Concept Note on Key energy efficiency options for Belize

Solar Water Heating (SWH) in Household Sector

December 31, 2020

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SUMMARY

As already indicated in the efficiency report, solar water heaters are already being promoted in Belize, but their dissemination has been rather slow. Barriers may have to do with the limited use of hot water in the residential sector and the lack of awareness. The potential impact of this technology on GHG emissions reductions is related to the energy sources to be replaced.

The selection of the sanitary hot water energy service, associated with the technology of solar heaters and the renewable source involved, was based on the certainty of the contribution of this option to sustainable development in all its dimensions. Indeed, it is an alternative that improves the economic situation (improving the welfare of the population and positively affecting the external sector), social aspects (giving access to a new energy service to a growing percentage of citizens), improving environmental conditions (by making a wider use of clean and renewable sources) and contributing to global sustainability by reducing emissions of Greenhouse Gases.

The estimation of the mitigation effect that the penetration of solar water heaters can has, is based on following assumptions and facts, relying on data collected or estimated by different sources.

- Urban and rural population data and the number of households in each of these areas according to information from 2016, which allow us to estimate the number of inhabitants per household.
- The total population data, urban and rural for 2019, estimating the number of households, while maintaining the number of people per household.
- The total population data for 2020, maintaining the percentage of urban and rural inhabitants calculated for 2019, as well as the number of people per household.
- Annual consumption, estimated on the basis of information extrapolated from other Caribbean countries and the baseline survey conducted by IRENA.
- The result of the prospective developed by IRENA, which assigns an important participation to the use of water heating, to the year 2030, 2040 and 2050.
- Energy consumption could be estimated in MWh but could be estimated in another source, especially in terms of calculating emissions, if it is determined that another source would be replaced.
- The assumed penetration percentages, by household, should be considered for the year horizon 2030, being the total number of urban and rural households, those resulting from the population projection estimated in the socio-economic scenario and the avoided energy consumption arising from such projection, without altering the conventional energy avoided per household.
- These penetration percentages are also based on a hypothesis of improved income distribution that would imply a decrease in poverty levels, both urban and rural.
- The percentage of savings, considering the consumption of the base year, over the total electricity consumption of the Residential Sector, is estimated at more than 10%

In the case of ***Tourism sector*** which, as mentioned, as one of the dynamic sectors of the economy, the estimation is based on information from different sources on hotel rooms estimated to 2020, the penetration of the use of solar water heaters in the hotel industry was also estimated, which are summarized in the following table.

- The number of hotel rooms and their percentage of occupation should be estimated by 2030, according to the expected socio-economic evolution and the dynamics of the Tourism sector.
- Hot water consumption per occupied room was estimated on the basis of two people per room and also considering part of the consumption in common areas.
- The percentage of hotels that would incorporate this technology is estimated in 70% and its correction would impact on the total energy avoided.
- As in the case of Households, energy consumption has been estimated in MWh but could be estimated in another energy source, especially in terms of calculating emissions if it is determined that another source would be replaced.

According to the analysis carried out by IRENA, it is estimated that, in the base year, energy consumption in households for water heating was 600 TJ and would reach 1200 TJ in 2050.

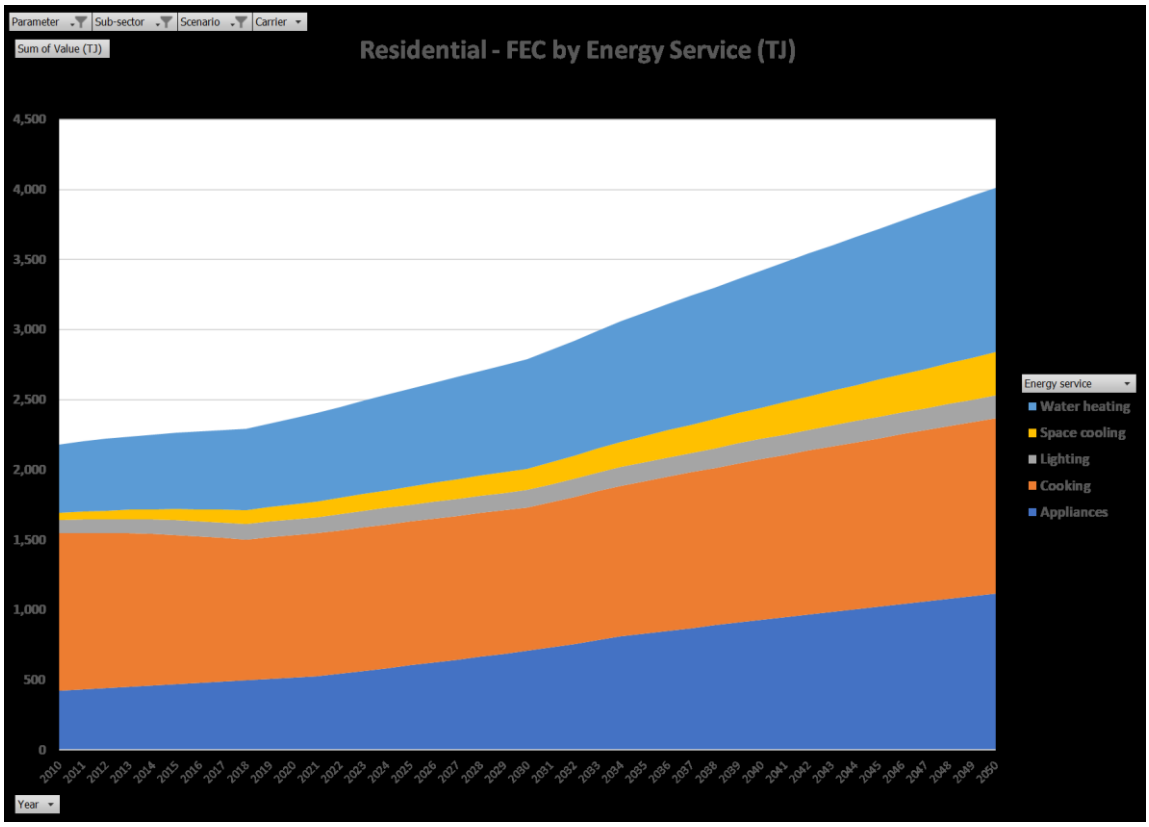
In the case of the tourism sector, the consumption estimated is considerably lower, but it will depend on the evolution of tourism activity over the next thirty years. A priori, it is estimated that growth will be significant. Assuming that, in this use, the fuel to be substituted is LPG, the emissions effect could be quite significant.

For reasons of available information, this Concept Note focuses on the Residential Sector and the use of the potential savings in this energy service.

Importance of the use of water heating

As already noted in the report linked to the identification of opportunities in the energy system, there are multiple options to reduce energy consumption and resulting emissions.

However, the annex that indicates the priority measures identifies the technology linked to Solar Water Heaters as one of the options with the greatest impact. On the other hand, as can be seen in the following graph, the consumption associated with this use, in the Residential sector will grow significantly until 2050. Reaching a consumption of around 1200TJ, according to estimates developed by IRENA for the Reference Scenario.

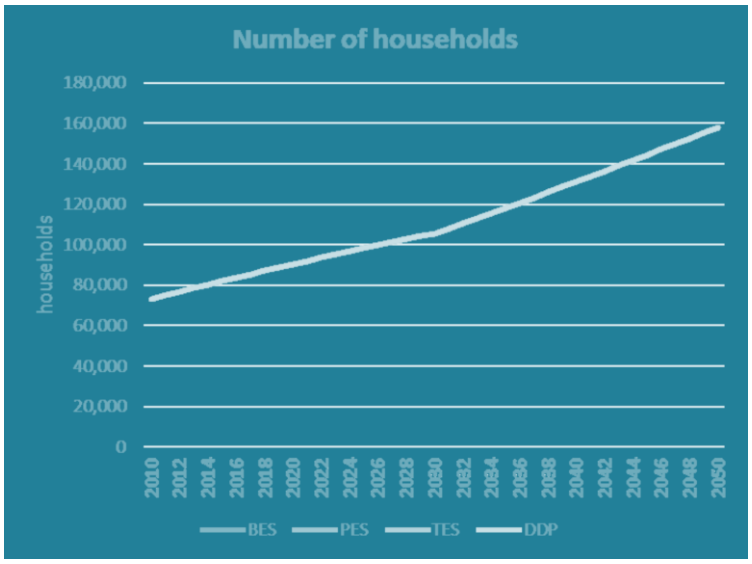


Fuente:IRENA - REmap Belize - September 2020

On the other hand, consumption would be concentrated, to a greater degree, in LPG and Electricity.

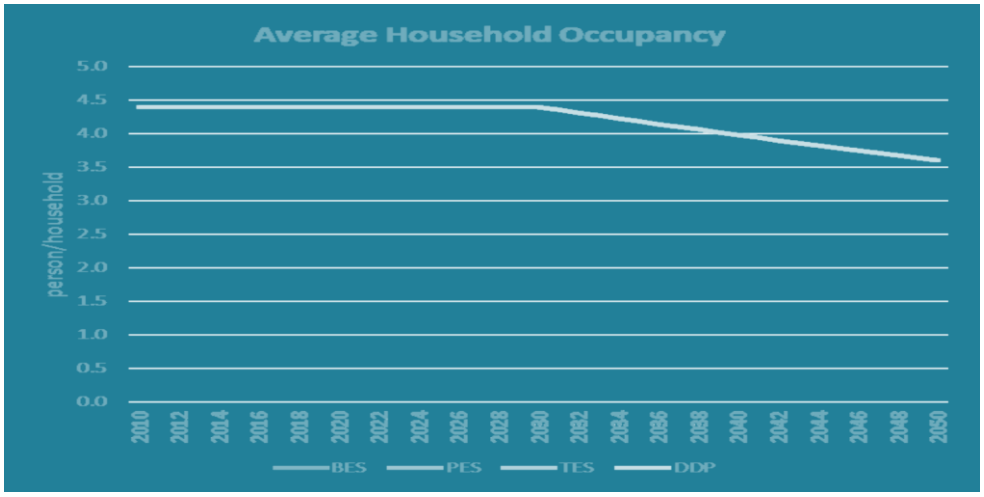
Similarly, it is estimated that there will be an increasing number of households, although with a lower number of occupants per home, which would increase from around 90,000 units in 2020 to 160,000 units in 2050, as reflected in the following graphs, which are the result of the same document. The growth of households accompanies the growth of the population that would reach nearly 600,000 inhabitants in 2050.

Graph 2: Evolution of the number of households



Fuente: IRENA - REmap Belize - September 2020

Figure 3: People per household



Fuente: IRENA - REmap Belize - September 2020

Why SWH?

Why there are favorable conditions to propose SWH in the Residential sector

- Abundant solar resource.
- The satisfaction of a need that would improve the welfare of the population in the Residential sector.
- The incorporation of the same in the tourism sector that is expected to be dynamic in the future.
- Globally and regionally known technology.
- Simple technology that presents no complexities.
- Existence or possibility of developing local technical capacity, both for installation and maintenance, generating a new economic niche.
- A market size that justifies the incorporation of the technology**.**

There is an important precedent which is the potential development of a NAMA to implement this technology, as included in the document cited below.[1]

Such document remarks that “Household sector, composed of all the houses in Belize that fulfil the conditions for the installation of a SWH system”.

The same document concludes that: “a key factor of success will be the implementation of pilot projects, which will serve as demonstrative projects to get the acceptance and interest among the local population in order to increase the awareness of the SWH technology among the population of the country. In addition, these pilot projects will be considered as the first stage of a phased implementation of the NAMA”.

Potential development and timeline

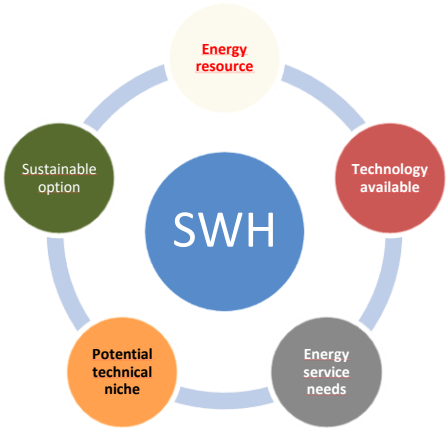
How can it be observed in other Caribbean countries, the availability of abundant solar energy that, forming part of and combined with multiple factors, namely

- Abundant solar energy resource
- Technology developed and available in the global market
- Growing need for an energy service that provides improved well-being and reduces "energy poverty".
- Opportunity to develop a technological niche, linked to the local development of a technology that is not complex but could generate a growing regional market.
- The potential to contribute to sustainability (economic, social, environmental, and technological) and ODS, offered by the combination of energy service and available technology, leads to the conclusion that

It faces a virtuous circle that, by overcoming the potential barriers it might face, can be considered an option to promote as a contribution to the reduction of GHG emissions.

[1] OLADE - SOLAR WATER HEATING NAMA CONCEPT FOR THE INDUSTRIAL, COMMERCIAL AND RESIDENTIAL SECTORS IN BELIZE - 2019

Graph 4: Virtuous circle of SWH in Households



As explained in the report that includes the option and role of the Energy System in the reduction of emissions, in this particular case, the barriers to be overcome can be considered to be of economic nature.

The economy would not be conducive to reducing poverty in Belize. Belize must accelerate national income growth and improve the growing wealth disparity. The slow-growing economy and high debt prohibit spending on social services and investment in human capital. Poverty in Belize could be reduced with the help of international donors, for example, promoting this type of technology.

These facts about poverty in Belize show that there are significant obstacles to improving the poverty situation in the country. However, they also show that many improvements are taking place that will contribute to help those in need in Belize. Development is not only achievable, but it is happening.

As mentioned in the Energy Report, recently, a sustainable growth and development strategy for Belize was established. It contains a plan for the key areas that will be the focus of change and new policy in Belize, with priorities including the development of disaster relief and improvements in education.

It is expected that higher levels of development and equity, together with a set of strategies and instruments (direct and indirect) aimed at promoting SWHs will be able to achieve positive results.

In the case of the Household sector and oriented to this technology, strategies and instruments could be suggested, such as:

- Targeted and bundled financing.Command and control mechanisms: Labeling and minimum standards of devices.
- Soft or free financing through funds available for climate change actions

- More information through more intensive and frequent campaigns to achieve greater awareness and accompanied by education and training.
- Training actions through specialized courses in the different energy efficiency options.
- Capacity building for SWH operation and maintenance.
- Support for the installation of renewable energy sources in homes, public and private buildings, etc.
- Appropriate price signals and tariff structures
- Tax incentives or penalties

GHG mitigation potential

One of the energy services in which we can think of a substitution of sources that implies efficiency actions and, above all, GHG mitigation, is ***water heating in homes.***

Hypothesis on consumption and potential rate of penetration f SWH, based on 2019 data and resulted on conventional energy consumption avoided by 2050[2]

SWH	Avoided consumption per household yearly (MWh)	Penetration in Urban Households	Penetration in Rural Households	Urban Households	Rural Households	MWh urban households	MWh rural households	Total MWh
2019	1	40%	20%	56276	43961	22510	5275	27785
2050	0.8	50%	30%	112000	48000	44800	11520	56320

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- The total population data for 2020, maintaining the percentage of urban and rural inhabitants calculated for 2019, as well as the number of people per household.
- Annual consumption (measured in MWh), estimated on the basis of information extrapolated from other Caribbean countries, but considering 50% of the yearly consumption in such energy service, based on electricity (e.g. Barbados which has 60% of all solar water heaters in the entire Caribbean area, avoid 1 Mwh yearly per household, using SWH).
- Energy consumption has been estimated in MWh but could be estimated in another source, especially in terms of calculating emissions if it is determined that another source would be replaced.

[2] A greater growth of urban households is assumed (urbanization process), added to a decrease in hot water consumption per household, due to the smaller size of families per household..

- The assumed penetration percentages, by household, should be considered for the year 2030 and 2050, being the total number of urban and rural households, those resulting from the population projection estimated in the socio-economic scenario and the avoided energy consumption arising from such projection.
- These penetration percentages are also based on a hypothesis of improved income distribution that would imply a decrease in poverty levels, both urban and rural.
- The percentage of savings, considering the consumption of the base year, over the total electricity consumption of the Residential Sector, is estimated at more than 10%

Barriers and Strengths

Given the relevance of the solar resource, throughout the Caribbean region, its use offers multiple opportunities in both consumption and energy supply.

In this sense, as other countries in the region have done, the use of the sun to heat water, both in homes and in the tourism sector, is an opportunity that should not be missed.

Solar water heater technology is widely developed globally and the excellent contribution it offers to reduce fuel use and the consequent improvement in well-being by having hot water, without generating unwanted environmental effects, drives the promotion of this technology.

In this case, the barriers are socio-cultural, technical and economic, among others. The culture of hot water for hygiene and sanitary use is still very limited, the equipment is expensive and, given the absence of a market, local technical capacities have not been developed for the installation, O&M of solar water heaters.

Conclusions

Achieving the estimated penetration of solar heaters requires the implementation of a specific program that includes: strategies, instruments and quantified targets to the horizons 2030, 2040 and 2050.

In this sense, a design of such a program is required, including the necessary activities and actions that provide the possibility of reaching the defined targets.

It is considered a viable and feasible measure, taking into account the experience of other countries in the region and the multiple benefits already mentioned.

As mentioned in the proposal for a NAMA, the development of pilot projects would be very useful.

As already indicated, it is a clear contribution to national and global sustainable development.