		Percent change²	LCOE (2015 USD/kWh)		Percent change
	2015	2025		2015	2025		2015	2025	
Solar PV	1 810	790	-57%	18%	19%	8%	0.13	0.06	-59%
CSP (PTC: parabolic trough collector)	5 550	3 700	-33%	41%	45%	8.4%	0.15 -0.19	0.09 -0.12	-37%
CSP (ST: solar tower)	5 700	3 600	-37%	46%	49%	7.6%	0.15 -0.19	0.08 -0.11	-43%
Onshore wind	1 560	1 370	-12%	27%	30%	11%	0.07	0.05	-26%
Offshore wind	4 650	3 950	-15%	43%	45%	4%	0.18	0.12	-35%

As seen on figure 6 above, the expectation on the market is towards the decrease of costs and increase of efficiency for any kind of VRES. The 2018 data shows positive tendencies comparing to 2015 data.

Figure 7: Global Electricity Costs in 2018[2]

	GLOBAL WEIGHTED-AVERAGE COST OF ELECTRICITY (USD/KWH) 2018	COST OF ELECTRICITY: 5TH AND 95TH PERCENTILES (USD/KWH) 2018	CHANGE IN THE COST OF ELECTRICITY 2017-2018
Bioenergy	0.062	0.048–0.243	–14%
Geothermal	0.072	0.060–0.143	–1%
Hydro	0.047	0.030–0.136	–11%
Solar photovoltaics	0.085	0.058–0.219	–13%
Concentrating solar power	0.185	0.109–0.272	–26%
Offshore wind	0.127	0.102–0.198	–1%
Onshore wind	0.056	0.044–0.100	–13%

ONSHORE WIND POWER PLANT

Figure 8 shows the standard cost breakdown for a 20 MW wind power plant.

[1] IRENA - The Power to Change: Solar and Wind Cost Reduction Potential to 2025 – publication of June, 2016
[2] IRENA - The Power to Change: Solar and Wind Cost Reduction Potential to 2025 – publication of June, 2016

The "balance of plant" cost items are the easiest to be manufactured locally, but since Georgia has no experience in the development and construction of wind power plants, only c. 70% of the balance of plant costs can be allocated to the local companies. Overall, including wind towers and even blades (which would be difficult to make but achievable), the share of the local component can go up to 40% for wind plants. It is important that some materials are still imported that is why only 75% of blades cost is allocated to the local content.

The main cost item for wind power plants remains with the equipment: turbine (c 40% of total cost), blades, and tower (with c 10% share in total each). The transportation cost, heavily depends on the number of imported elements. The local production of these elements would dramatically increase the share of local production in overall costs and add value to Georgian economy. To quantify this analysis for each component of equipment we will need several aspects of information: 1) the estimated demand of production 2) available production capacities 3) available materials and workforce 4) technological compliance and 5) the options for further discussions.

Figure 8: Elements and Cost Breakdown for 20MW Wind Power Plant[3]

Construction Costs	Cost, '000 US$	Cost Per kW	Percent of total Cost	Local Share, potential
Total	**$30,088**	**$1,494**	**100.0%**	**42%**
Equipment Costs	**$20,699**	**$1,035**	**68.8%**	**29%**
Turbines and other equipment (excluding blades and towers)	$12,378	$619	41.1%	**0%**
Blades	$2,898	$145	9.6%	**50%**
Towers	$3,208	$160	10.7%	**75%**
Transportation	$2,215	$111	7.4%	**100%**
Balance of Plant	**$9,389**	**$459**	**31.2%**	**70%**
Materials	**$4,337**	**$209**	**14.4%**	**81%**
Construction (concrete, rebar, equip, roads and site prep)	$2,991	$150	9.9%	**90%**
Transformer	$338	$17	1.1%	**0%**
Electrical (drop cable, wire,)	$357	$18	1.2%	**100%**
HV line extension	$651	$33	2.2%	**70%**
Labor	**$4,279**	**$212**	**14.2%**	**63%**
Foundation	$677	$34	2.2%	**95%**
Erection	$766	$38	2.5%	**75%**
Electrical	$1,117	$56	3.7%	**70%**
Management/Supervision	$580	$29	1.9%	**20%**
Misc.	$1,140	$57	3.8%	**50%**
Development/Other Costs	**$772**	**$37**	**2.6%**	**53%**
HV Sub/Interconnection	$269	$13	0.9%	**70%**
Engineering	$280	$14	0.9%	**0%**
Legal and land acquisition Services	$224	$11	0.7%	**100%**

SOLAR PHOTOVOLTAIC

Cost per MW for the solar power plants has decreased dramatically over the last decade. Based on International Renewable Energy Agency (IRENA's)[4] recent publication, the decline in the global weighted-average LCOE of solar PV was 77% between 2010 and 2018. The average cost per MW is expected on average at USD 1 mn /MW. The cost decrease is expected to continue[5] further.

For the solar power plants, local content can be achieved in metal support structures, like mountain brackets, but some of the products used in production of mountain brackets will be still imported.

[3] National Renewable Energy Laboratory, JEDI wind energy model W9.14.18
[4] IRENA- RENWABLE POWER GENRATION COSTS IN 2018 – publication of May, 2019
[5] IRENA - The Power to Change: Solar and Wind Cost Reduction Potential to 2025 – publication of June, 2016

Figure 9: Elements and Cost Breakdown for 20 MW Solar Power Plant[6]

Construction Costs	Cost, '000	Cost Per kW	Percent of Total Cost	Local Share potential
Total	**$30,000**	**$1,500**	**100.0%**	**37%**
Equipment Costs	**$21,049**	**$1,052**	**70.2%**	**18%**
Mirrors	$1,775	$89	5.9%	0%
Heat Collection Elements	$5,628	$281	18.8%	0%
Thermal Energy Storage Tanks	$1,634	$82	5.4%	42%
Heat Exchangers	$1,214	$61	4.0%	0%
Heat Transfer System Equipment	$996	$50	3.3%	34%
Heat Transfer and Storage Fluids	$3,516	$176	11.7%	10%
Steam Turbines & Generators	$2,376	$119	7.9%	12%
Misc. Electrical and Solar Equipment (pumps, motors, drive, etc.)	$80	$4	0.3%	59%
Water Treatment	$69	$3	0.2%	50%
Metal Support Structure	$1,066	$53	3.6%	50%
Interconnection Piping	$1,549	$77	5.2%	59%
Electronics & Controls	$535	$27	1.8%	50%
Balance of Plant	$611	$31	2.0%	50%
Construction Subtotal	**$5,118**	**$256**	**17.1%**	**99%**
Materials	**$801**	**$40**	**2.7%**	**95%**
Labor	**$4,317**	**$216**	**14.4%**	**100%**
Site work and Infrastructure	$226	$11	0.8%	100%
Field Erection	$2,700	$135	9.0%	100%
Support Structures	$159	$8	0.5%	100%
Piping	$881	$44	2.9%	100%
Electrical	$351	$18	1.2%	100%
Other Costs	**$3,833**	**$192**	**12.8%**	**59%**
Engineering & Project Management	$3,109	$155	10.4%	50%
Misc. Costs (permitting, licensing, legal)	$725	$36	2.4%	100%

Another categorization of solar PV costs are as follows:

Figure 10: Balance of System Cost Breakdown Categories for Solar PV[7]

CATEGORY	SUB-CATEGORY	LOCAL CONTENT AVAILABILITY
Non-module hardware	Cabling Racking and mounting Safety and security Grid connection Monitoring and control	Cabling Grid connection Part of monitoring and control
Installation	Mechanical installation (construction) • Access and internal roads • Cable routing • Installation of mounting/racking system • solar modules and inverters • grid connection components • transport of components/equipment Electrical installation • DC installation • AC medium voltage installation monitoring and control systems Inspection (construction supervision)	Mechanical installations
Soft costs	Permitting System design Incentive application Consumer acquisition Financing costs	Already done mostly by local companies

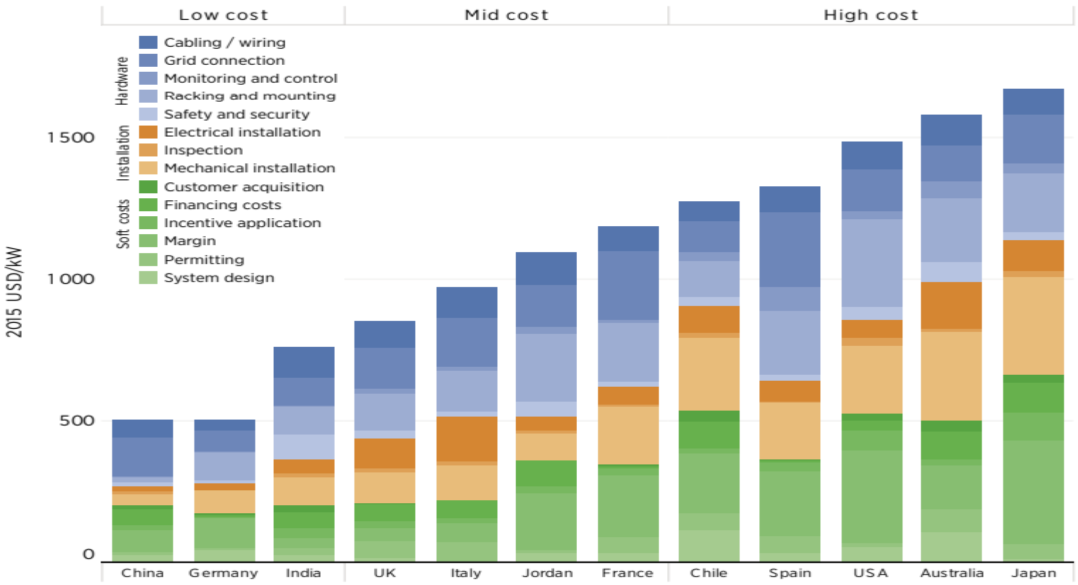
The overall cost allocation between these items differs depending on the country. Countries with advanced technologies like China and Germany have lower hardware and installation costs due to

[6] National Renewable Energy Laboratory, JEDI wind energy model W9.14.18
[7] IRENA Renewable Cost Database, interviews

well developed markets. Such advanced markets operate on the principles of competition, hence cost of software is competitive and reasonably lower compared to other countries.

USA, Australia and Japan have on average 3 times higher costs than China and Germany. These countries have high costs of racking and mounting, as well as for mechanical installation, and also have higher margin expectations (included in soft costs).

Figure 11: Detailed Breakdown of Solar PV Balance of System Costs by Country, 2015 Data[8]



Source: IRENA Database

GEORGIAN PRODUCTION CAPABILITIES AND IMPACT ON COST

The value chain analysis of global VRES created a better understanding of which parts can be produced in Georgia in view of the local production capacity (discussed in the next chapter). **Georgia has the capacity to manufacture low-tech parts of the VRES such as wind towers, solar PV mounting brackets, etc.**

Local production of wind or solar power plant parts might increase the cost of equipment due to the absence of the economy of scale. On the other hand, transportation costs will be much lower for any project in Georgia. Roughly, 30% increase in the production cost of wind towers and reduction of total transportation costs by 30% will result in a 1% increase in overall cost of the wind power plant (calculations made from figure 8). In the case of 20% or less increase in wind tower costs, the overall project cost will decrease. For the solar power plants, under the assumption that metal support structure will increase in cost by 20% including transportation, the overall cost of the solar projects will increase by mere 0.7%.

On the other side, if LCR gives additional income for renewable energy developers, it will stimulate the investments in renewable energy and bring additional investments in the sector. The impact of overall investments, both in LCR factory and in renewable energy projects is calculated in the chapter of impact analysis.

DISTRIBUTED GENERATION

Distributed generation refers to a variety of technologies that generate electricity closer to the end-user or where it will be applied, such as solar photovoltaic panels, small wind turbines, emergency backup generators, etc. Distributed generation is connected to the electric utility’s lower-voltage distribution lines. The distributed generation in Georgia is known under the name of "micro power plants” and is defined as power plants with a capacity below 100 kW. They fall under the “net-metering” policy in Georgia, which means that distributed generation owners can net their generated

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[8] IRENA

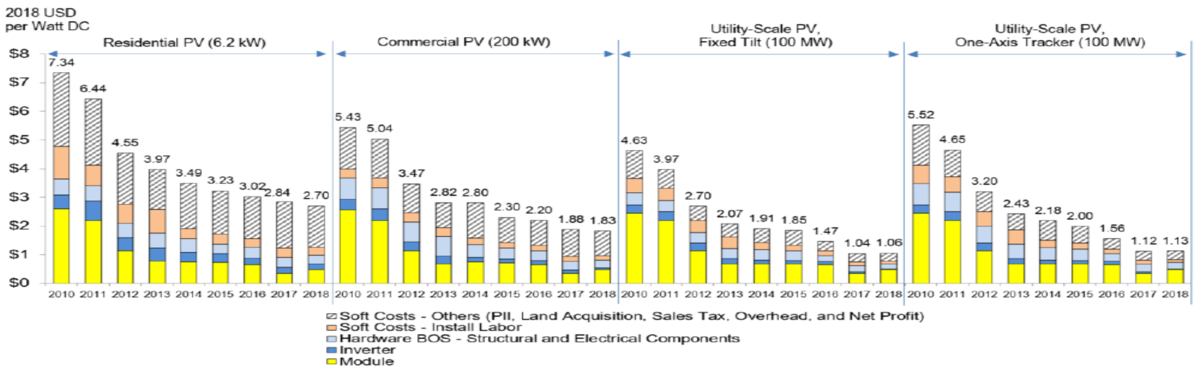
and consumed electricity and pay/or get paid for the difference between generation and consumption (during each month).

Distributed power might have the highest potential in terms of LCR in Georgia. The technological process for micropower plants is so much easier than the whole production process that can be built in Georgia. E.g. AE Solar which has distributed solar panels production in FIZ of Georgia. The example of AE Solar shows that Georgia has the capacity of full production of household-scale solar panels. On the other side, the demand for distributed generation is raising and is still untapped, which means that demand on each solar PV or micro wind turbine can reach high scales.

As shown in the Figure below the cost of production is going down for residential-scale turbines (same as micro-generators) as well as utility-scale ones. Since Georgia has considerably lower soft costs compared to the United States, the prices might be lower in Georgia. Also, the availability of old factory buildings in Georgia, that might be used for an investment proposal from the state, might reduce the construction costs of a new plant, thus the depreciation costs allocated to the turbine might also be lower. These additional incentives (investment property, low workforce, depreciation) might decrease the cost of production when compared to import from other countries.

Furthermore, if the initial installation is promoted, or additional benefits are given to producers, the cost of micro power plants might go down and become more profitable and affordable for the Georgian population. This will further increase the demand for the micro-scale power plants (in line with net-metering regulation), even in the current tariff structure.

Figure 12: Estimated Installation Cost Dynamics in US[9]



For the micro-power plants, Georgia has capacity to assemble 100% locally, but most of the parts will be imported.

LOCAL PRODUCTION CAPABILITIES

The availability of workforce and materials on the local market is important. If most of the materials should be imported and there is no workforce available in Georgia, the policy will never work. In the next chapter, the Research Team analyzed the value chain components and assessed the Georgian companies' capabilities.

AVAILABILITY OF WORKFORCE AND INDUSTRIAL CAPACITY IN GEORGIA

There is not a readily available workforce with experience in wind turbine installation and maintenance in Georgia, as there is only one power plant constructed in Georgia with foreign contractors in charge of construction and maintenance. It is important for the development of the industry and the working environment to develop a training center in Georgia. There is civil engineering and/or electric engineering training center necessity in order to acquire necessary skills for the wind / solar power plant installation and electricity transmission lines construction. If the wind development hits high scales, local personnel might evolve. However, labor amounts to only an insignificant part of the total local costs, as without any local equipment, the share of local content can never be of a significant amount for savings.

[9] National Renewable energy laboratory; U.S. Solar Photovoltaic System Cost Benchmark: Q1 2018; October 2018; NREL/PR-6A20-72133

Georgian metal manufacturers have expressed readiness to cooperate. Georgia has a capacity to produce at least mountain brackets and towers for wind turbines locally. In order to understand the readiness of local market for these manufacturing opportunities, the Research Team analyzed the basic metals manufacturing sector in Georgia in terms of turnover, profitability, workforce, and technological advancements.

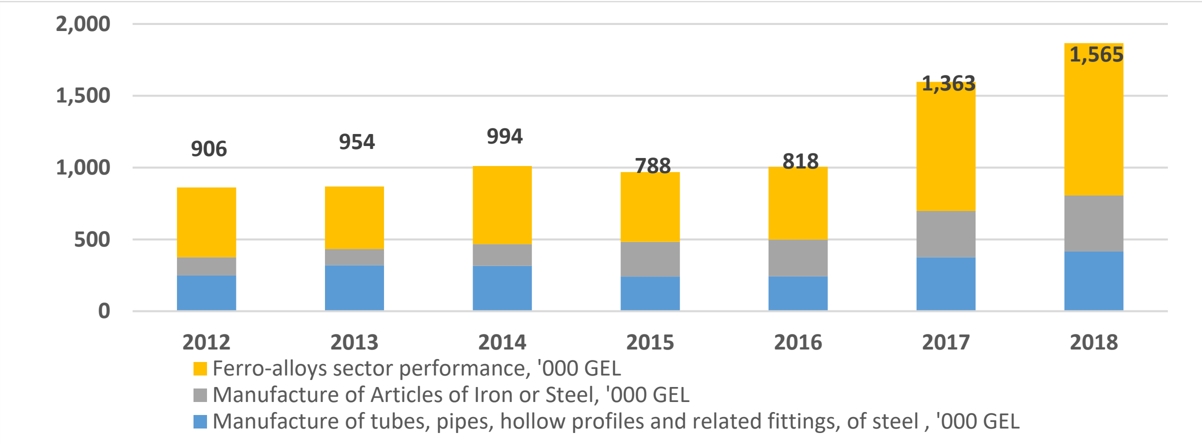
There are over 87 manufacturers of basic metal in Georgia, mainly casting the metals or manufacturing basic iron and steel. There are eight large basic metal manufacturing companies with the revenue above GEL 60mn. Others are small and medium-sized entities. The key companies operating in manufacturing of basic metals are shown in the figure below, with the key profitability ratios of 2018. The figure shows that industry has companies with strong financial positions and ability of further growth (e.g. Geosteel, Rustavi Steel Corportation, ISeko, Geo Fero Metal, Georgian Alloys group, etc.).

Figure 13: Large and Medium Size Companies Operating in Manufacturing of Basic Metals Sector and their Key Profitability Indicators for Year 2018

Name of company	Size of company*	Revenue (GEL)	EBITDA Margin	Net profit Margin
Geosteel	Large	175,351,985	15.5%	14.7%
Russalloys	Large	72,863,779	-5.2%	-10.1%
GTM Group	Large	60,007,306	-0.8%	-3.0%
Mould's and Metal Georgia	Large	51,116,611	-0.3%	-5.2%
Chiaturmanganum Georgia	Large	Not public info	Not public info	Not public info
Eurasian steels	Large	Not public info	Not public info	Not public info
Georgian Manganese	Large	Not public info	Not public info	Not public info
Globe LTD	Large	Not public info	Not public info	Not public info
Rustavi Steel Corporation	Medium	21,687,701	28.5%	24.0%
Iseko	Medium	14,280,906	6.7%	0.4%
JT Trade	Medium	12,070,858	-3.3%	-4.8%
Geo Fero Metal	Medium	11,299,235	9.0%	6.5%
Georgian Alloys Group	Medium	10,205,120	6.8%	2.1%
Caucasus Metal Group (CMG)	Medium	6,951,499	-11.9%	-13.4%
Kutaisi auto-mechanical plant	Medium	5,213,000	2.4%	-2.0%
Glass Work	Medium	4,448,340	-123.3%	-123.3%
Metallolam	Medium	Not public info	Not public info	Not public info

The basic metal manufacturing industry in Georgia evolved fast with a 9.5% compound annual growth rate in 2012-2018, increasing the turnover of the sector from GEL 900mn in 2012 to GEL 1.5bn in 2018. The basic metals (iron, steel, ferroalloys, precious and non-precious metals) manufacturing sector comprises of companies producing ferroalloys, manufacturing tubes, pipes, hollow profiles and related fittings, of steel; manufacture of articles of iron or steel, etc. The companies in the industry have gained some experience and currently boats the presence of qualified workforce.

Figure 14: Turnover of Manufacturing of Basic Metals[10]

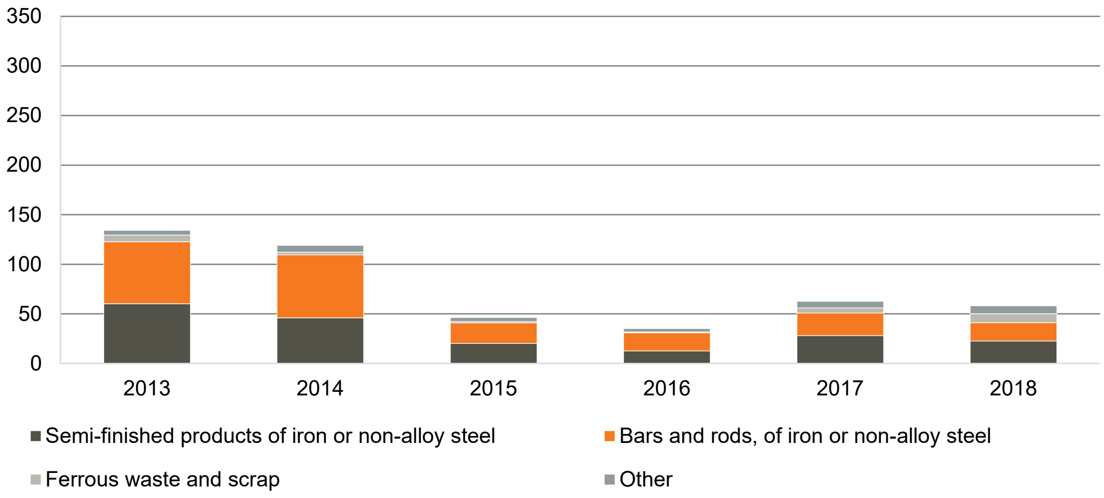


[10]Source: GEOSTAT

Construction of a production line for a specific part of the power plant can be challenging, as the line must be consistent with other parts of the plant, like turbine & generator. Thus, any plant would need pre-qualification from turbine suppliers, or even more, the full technology transfer. It is important that the local factory for PP parts has a capacity for universal production, therefore not linked to only one specific turbine manufacturer but can be applied by others. Combining knowledge and forces in the form of a joint venture, with an international experienced partner specializing in the production of hi-tech parts, is crucial to success.

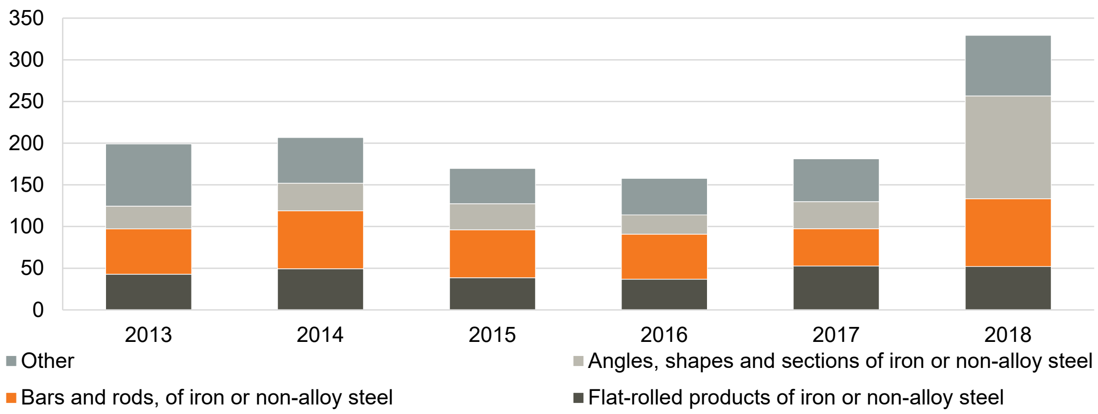
The abovementioned companies are engaged in both local market and export activities. While the export of overall basic metals is increasing, the import of iron and steel remains high and increases due to the demand from the Georgian side. If the LCR is implemented in Georgia, the required steel and iron will still be imported. The idea of localization will solely be working on value added created during the manufacturing process.

Figure 15: Iron and Steel Exports from Georgia, US$ mn



Source: MoF

Figure 16: Iron and Steel Imports to Georgia, US$ mn

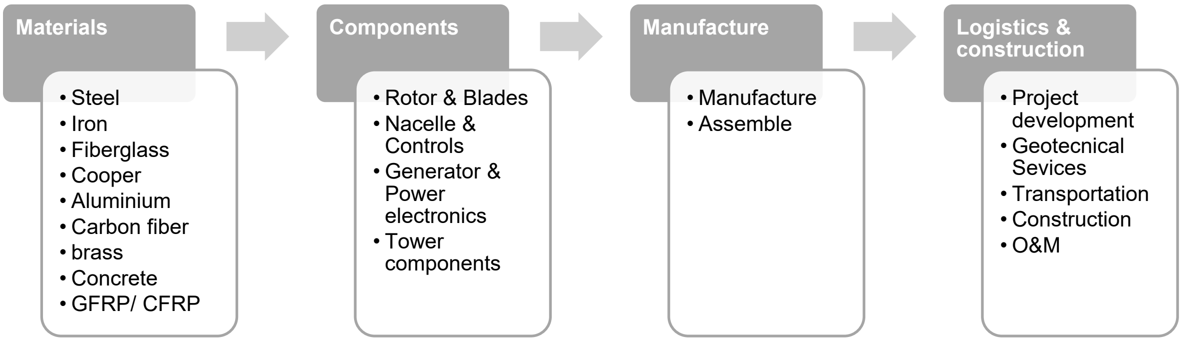


Source: MoF

The analysis of simplified wind power plant value chain, allows the assumption that the main materials will be imported, whereas the components related to the tower and rarely blades can be produced locally.

Wind turbines can be assembled locally, however, this process is hindered by the absence of respective qualification. As mentioned earlier, there is not a readily available workforce with experience in wind turbine installation and maintenance in Georgia. The presence of civil engineering and/or electric engineering training center is essential to obtain skills for the wind/solar power plant installation and construction of the electricity transmission lines. If the wind development hits high scales, local personnel might evolve. Logistics & construction part is also dependent on qualified personnel of RES itself and will need some qualification updates to be fully localized.

Figure 17: Simplified Wind Power Value Chain[11]



Construction of the production line for a specific part of a power plant can be challenging, as it must match other parts of the plant, like turbine & generator. Thus, any plant would need pre-qualification from turbine suppliers, or even more, the full technology transfer. It is important that the local factory for PP parts has a capacity for universal production, therefore not linked to only one specific turbine manufacturer but can be applied by others. Combining knowledge and power in the form of a joint venture, with an international skilled partner who specializes in the production of hi-tech parts is crucial to success.

Financial strength of manufacturers of basic metal depends on the company size and overall performance. The companies operating on export markets have higher profitability ratios compared to those operating only locally. The exchange rate risks affect the profitability of companies. The sector is not very leveraged. Based on data obtained from the selected companies, there is an opportunity for expanding production lines through an additional loan.

The financing for new factories producing the local components for renewable energy can come from the state-owned programs, like Enterprise Georgia, commercial banks, either local or IFI's, and both local and foreign investors will be keen to make equity investments.

The sector employs c. 10'000 people. The number of employees slightly decreased since 2012 due to technological advancements, but the average salary has increased from GEL 640 in 2012 to GEL 1025 in Q2 2019. The local workforce is ready for new technologies and new production lines. **The interviewed companies declare that Georgians are keen on studying. With acquired skills in metallurgy (c. 10ths people) through proper trainings, the trained personnel won't have difficulties in any new factory.**

In conclusion, it can be noted that the most optimal parts of the wind powerplant that can be produced locally are towers and mountain brackets for solar PVs. The tower is the easiest part for the local production. With the metallurgical plants available in Georgia and lots of soviet buildings once constructed as factories but currently left idle, the capacity for towers development is in place. Importantly, the towers for transmission lines are constructed locally. Having in mind the same available capacities, the blades factory might also be an option, but the technological process is much more difficult compared to towers.

DEMAND ON RES IN GEORGIA AND REGIONS

To analyze the demand of any factory working on the LCR, the number of wind turbines/solar panels (with all consecutive parts) needed in Georgia and in the region, should be calculated. Initially the focus was made on the demand of Georgia, Armenia and Azerbaijan (only for wind turbines, as they have local solar PV manufacturers), as other neighbors have their own production. Additionally, the export of materials/products to further countries is an extra opportunity not included in the analysis below.

[11] Ayee, Gloria & Lowe, Marcy & Gereffi, Gary. (2009). Wind Power: Generating Electricity and Employment.

INDUSTRIAL SCALE WIND AND SOLAR POTENTIAL IN GEORGIA AND NEIGHBOURS

Due to their volatility, wind and solar integration into the grid is limited. According to Georgian State Electrosystem (GSE) estimations these limitations are 333MW wind and 130 MW solar by 2020 and to 665 MW wind and 260 MW solar by 2025, with the assumption that the power plants able to provide reserve capacity will be commissioned.

The limitations were revised in 2018 and published in TYNDP 2019-29 in Apr-19. Before that, grid integration of wind and solar was limited to 100 MW by 2025, which was very small limit for developers having cumulative memorandums on 1.8 GW. The increase of the limits was based on specific studies. Additional studies might be needed to understand the essential reserves in Georgia to increase the grid integration of variable renewable energy and identify measures to safeguard the security of the system. GSE is working on this challenge with the assistance of donor organizations. Additionally, pump storage on the Enguri power plant might also increase the flexibility of the system, thus pump storage is not only good for the security of the country, but also ensures grid integration of the variable energy sources. The development of the overall potential of Georgia needs proper investment environment and investment promotion mechanisms. The local content requirement might be one of the options promoting investments not only in renewable energy but also in the heavy industry.

The wind potential in Georgia is 1330 MW, based on the Ten Years Network Development Plan (TYNDP)- a document prepared by Georgian Transmission System Operator (TSO) considering the grid restrictions and demand-supply development scenarios. Based on the document, the maximum capacity of wind (1330 MW) can be integrated into the grid by 2030. ***With the average 3 MW capacity per turbine, the demand on wind turbines in Georgia can be estimated at 450 MW by 2020-30.***

The neighboring countries' demand for wind turbines is considerably low. According to the Ministry of Energy Infrastructures and Natural Resources of the Republic of Armenia, economically reasonable wind power potential in Armenia is estimated at 450 MW, which is roughly 150 turbines.

The potential of wind power in Azerbaijan is estimated at 4.5 GW, the highest number in the region - translated into roughly c. 1500 turbines. Although, according to the State Agency on Alternative and Renewable Energy Sources of the Republic of Azerbaijan[12] strategic roadmap for Azerbaijan which considers development of 465 MW wind PPs by 2030, which translated roughly into 150 turbines.

Overall, Georgia, Armenia and Azerbaijan have demand on 750 turbines (2.2 GW) during 2019-2030. Additionally, if the total theoretical potential of each these countries are utilized, the total demand of these countries will reach c 6.5 GW or 2000 wind turbines.

Industrial scale solar energy might have a higher demand in the region. Solar potential of Georgia, according to the same TYNDP is estimated at 520 MW, considering the grid constraints and special conditions the potential can be fully absorbed by 2030. Armenia's plan for solar power plants is 120 MW in the near future, Azerbaijan has a comparatively large potential of 115 GW solar power, according to UNDP paper[13], but the declared goal of Azerbaijan for 2030 is 190 MW[14]. Consequently, the total potential for industrial scale solar PVs goes up to 830MW for all three countries by 2030 and can increase when overall potential of Azerbaijan and Armenia will be considered. It should be mentioned that Azerbaijan has local solar PV manufacturing factories (Azguntex, Solaris), mainly producing residential scale PVs. Those manufacturing companies also have a potential to become industrial scale PV manufacturers if they see demand and become competitors with Georgian manufacturers. On the other hand, residential potential in Azerbaijan seems higher, than utility scale and the manufacturers might benefit from concentrating on small scale production, leaving the room for utility scale PVs for Georgian manufacturers.

[12] Overview of the renewable energy developments in Azerbaijan by The State Agency on Alternative and Renewable Energy Sources of the Republic of Azerbaijan, published by IRENA in 2018.
[13] UNDP- Renewable energy snapshot of Azerbaijan
[14] Overview of the renewable energy developments in Azerbaijan by The State Agency on Alternative and Renewable Energy Sources of the Republic of Azerbaijan, published by IRENA in 2018.

DISTRIBUTED POWER IN GEORGIA

Distributed power in Georgia is another area for potential development. Net metering represents one of the wide-spread policies for developing micro generation power plants (wind, solar, hydro) owned by customers, primarily used for satisfying their own consumption and delivering excess energy to the network with respective compensations to be received from distribution system operator's Distribution System Operator (DSO).

According to the existing ''Electricity (Capacity) Supply-Demand Rules'', micro generation source of electricity is defined as up to 100 kW installed capacity power source. A micro generation source of electricity is connected to the distribution grid by applying to the corresponding distribution licensee and the company is obliged to install a reverse meter instead of an existing meter within 10 to 20 working days after the customer has submitted the application. The customer pays for the connection and meter substitution fee and DSO is obliged to receive electricity generated by the micro generation power plant into the network and arrange settlement according to net remainder after deducting for consumed electricity.

The settlement period to calculate net power is defined from May to May and if at the end of April customer has delivered surplus electricity throughout the year, the distribution licensee is obliged to arrange a final settlement with retail customer according to the weighted average price of electricity purchase reflected by the GNERC in the household tariffs of respective DSO.

According to GNERC 2018 Annual report, at the end of 2018, the total number of subscribers connected to the net metering regulation reached 75 and the installed capacity amounted to 740 kW[15].

Net metering tariff paid by DSO's does not provide enough incentives to the consumers to invest in development. Most of the micro power plants were built on a voluntarily basis, while almost none of the project owners were relying at payback period. Nowadays, it remains to stay as a long-term investment for which consumers are not willing to invest today. Consumer prices (household, commercial users), that are approved by GNERC for distribution licensees, are the lowest compared to the regional and EU prices.

The distributed power is another aspect of LCRs development. The technological process might be easier for production of small scale power generators and its components. Azerbaijan companies might be seen as competitors or as easy access for qualified personnel for initial trainings and factory line assembly.

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[15] GNERC Report on Activities 2018: http://gnerc.org/files/wliuri%20angariSi/1%20Annual%20Report%20-2018%20ENG.pdf

4. SUMMARY OF MAIN FINDINGS

The use of LCR in Georgia should create domestic jobs, channel business to domestic firms and, in the medium to long term, create a technological and knowledge pool for renewable energy products. The Introduction of the policy is viewed to offset the fiscal risks that accompany renewable support schemes. Building capacity of respective companies is essential. Multi-lateral dialogue between the local content providers, offtakes, and the government is key for a proper LCR policy development. The main findings and recommendations derived from the presented RIA of LCR can be summarized as follows:

RECOMMENDED LCR POLICY FOR GEORGIA

- The best LCR policy for Georgia is Optional, not Obligatory. Investors should have a choice to use local content and get additional benefit. The tariff premium, given as an incentive for LCR, should be carefully chosen based on an in-depth analysis of the technological advancements;
- An LCR methodology might be paired with an existing and EU-acclaimed support scheme (feed-in tariffs, feed-in premiums, etc.) for a better effect, e.g. Turkey – the feed-in tariff level depends on the percentage of local content;
- The best LCR practice, based on expert assessment and the case study analysis, has to use the local content premium as a bonus rather than pre-requisite to participate in the auction or any public tender;
- Open market conditions must prevail. Most countries have pushed towards the LCR law due to political or social pressure. As mentioned in recommendation #1 – the policy shall be optional and not restrictive – the investor should be motivated to use local intermediary goods but should not be prohibited from using others. Open market conditions must prevail not only to encourage investors but also to evade costly and lengthy process at the WTO in case the law is found non-compliant to Georgia's WTO commitments;
- The LCR application will encourage the investments in VRES and lead to abolition of electricity imports with the RES generation. An LCR alternative creates additional social benefits for the country in terms of investments, jobs, and technology transfers;
- Considering the low rate of soft costs and elimination of transportation costs in case of the LCR, the costs for the company using local content might actually decrease and be more cost efficient even without additional tariff incentive. This might actually promote the production of wind/solar plant components in Georgia for export opportunities as well;
- For the energy security and public awareness, the price premiums that might result from renewable energy promotional policies are reasonable and insignificant in terms of fiscal pressure on Georgia;
- Ultimately, the LCR, if implemented correctly, can boost renewable energy development and give better social benefit compared to any other promotional mechanism.

CAPACITY FOR LOCAL PRODUCTION AND SELECTION OF MANUFACTURER

- Georgia, with a little external assistance, can manufacture low-tech parts of the renewable supply chain such as wind towers, solar cell mounting brackets, etc.;
- Georgia can produce wind towers and stands for solar panels for utility scale power plants. The methodology of production should be tested and agreed with the producers of electro-mechanical equipment to ensure the safe installation of any generator;
- Besides towers, local production has some other opportunities as well. The blades and turbine nose for a generator can also be produced, however, this can be considered more as an opportunity for development rather than an asset while discussing LCR RIA. Distributed power might be a good opportunity for LCR. The production process is easier and international companies need fewer turbines to break even on their investments;
- It's preferable to have an international company on the market, equipped with knowledge and experience in the production process and turbine production. Having experienced local companies creates an opportunity for knowledge and technology transfer with the franchise or other similar options;
- Georgia has a potential to mobilize and facilitate training and re-training programs to produce higher skilled workers and build up the capacity for the future to manufacture higher-tech parts, such as wind turbine blades for smaller sized turbines;

- Consultative engagement showed that the direct employment by the sector will not be significantly high, around 500-700 people. However, the salaries will be above the average and secondary spillovers, such as service industries supporting the development of local RE supply chain base, will have a multiplier of at least 3x. Though, this cannot be exactly quantified and counted econometrically as of now;
- Average salary in heavy industries is 1025 GEL which is significantly above the average salaries in main workplace provider in Georgia – Agriculture (c700 GEL). The addition of workplaces in this industry will increase the average salary in Georgia and decrease the unemployment. The workplaces will be created in both industries – renewable energy and manufacturing – with the latter being the largest employer;
- According to preliminary assessment, it is expected to create more than 1500 additional temporary and permanent jobs for 2030, where mainly the local population will be employed. Manufacturing of basic metals employs on average 100 people with an average salary of GEL 1,000 per month. The jobs created during the construction of factories is an additional benefit of LCR;
- As LCR can provoke investments in renewable energy, jobs created during the VRES construction and operation will also be a benefit from LCR. During the construction of "Qartli wind farm" LLC (located in Gori - Kareli municipality, with installed capacity of 20.7 MW), about 200 people were employed temporarily and about 30 people remain employed permanently. Respectively temporary and permanent jobs will be created in the energy, construction, and industry sectors.

POLICY IMPLEMENTATION PROCESS

- The involvement of the WTO, manufacturers and renewable energy developers in the policy preparation process is highly recommended. Consultations with international trade organizations and lawyers are also recommended for formulating the decree in order to avoid costly lawsuits that will damage Georgia´s reputation as a country with a favorable investment climate;
- Transparent, simple and clear rules are prerequisites for the implementation of any stimulation policy. Solid policy framework and context are precondition for efficiently deploying the LCR policy. The LCR policy should be an extension of a well-researched policy framework of renewable energy and support schemes;
- In most cases, the countries passed the law at a very fast pace without acknowledging the implementation burden. The law should be aimed at motivating change;
- The government should annually monitor the law and its outcomes over the first five-years, followed by bi-annually monitoring of the industry and the impact of LCR in terms of meeting the designed goals;
- Metrics is everything – the government should choose the means for measuring success such as the number of jobs in the renewable, the installed capacity, Foreign Direct Investment (FDI), etc. The metrics have to be clearly communicated, without any bias to organic growth;
- For the motivational effects of the LCR policy, the government and local stakeholders should form a favorable environment characterized by various facets such as skills development that later can be applied for manufacturing intermediary products, cooperation with the agricultural university of Georgia, Georgian technical university and ilia state university to evaluate the existing capability of the educational institutions in terms of renewables. Design tailored short programs to build specific skills set;
- A multilateral dialogue between the government, potential intermediary good manufacturers, developers, investors, and operators should be facilitated with a common objective to set realistic goals and understand the capabilities of intermediary goods providers. At the same time, if the government lacks the capacity to lay down the suitable policy, the identified skills gap should be eliminated through appropriate capacity building. Not only should the local companies be motivated to start dipping into the intermediary good markets, but also international companies should be attracted to start operations on the Georgian market by branding their products as made in Georgia.

BRIEF SUMMARY FOR ALTERNATIVES' COMPARISON

After analyzing the major aspects of LCR, the focus was made on comparing the alternatives and understanding the main advantages and disadvantages of each scenario.

With No-LCR scenario, the market has free competition without renewable energy capacity. With the current market rules and prices, the fast and organized development of renewable energy is impossible. The creation of other support mechanisms would change the situation on the market but not completely. LCR option would be better, as it develops not only one sector of the economy, but two other sectors like – renewable energy and heavy industry. In addition, it enables technology and knowledge transfer.

The tax incentive is a least preferable option. The tax regime in Georgia is already very investor-friendly, thus, there is no need for further incentivizing. The only tax-based LCR discussed in this report is for FIZ, which is related to FIZ legislation, rather than the LCR framework.

Obligatory LCR is the least attractive option for Georgia, since it raises WTO concern and limits competition, with possible negative impact on production quality. On the other hand, in case of obligatory LCR, there is guaranteed demand for local component manufacturer and this makes the creation of local factory less doubtful.

The main disadvantage of **Optional LCR** is the difficulty to find companies manufacturing local components in Georgia. Mainly, as revealed during stakeholders' consultations, potential manufacturers of wind towers or mountain brackets would require a guaranteed contract in order to ensure that their investment in the plant breaks-even and gives desired return. On the other hand, the main positive side of the optional LCR is that it does not limit the competition and boosts economy, both in terms of renewable energy and heavy industry development.

Table 1: Comparison of Different Alternatives

Aspect of Comparison	No-LCR	Optional LCR	Mandatory LCR
Increase in energy independence	-	+	+
RE goal of 35% as of 2030	-	+	+
Market independence	+	+	-
Increased employment	-	+	+
Technology transfer	-	+	+
Boost in GDP	-	+	+/-
No conflict with WTO	+	+	-
Encourages competition	+	+	-
Quality of RES**	+	+	-

*Plus, and Minus in the table are comparative statements. Minus mark ("-") does not necessarily mean absence of that statement, it just means comparative advantage of other options.

**As seen in some of the case studies, the mandatory LCR might cause the worsening of the quality of solar panels or wind turbines; furthermore, the restriction to only one manufacturer does not guarantee the high quality and good value for money mix, as it would be when there is competition.

5. ANALYSIS OF IMPACT – OPTIONAL LCR

The case studies, stakeholder interviews, and desk study showed that Optional LCR is the best alternative for Georgia.

Another concerned aspect when discussing LCR is the identification of investors' incentive for using local components. More importantly, evaluation of costs and benefits for LCR implementation. Further studies are suggested to identify the optimal tariff premium or tariff structure for LCR.

Nevertheless, in order to quantify the costs of the LCR under the scope of this RIA, the Research Team made assumptions for different tariff premiums given for the LCR. For the purpose of RIA, the Research Team assumed three different scenarios for tariff premium: 1) USc/kWh 0.5 2) USc/kWh 1.0 3) USc/kWh 2.0. It is assumed that this tariff premium is granted as an incentivizing mechanism for using local components.

The goal of this chapter is to quantify the impact of the optional LCR for different tariff premiums.

METHODOLOGY APPROACH

The methodology applied in this analysis is for the impacts of the identified alternatives, and the purpose of an assessment, like any policy analysis, is to provide information that will materially assist decision-making.

As mentioned above, the costs and benefits for the following stakeholders are considered:

1. GoG;
2. Energy companies;
3. Private industrial companies;
4. Georgian citizens.

After quantifying the expected impacts, we will determine the expected NPV.

We estimate costs and benefits over a 10-year period from 2021 to 2030, which represents a reasonable period for long-term impact. The discount rate used is 9.45%[16] (i.e. real return on 10-year government bonds).

APPRAISAL OF POLICY PROPOSAL

The ultimate mission of any government is to design viable public policies to benefit society and enhance the economy and businesses.

LCR's are deliberated as a base which promotes the development of domestic manufacturing, create jobs, and enable technology transfer to generate local industrial clusters. Local content requirements may have some positive effects on investment across value chains.

Based on Alternative Scenarios reviewed in the Regulatory Impact Assessment (RIA) report, the best LCR policy for Georgia is **optional, not obligatory**. The preferred option was compared to the alternative that proposes a no-LCR scenario that foresees no changes on the market and leaves the current status quo. This is used as a base case scenario for further comparisons.

An LCR component can be considered as a driver for boosting installed capacity, which provides enough incentives through the renewable support schemes to invest in renewable energy. LCR is the vehicle to motivate and change the behavior of the investors. For cost-benefit analysis of the proposed alternative three assumptions were made through the renewable support schemes, which include the introduction of a tariff rate of USc/kWh 0.5, USc/kWh 1.0 and USc/kWh 2.0.

Whatever the case, any scenarios will result in increased investment in local manufacturing capacity. The higher the tariff incentive, the higher the interest from investors and more projects will be economically feasible, therefore, the proposed cost-benefit assessments are based on the following numerical assumption for **Wind and Solar Power capacity additions**:

- Scenario 1 (USc/kWh 0.5): installed capacity will increase annually by 50%;
- Scenario 2 (USc/kWh 1.0): installed capacity will increase annually by 70%;
- Scenario 3 (USc/kWh 2.0): installed capacity will increase annually by 85%.

[16] nbg.gov.ge (January, 2020)

As previously mentioned, the wind potential in Georgia is 1330 MW, based on the TYNDP and the maximum capacity of wind (1330 MW) can be integrated into the grid by 2030.

Based on the first assumption, through the renewable support schemes about USc/kWh 0.5, only 440 MW of installed capacity of wind power is expected to be achieved by 2030. For the second assumption, which includes support schemes by USc/kWh 1.0 it is expected to reach over 750 MW by 2030, and for the third assumption by USc/kWh 2.0 the total installed capacity of wind power for this period will reach over 1300 MW.

Figure 18: Projection of the Total Installed Capacity of Wind Power (MW)

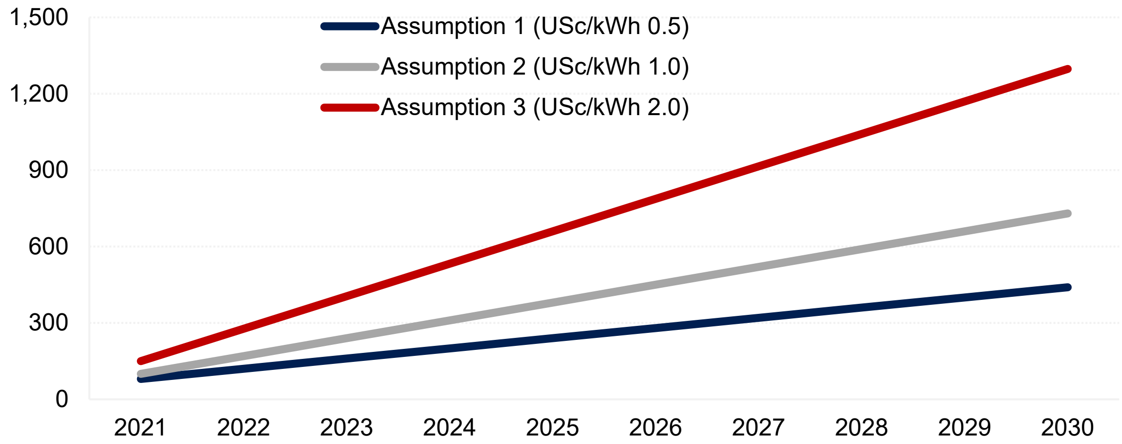
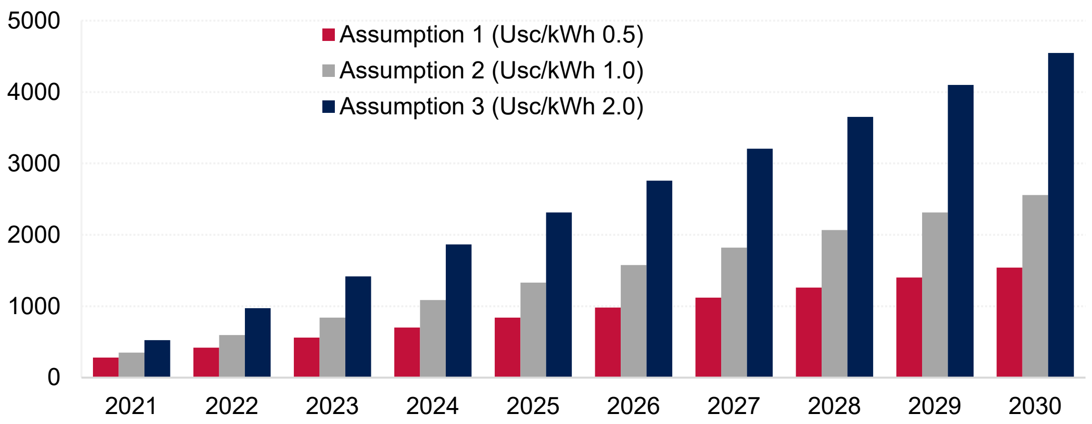


Figure 19: Projection of Generation for Wind Power Plants (GWh)



In the case of solar power plants, based on the first assumption, through the renewable support schemes about USc/kWh 0.5, only 110 MW solar power plants are expected to be installed by 2030. For the second assumption (USc/kWh 1.0) about 300 MW will be installed by 2030, and for the third assumption (USc/kWh 2.0), 260 MW and more than 500 MW solar power plants will be installed, respectively by 2025 and 2030.

Figure 20: Projection of the Total Installed Capacity of Solar Power (MW)

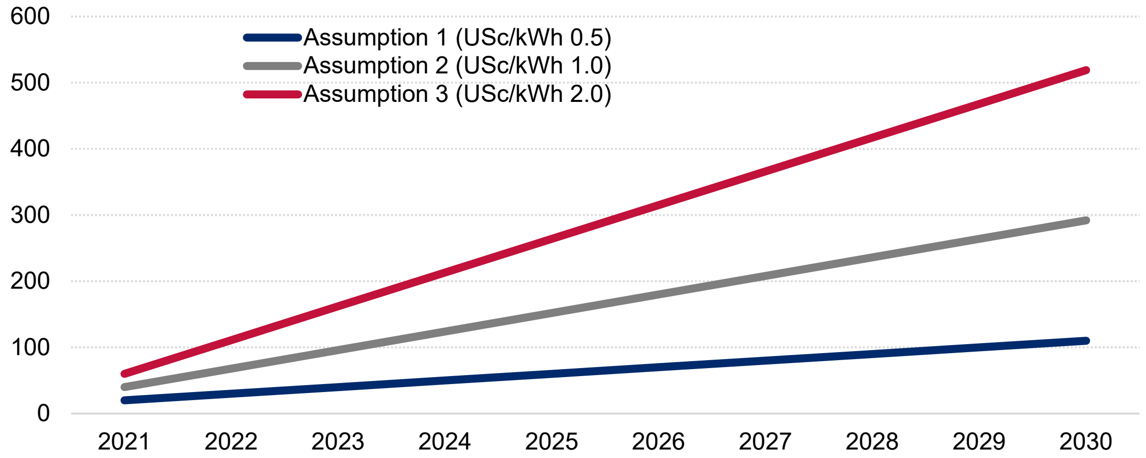
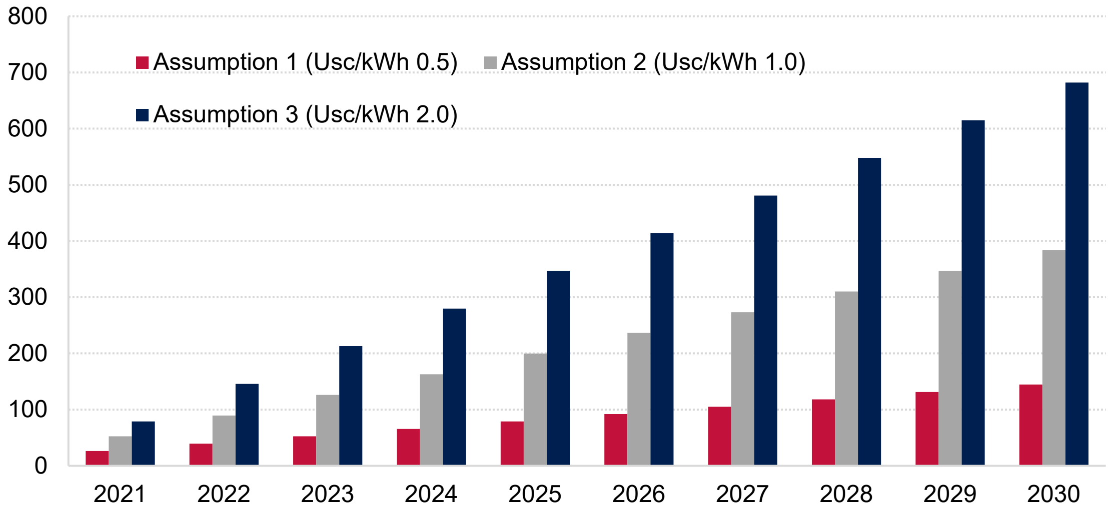


Figure 19: Projection of Generation for Solar Power Plants (GWh)



The sustainable development of the energy sector and the introduction of auxiliary instruments have a significant positive effect on economic growth and development, as well as on mitigating external risks. It is a powerful and sustainable tool for economic growth.

Clearly, the energy sector characterized with high positive economic effects, and financial costs stimulate significant economic benefits over the long-term period.

The research team assessed the impacts with a positive outcome on economic indicators, such as increased employment and household revenues, investments, the introduction of technological innovation, and fiscal impact.

- *Impact on jobs* - the employment will likely increase in many directions, such as energy, industry, and construction sectors respectively. As mentioned above, the LCR component will help attract investments in the industry, this in turn will create jobs in both renewable energy and manufacturing. Based on the consultations with the stakeholders, only in the heavy industry, the direct employment by the sector will exceed 500. According to preliminary assessment, more than 1500 additional temporary and permanent jobs are expected for 2030, where mainly the local population will be employed. This is important in terms of increasing the income of the population and improving their welfare. As an example, only the process of installing wind power requires over 200 people.[17] Respectively temporary and permanent jobs will be created in the energy, construction and industry sectors.

[17] https://gedf.com.ge/

- *Investments* - the purpose of the LCR is to encourage, incentivize, and initiate investments in the sector, as well as promote energy infrastructure improvements. The development of the energy infrastructure is perceived not only as a method of increasing economic growth through spending, but also a key booster of the economic growth through developing energy infrastructure supply chains and new technology in the sector. In Georgia, the initial investment for the construction of a factory for the production of towers will exceed USD 5 mln. The initial investment by AE Solar for solar panels in the Kutaisi FIZ was above USD 3 mln. If the total capacity for wind power reaches 1330 MW and for solar power 520 MW by 2030, for a 10-year period the investment for the LCR component will reach USD 1 billion.
- *Fiscal impact* - Energy sector development significantly increases budget revenues, particularly the local budget revenues, through property and land taxes. It is expected that revenue from property tax in 10-year period will equal GEL 12 mln. and land tax will reach around GEL 575 thousand. In view of anticipated annual employment growth, around 1,500 jobs will be created by 2030. Accordingly, the revenue from the income tax in state budget will likely exceed more than GEL 45 mn.mn. over a 10-year period. The introduction of support schemes is a significant financial burden for the budget. Support schemes such as LCR are linked to high financial costs. For example, if the installed capacity of a wind power plant at the initial stage equals 150 MW and increases year by year, the total installed capacity of Wind Power Plants by 2030 will reach around 1330 MW. Respectively generation for wind power plants for this period would will make 4500 GWT. In the frame of LCR support schemes, in case of Usc/kWh 2.0 total real cost (discount rate - 9.45%) with the annual gradual increase for 10 years, it would total around USD 350 mln.

The monetized costs and benefits of the policy options and net of the baseline counterfactual are combined into a net present value estimate. The net present value is calculated as the discounted value of all benefit less the discounted value of all costs.

According to the abovementioned assumption, the NV of cost in the frame of support schemes of LCR for the installed capacity of wind and solar power over a 10-year period is the following: In the case of the first assumption (USc/kWh 0.5) cost will equal to around USD 30 mln. In the second scenario (USc/kWh 1.0) - USD 100 mln, and in the third scenario (USc/kWh 2.0) the financial cost will reach USD 350 mln.

As mentioned above, the potential for attracting new investment was assessed in terms of its value. The results show that the growing economy facilitated the creation of new jobs. The report also assessed the prospects for local economic development, budget revenues for the state and local governments. Thus, benefits included investments in local production, construction of solar and wind power plants, local and state budget revenues in the form of property, land and income taxes.

The analysis of impacts revealed, that LCR has a significant positive impact on a number of factors, such as investments in local production, the investment share of the LCR component itself. For this part LCR promotes the creation of new jobs and tax revenues to the central and local budgets.

The assessment revealed that the most optimal part of the wind power plant equipment are towers, since tower is the easiest part for the local production. As mentioned above *"Figure 8: Elements and cost breakdown for 20 MW wind power plant"* for a 20 MW wind power plant, costs in towers are about USD 3.2 mln, respectively, the percent of total cost for 1 MW towers are about 10%. For assumptions of investments the Research Team took around USD 150 thousand for projection.

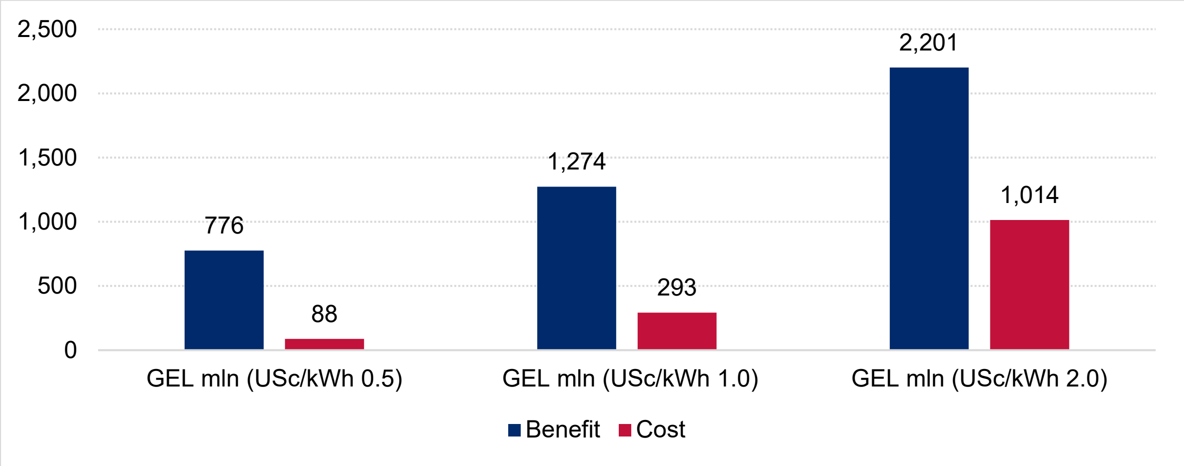
Georgia has a capacity to produce solar panels and mountain brackets. Investments for 1 MW for solar energy are USD 500,000. To evaluate the potential investments, the benefit analysis included relevant assumptions on installed capacity and a generation forecast for wind and solar power plants.

The NV of benefits, in the frame of support schemes of LCR for the installed capacity of wind and solar power over a 10-year period is the following: In the case of the first assumption (USc/kWh 0.5) benefit will equal around USD 268 mn (around GEL 776 mn). In the second scenario (USc/kWh 1.0) - USD 439 mn, and in the third scenario (USc/kWh 2.0) the benefit will reach USD 759 mn.

The net benefit of support schemes of LCR for the installed capacity of wind and solar power over the 10-year period will be GEL 688 mn in the first assumption (USc/kWh 0.5), GEL 981 mn in the second assumption (USc/kWh 1.0) and GEL 1,187 mn. in the third assumption (USc/kWh 2.0).

The diagrams below show the present value of the benefit and cost over all scenarios over a 10-year period.

Figure 2: Comparison of Costs and Benefits of Assumptions (GEL mn.mn., Net)



The present analysis confirms the positive impact of the LCR and the importance of its implementation in the Georgian electricity system.

SUMMARY

The best LCR policy for Georgia is optional, not obligatory. Investors should have the option to use local content and get additional benefits. The Research Team performed a cost-benefit analysis for not-obligatory alternative and assessed three assumptions presented in Table 1 which demonstrate the marginal impacts of each assumption. Assumption 3 generates more benefits than assumption 1 and 2. However, the costs is also higher compared to other two (1.2) alternatives.

The NPV of net benefits is positive for all assumptions. The third alternative generates higher net benefits, together with high costs for a financial instrument; whereas assumption first and second provides fewer benefits with less cost.

Figure 21: Summary of Costs and Benefits

	USc/kWh 0.5	USc/kWh 1.0	USc/kWh 2.0
Benefits (PV) (GEL mn)	776	1,274	2,201
Costs (PV) (GEL mn)	88	293	1,014
Benefits – Costs (NPV) GEL mn.	**688**	**981**	**1,187**

6. RECOMMENDATIONS

- Optional LCR is the best choice for Georgia. In the case of Optional LCR, an investor gets additional benefits for using local components during the construction of the RE project. The amount of additional benefit should be carefully selected. LCR can be a good justification for the tariff premium given to VRES.
- Towers for wind turbines, mountain brackets for solar PVs, distributed scale wind turbines and solar PVs can be produced locally in view of the local experience consistent with the global practice and production specifications. Local companies have the capacity to add new production lines, but the technology transfer is compulsory to make it happen. The local content, that will be supported, should be carefully chosen and fit within the available capacities of local producers.
- Construction of production line for a specific part of a power plant can be challenging, as it should match with other parts of the plant, like turbine & generator. Thus, any plant would need pre-qualification from turbine suppliers, or even more, the full technology transfer. It is important that the local factory for power plant parts has universal production, not linked to only one specific turbine manufacturer but suitable for others as well. Combining knowledge and power in the form of a joint venture, with an international partner skilled in the production of hi-tech parts is crucial for success.
- Georgia has a skillful workforce, who can be trained and adjusted to new technologies. It is recommended to include training costs into the CAPEX for the project.
- Developers should cooperate with the local banks and, where possible, with IFIs, in order to develop an attractive plan that can be funded. In addition, the companies shall familiarize banks with their activities and keep them engaged in a project monitoring process. The government can support the effort with investment incentives and education programs.
- Having optional LCR will encourage the development of renewable energy and incentivize local producers to maintain high quality.

ANNEX 1: ASSUMPTIONS USED IN ANALYSIS OF IMPACT

Scenario 1: Installed capacity and generation for wind power plants (USc/kWh 0.5)

Wind	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
MW	80	120	160	200	240	280	320	360	400	440
GWh	280	420	561	701	841	981	1121	1261	1402	1542

Assumption 2 - installed capacity and generation for wind power plants (USc/kWh 1.0)

Wind	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
MW	100	170	240	310	380	450	520	590	660	730
GWh	350	596	841	1086	1332	1577	1822	2067	2313	2558

Assumption 3 - installed capacity and generation for wind power plants (USc/kWh 2.0)

Wind	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
MW	150	278	405	533	660	788	915	1043	1170	1298
GWh	526	972	1419	1866	2313	2759	3206	3653	4100	4546

Assumption 1 - installed capacity and generation for solar power plants (USc/kWh 0.5)

Solar	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
MW	20	30	40	50	60	70	80	90	100	110
GWh	26	39	53	66	79	92	105	118	131	145

Assumption 2 - installed capacity and generation for solar power plants (USc/kWh 1.0)

Solar	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
MW	40	68	96	124	152	180	208	236	264	292
GWh	53	89	126	163	200	237	273	310	347	384

Assumption 3 - installed capacity and generation for solar power plants (USc/kWh 2.0)

Solar	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
MW	60	111	162	213	264	315	366	417	468	519
GWh	79	146	213	280	347	414	481	548	615	682

Benefits within the framework of the support schemes (PV)

	2021	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
GEL (USc/kWh 0.5)	47.5	53.3	64.7	73.8	80.8	86.1	89.9	92.3	93.7	94.2
GEL (USc/kWh 1.0)	59.7	79.0	101.5	119.5	133.7	144.6	152.6	158.2	161.6	163.3
GEL (USc/kWh 2.0)	85.6	129.0	171.3	205.3	232.3	253.0	268.5	279.4	286.5	290.3

Costs within the framework of the support schemes (PV)

	2021	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
GEL (USc/kWh 0.5)	4.4	6.1	7.4	8.5	9.3	9.9	10.3	10.6	10.8	10.8
GEL (USc/kWh 1.0)	11.7	18.2	23.4	27.6	30.9	33.5	35.3	36.6	37.5	37.8
GEL (USc/kWh 2.0)	35.1	59.3	79.0	94.9	107.5	117.2	124.4	129.5	132.8	134.5

ANNEX 2: SOW QUESTIONS ADDRESSED

SoW Question to be Addressed	Brief Review / Summation
Different modalities of local content requirement, how in Georgia the requirement might be defined, enforced, structured.	• Report discusses mandatory and optional LCRs as two main modalities of LCR. The sub-modalities differ based on the required share of local component in overall investment costs or based on the benefits offered by the state to investors for stimulation of local content usage. One of the offered benefits can be tax incentive, discussed in the report, as it has been prioritized by the stakeholders. • While defining the LCR policy, discussions with the with World Trade Organization is pivotal to ensure the consistency of the policy with WTO free trade principles and thus avoid the impairment of Georgia´s positioning as investment friendly environment • During the enforcement of LCR it is important that local manufacturers get support from international experienced companies, to make their production in compliance with all turbine / Solar PV manufacturers and not limit the market for specific turbine manufacturers. • The main challenge from manufacturing point of view is revenue estimations. In mandatory LCR the state plan might be assumed as guaranteed demand for the factory producing local components. In optional LCR the demand depends on the quality / price ratio or the additional benefits offered. Another benefit offered by state might be co-financing or cheap financing for LCR? factory, which can be done by LEPL Enterprise Georgia. • The incentives offered should be carefully chosen and needs additional calculations, rather than given in this report. This will need simulations, discussions with stakeholders and WTO, etc.
What elements of the renewable and energy supply chain can be realized in Georgia, what labor skills exist, what subcontractors exist, what are their capabilities and financial strength, bearing in mind such requirements for construction financing as bonding, performance guarantees, and spare parts	• Georgia has capacity to manufacture low-tech parts of the VRES such as wind towers and solar PV mounting brackets. For the micro-power plants, Georgia has capacity to assemble 100% locally, but most of the parts will be imported. Wind blades also can be produced locally, but will need more investments and might be hard to do at first stage. • Local manufacturers of basic metals (like Geosteel, Rustavi Steel Corportation, ISeko, Geo Fero Metal, Georgian Alloys group, etc.) can easily add new production lines and start production of wind towers and/or mountain brackets for solar PVs. This assumes that existing labor skills in those companies are adequate for producing the identified parts. • The financing for new factory working on local components for RE can come from state owned programs, like Enterprise Georgia, commercial banks, either locals or IFIs, and both local and foreign investors will be keen to make equity investments. Based on data obtained from selected companies, the sector is not very leveraged, however can expand production line through additional financial liabilities.
Renewable energy means solar PV both residential and grid-connected, solar thermal for heat applications, biomass, and wind projects	• As provided in the SoW, the research concentrated on non-hydro renewable energy resources and provided recommendations for opportunities in wind and solar industries. • Georgia has capacity to manufacture low-tech parts of the industrial scale VRES, such as wind towers and solar PV mounting brackets. For the micro-power plants (residential scale), Georgia has capacity to assemble 100% locally (as in case of AE Solar), but most of the parts will be imported.
What other countries are doing with respect to local content requirements, what are leading practices	• Three case studies, LCR policies in India, Turkey and Canada, were analyzed. The case studies underlined pros and cons of two main modalities of LCR- obligatory vs optional. • Obligatory LCR used in India showed negative effect of obligatory LCR on the solar PV development, promoting on

SoW Question to be Addressed	Brief Review / Summation
	the contrary the other technologies, imported from USA. As a result of obligatory LCR policy in India, the imports increased, more expensive solar PVs were built, local manufacturers did not saw the payback, and more dramatically, country created problems with WTO, as their LCR policy was against free trade principles. • Canada and Turkey showed positive effects of optional LCR coupled with FIT incentives. Most importantly, the optional policy does not contradict with WTO - being most significant advantage of optional LCR vs mandatory. Optional LCR encouraged development of RES in these countries and developed heavy industry. • Turkey has both options - mandatory LCR used in some of the auctions and optional LCR, which gives additional tariff premiums to those using local components. Turkish experience shows that the attractiveness of the sector will generate increased interest in securing the spots of renewable development, eventually bringing down the market prices for electricity to its market level.
A projection of the jobs potential related to renewable energy under different local content requirement regimes	• According to preliminary assessment, it is expected to create more than 1500 additional temporary and permanent jobs for 2030, where mainly local population will be employed: • Manufacturing of basic metals employees on average 100 persons with average salary of GEL 1,000 per month. The jobs created during the construction of a factory is additional benefit of LCR. • As LCR will provoke investments in renewable energy, jobs created during the VRES construction and operation is also a benefit from LCR. For example, during the construction process of "Qartli Wind Farm" LLC (located in Gori - Kareli municipality) with installed capacity of 20.7 MW, about 200 people were employed and about 30 person are employed permanently on wind power plant. Respectively temporary and permanent jobs will be created in the energy, construction and industry sectors.
What are the detriment or impacts that local content requirement would have on investment or on the cost of energy from renewable energy projects	• Local production of any part of wind or solar power plant might increase cost of the equipment due to absence of economy of scale. On the other hand, transportation cost will be much lower for any project in Georgia. Roughly, 30% increase in production cost of wind towers and reduction of total transportation costs by 30% will result in 1% increase in overall cost of the wind power plant (calculations made from figure 8). In case of 20% or less increase in wind tower costs, the overall project cost will decrease. For the solar power plants, if we assume that metal support structure will increase in cost by 20%, including transportation, the overall cost of the solar projects will increase by mere 0.7%. • On the other side, if LCR gives additional income for RE developers, it will stimulate the investments in renewable energy and bring additional investments in the sector. The impact of overall investments, both in LCR factory and in RE projects is calculated in chapter "analysis of impact -optional LCR".
A summation of information from consultative engagements with stakeholders	• Georgia has capacity to produce at least mountain brackets and towers for wind turbines locally. Georgian metal manufacturers have expressed readiness to cooperate. Local workforce is ready for new technologies and new production lines. The companies declare that Georgians are keen to studying and with some skills in metallurgy (c. 10 ths people) and proper trainings, they will have no difficulty in any new factory. • AE Solar produces small-scale solar panels in Georgian FIZ. They are mainly concentrated on export, but can sell locally as well. Tax regime in Georgia is already very investor-friendly, slight room for improvement here might be for

SoW Question to be Addressed	Brief Review / Summation
	companies in FIZ for sales to Georgia. This aspect needs additional study of FIZ regulations. • The financing for new factory working on local components for RE can come from state owned programs, like Enterprise Georgia, commercial banks, either locals or IFIs, and both local and foreign investors will be keen to make equity investments. Having skilled bankers who can assess risk and reward in new industries will speed up the process. • Construction of production line for specific part of power plant can be challenging, as it must match other parts of the plant, like turbine & generator. Thus, any plant would need pre-qualification from turbine suppliers, or even more, the full technology transfer from them. It is important that local factory for power plant parts has universal production, not linked to only one specific turbine manufacturer but able to be used by several ones. Joining forces in the form of a joint venture, with an international partner who is already skilled in production of hi-tech parts is crucial to success.

USAID Energy Program

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