Case Studies with Targeted Assistance for Small Businesses in Selected Rural Areas to Introduce Energy Efficiency Measures in Georgia

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The objective of case study assignment was development of a case study with targeted assistance for small businesses in a selected rural area to introduce energy efficiency measures in Georgia

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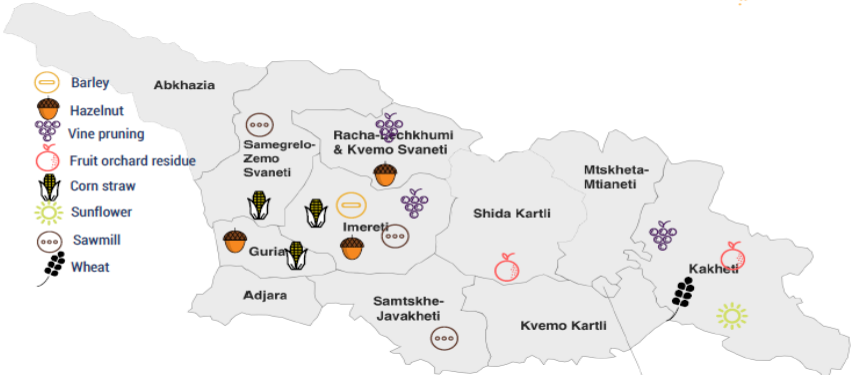
- Executive summary
- Introduction
- Background information
- Methodology for the selection of case study
- Selection of a small business for case study
- Analysis of possible areas for improving energy efficiency
- Implemented energy efficiency measures
- Potential energy efficiency measures recommended for implementation
- Conclusions
- Recommendations to the Government of Georgia and other stakeholders for encouraging energy efficiency measures and delivery of energy efficiency products in Georgia
- References
- Annexes

The most common agricultural residues in Georgia promising potential in terms of generation into biomass energy:



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- **Vineyards** - the biggest potential in agricultural residue of, Kakheti, Kvemo Kartli, Imereti, Racha Lechkhumi and Kvemo Svaneti regions that are not used as an alternative heating source, most of the residues are left in the field or burnt. Total residue **108 kT**, with 2,0 PJ total energy resource is annually yielded in Georgia from vineyards. According to the research, there are *37 419 ha* of vineyards in Georgia and energy value of residue per unit of area is 54.2 GJ/Ha.
- **Fruit orchards** are an important source of biomass as well. Total residue **81 kT**, with 1.5 PJ total energy resource is available from fruit orchards. At present, the total land area occupied by orchards is about *40,000 hectares*. Based on research, apple orchard pruning leaves the highest residue (21,715 t) and bio-energy resource (406,074 GJ) are in Shida Kartli region; pear orchards' pruning has highest residue (1140 t) and bio-energy resource (21,318 GJ) - again in Shida Kartli region; peach orchards' pruning highest residue (5,289.6 t) and bio-energy resource (99,444 GJ) - in Kakheti region.
- **Hazelnuts** are the 3rd biggest provider of agricultural residues in Georgia. Estimated number of ha is up to *15,000 ha* under hazelnut plantations **with 67,629t** (fronds & shells) biomass/1264671 GJ energy are available every year from hazelnut production in Georgia. Main hazelnut producer regions are Samegrelo-Zemo Svaneti, Guria and Imereti.
- **Bay leaf** is also an important source of residue. The main producer regions of it are Samegrelo Zemo-Svaneti, Adjara, Guria and Imereti. **9,000 t** residue of bay leaf is available annually in Georgia, which can be used as 0.2 PJ energy resources. Most of this residue – 7,500 t is available in Samegrelo-Zemo Svaneti region.

Selected Case Studies in Selected Rural Areas to Introduce Energy Efficiency Measures in Georgia

Case Study 1: Implementation of Energy Efficiency Measures in Zugdidi Kindergarten #15

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Locally available biomass - hazelnut shell is used as fuel

Zugdidi Kindergarten #15 2-storey typical old Soviet-style building, built in 1964 with total space – 1,050 sq.m.

35 staff members & 115 kids separated into 4 groups working at the kindergarten, which has more than .

*Before introduction of autonomous heating system, the KG used wood fuel for heating of several rooms. Only **35-40 m3** of wood was used per season in the primitive **4 wood stoves**, which did not provide adequate heating for this type of institution throughout the day. The total cost for heating per season was **5,000 GEL**.*

*The total amount of hazelnut shells needed for each heating season after introduction of 150-kW autonomous heating system is around **12,000kg**, costing a total of **2,640 GEL**.*

*If **natural gas** was used to heat the facility, the kindergarten would spend **9,700 GEL** more on energy resource and produce **24,600 kg** more CO2.*

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Case Study 2: Implementation of Renewable Energy and Energy Efficiency Measures in Erisimedi Kindergarten

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*The Erisimedi KG 1-storey building built in 1989. During the winter season, the KG used **17m3 of fuel wood**, which was burned in **3 primitive wood stoves** that did not meet relevant standards for creating indoor temperature in the entire building. **The cost of used fuel wood was 1,050 GEL***

With introduction of the heating system the kindergarten annually needs around 3,000 kg hazelnut shells. The costs of purchase and transportation of hazelnut shells (with cost 600 GEL) was covered by the municipality.

*This demonstration project followed the same approach as it was in previous case, which led to the achievement of social and healthcare benefits. The installation of the heating system (boiler house, stove, radiators, pipes, etc.), with cost **12,000 GEL** having positive social impact. Also, the environmental benefits were also achieved, for the purpose of which the bunker with a supply mechanism was installed, with a total cost of **5,100 GEL**.*

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Case Study 3: Assessment of Firewood Consumption Reduction in Villages Surrounding the Machakhela National Park in Adjara Region

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- *An Initiative Group was formed;*
- *For the winter of 2017/2018, 105 families expressed their desire to purchase 298 tons of shells;*
- *The number of families for using the alternative energy source has been increased 5 times;*
- *The cost of 1 ton of shell was 160 GEL;*
- *3 tons of shell = 10 m3 of firewood;*
- *3 tons of shell 480 GEL;*
- *10 m3 of firewood = 600-800 GEL;*
- *In the winter of 2017/18, 500 m3 of firewood were saved - up to 200 trees were not cut;*
- *If 40-50 families switch to shell consumption every year and the consumption exceeds 600 tons by 2022, about 2200 more m3 of firewood are to be saved.*

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Case Study 4: Biomass Supply Chain in Telavi Municipality

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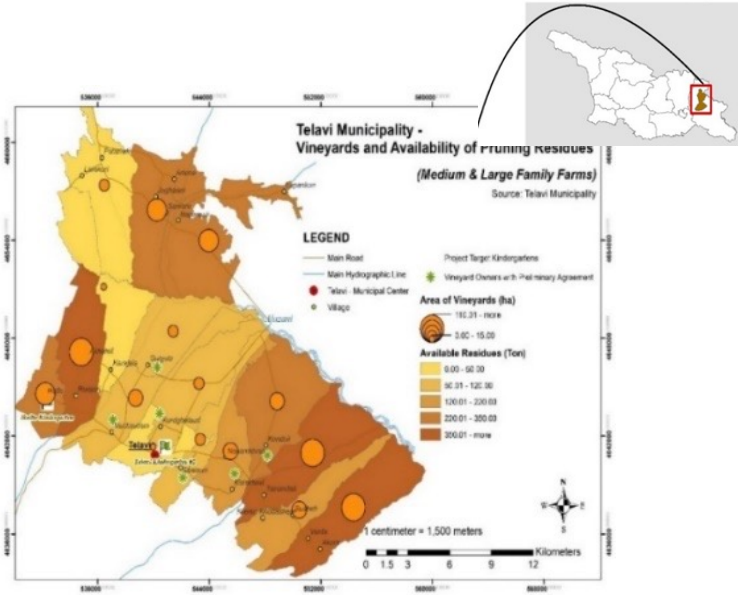

The main findings revealed during the testing process based on the Georgian reality

- *According to 2018 statistics, the total amount of vineyards (ha) in Telavi Municipality is around 6000 hectares.*
- *In the Telavi municipality, the volume of biomass (vineyards pruning) is expected to be up to 12000 tons.*
- *The amount of pruning from one hectare is around 1.5-2 tons;*
- *Bales of vineyards pruning weigh 18-28 kg, with an average weight of 20 kg and a humidity of 35%.*
- *Bales' dry weight ranges from 11 to 15 kg, with an average weight of 12 kg at 8% humidity.*

Total biomass (vineyards pruning) required for Telavi # 1 and Ikalto KGs for one (1) season: according to theoretical calculations up to 50 tons (dry mass): ***(Less then 1% of the local potential).***

- *Ikalto Kindergarten - not less than 10 tons (dry mass);*
- *Telavi Kindergarten # 1 - not less than 40 tons (dry mass);*

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Conclusions

Given that all four case studies were related to the promotion and popularization of the introduction of agricultural residues as energy source, it may be concluded that revealed barriers and challenges are common. Thus, the following barriers and challenges were identified:

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- **The administrative-institutional barriers and challenges** related to the establishment of biomass supply chain. It should be noted that this issue may be slightly different depending on the biomass (vineyards pruning residues) used. In the case of vineyards pruning, there has never been a precedent for using it as energy resource in Georgia, and therefore it has been related to an innovative approach. Therefore, establishing of supply chain involves a different set of challenges rather than hazelnut shells. More specifically, unlike hazelnut shell, which is a direct output of hazelnut production and hence does not require additional processes to get biomass, vineyards pruning residues require collecting, storage, and shredding before using it as energy resource. It is important to note that the same schemes should be considered in case of pruning of nuts, fruits and bay leaves.

- **The technical-engineering challenges** requiring the innovative solutions for heating systems working on the vineyards/fruit/nut, bay leaf pruning residues. For instance, the utilization of vineyards pruning due to its specific structure (shredded mass) has required introducing some of innovation solutions during the installation and action process of the heating system, which are, of course, manageable and surmountable.

- **The mental and behavioural challenges** connected to the service and maintenance of biomass heating systems. In Georgia, using natural gas is considered as a more convenient way as far as it does not require daily repairs and maintenance. Therefore, it is critical to educate local community about the benefits of such projects in terms of environmental protection, social-economic, and energy independence perspectives not only for the municipality and/or region, but also for the entire country.

Recommendations to Stakeholders for Encouraging Energy Efficiency Measures and Delivery of Energy Efficiency Products in Georgia

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Recommendations to the Government:

- Create mechanism for alleviation of the tax burden on agricultural residues as current system envisages impose of taxes for users of such resources;
- Adapt legislative initiatives and/or relevant regulatory measures for the generation of thermal energy from agricultural residues;
- Develop the innovative financial mechanisms (e.g., combination of loan and grants, guarantees or low-cost credit opportunities) for small businesses and farmers;
- Encourage the use of subsidies for biomass (solid fuel) technologies;
- Promote tax exemptions for renewable and energy-efficient energy technologies
- Ensure the awareness raising campaigns for various stakeholders: business sector, farmers, local authorities, local population.

Recommendation to Local Authorities:

- Explore the full potential of locally available agricultural residues in rural areas for development of relevant strategies and/or action plans and identify local users of produced energy efficient products (as energy source) by mapping.

Recommendations to Small Businesses Sector/Farmers:

- Encourage the establishment of agricultural cooperatives with participation of small businesses and/or farmers for the production and lobbying of energy-efficient products (as energy source);
- Create *Agricultural Residues' Collection Points* for their further processing and/or supply to consumers as an energy-efficient products (as energy source);
- Participate in the state and local programmes, as well as in the programmes announced by international donor organizations for creation of energy efficient products (as energy source).

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Thanks for Attention