Stakeholder Report: Lebanon

IKI Project: Accelerating 0-emission building sector ambitions in the MENA region (BUILD_ME)

Prepared on behalf of the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety under the International Climate Initiative

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This report summarises the results stakeholder interviews and roundtables conducted during the first phase of this project from 2016 to 2018. Any developments after this date are not reflected in this report. Also, some of the results presented in this report reflect the views of individuals interviewed in the course of the project and may therefore not reflect the position of Navigant, it's partners or the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety.

[1] On October 11, 2019, Guidehouse LLP completed its previously announced acquisition of Navigant Consulting Inc. In the months ahead, we will be working to integrate the Guidehouse and Navigant businesses. In furtherance of that effort, we recently renamed Navigant Consulting Inc. as Guidehouse Inc.

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OVERVIEW

Context: LCEC and Navigant, project partners within the IKI Project "Accelerating 0-emission building sector ambitions in the MENA region" have conducted numerous interviews and organized stakeholder roundtables to assess drivers and barriers for efficient heating and cooling in residential buildings in Lebanon. A similar approach was used in Jordan and Egypt, for which stakeholder reports are also available.

Aim: The aim of the interviews and interaction with stakeholders at roundtables was to

- Assess barriers for the uptake of efficient and/or renewable energy-based cooling and heating technologies in residential buildings;
- Evaluate what role different stakeholder groups play in the decision process;
- Collect recommendations on how the financial and regulatory framework should be changed to make it easier for homeowners and developers to choose efficient heating and cooling appliances rather than conventional ones.

Measures to unlock energy efficiency potential in new residential buildings in Lebanon

This report presents policy recommendations to unlock rapidly the potential savings of accelerating energy efficiency in new residential buildings in Lebanon. The recommendations are based on interviews with key stakeholders and roundtable workshops in Lebanon allowing key stakeholder groups to provide inputs.

Project Developers

i. Update the Lebanese Building Code to include a dedicated energy efficiency code for heating and cooling. The code becomes mandatory for all new building construction.
ii. Strengthen enforcement systems in the construction sector, applying severe penalties to the engineering design company for non-compliance to the energy efficiency building code.
iii. Differentiate financial incentives between energy efficiency projects, offering highest incentives for projects with highest degree of ambition.
iv. Digitalize the permitting process to accelerate the process and facilitate enforcement.

Banks

i. Raise awareness among end users on the social, economic and environmental benefits of energy efficient and renewable energy solutions in the building sector and the possibility to apply for funding from the National Energy Efficiency and Renewable Energy Action (NEEREA).
ii. Build a legislative framework that offers low-interest loans for end-users to purchase an energy efficient house or apartment.
iii. Offer training and capacity building to support credit officers in understanding the impact of low interest loans on business opportunities for energy efficiency in the building sector.
iv. Implement faster methods for loan approvals.

Public Authorities

i. Develop Minimum Energy Performance Standards (MEPS) for heating and cooling equipment being imported in the country.
ii. Regulate laws that enable municipalities to offer incentives for energy efficient buildings beyond the double-wall ordinance.
iii. Develop a solar ordinance that mandates new residential buildings to have solar water heaters on their rooftop in accordance with space availabilities, otherwise the obligation to install heat pumps.

Suppliers

i. Improve electricity supply in Lebanon to increase electricity prices and improve the business case of energy efficiency technologies.
ii. Incentivize suppliers to import energy efficient technologies by facilitating import procedures.
iii. Finalize MEPS for heating and cooling equipment and build capacity at the supplier's floor staff level on the economic and environmental benefits of energy efficient technologies imported to Lebanon

1. PROJECT BACKGROUND

The MENA region, for most aspects excluding the Gulf countries, is characterized by three important energy challenges, to which energy efficiency in buildings can be an important part of a response:

- Insufficient electricity generation capacities lagging behind demand growth due to a growing population, rising living standards and unpredictable increase in demand;
- High dependence on fossil fuels resulting in economies exposed to the price volatility of fossil fuels, be it as an exporter or importer;
- High emission factor of electricity production despite considerable renewable resource potential.

In light of these challenges and the Paris Agreement, the International Climate Initiative (IKI) of the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) has decided to finance the two-year project “Accelerating 0-emission building sector ambitions in the MENA region”. The project focuses on improving the energy efficiency of buildings through the uptake of highly energy efficient and/or renewable-energy based heating and cooling systems in new multi-family residential buildings.

In the first phase of the project three target countries out of six were selected for the implementation of project-specific measures, namely Lebanon, Jordan and Egypt. A macroeconomic base analysis served as a foundation for the selection of the target countries. The macroeconomic analysis examined the most relevant parameters pertaining to the economic and legal framework in these countries, as well as other aspects influencing the implementation of energy efficiency measures in the building sector. The target countries were those in which the framework conditions promise the greatest possible success for the implementation of the project objectives.

Phase II of the project focused on the implementation of project activities in the target countries by providing support for the implementation of pilot projects and facilitating a policy dialogue for improving energy efficiency policies and accelerating the uptake of energy efficiency measures in the building sector.

The following sections summarize project findings for key stakeholder groups and lay down policy recommendations for accelerating energy efficiency in buildings in Lebanon. These recommendations have been derived from a round of 95 interviews with key stakeholders, 300 surveys with local residents and two round-table workshops conducted in Lebanon with relevant stakeholders in 2017 and 2018 from the following groups:

- Project developers, including architects and engineers;
- Banks, including national funds;
- Ministries, including national research centers and municipalities;
- Utilities, including grid operators;
- Technology suppliers.

2. THE ROLE OF ENERGY EFFICIENCY IN BUILDINGS IN LEBANON

2.1 State of the electricity sector

The electricity sector in Lebanon faces numerous challenges. Electricity supply is almost completely dependent on fuel oil imports (>95%) and the Lebanese Government adopted a fixed tariff policy at the cost of an oil barrel in 1994 ($ 20 per ton). Within three decades, financial flows to the national electricity utility, Electricité du Liban (EDL), have drained the state budget with increasing fuel oil prices. Subsidies to EDL increased from 60 million USD in 1998 to 3.1 billion USD in fuel subsidies for the year 2013[2], representing 7.0% of Lebanon's Gross Domestic Product (GDP).

In addition to EDL's direct financial losses, the economic cost of the load not served by EDL in Lebanon is very high with a supply-demand gap persisting since the end of the civil war in the early 1990s. Investment in generation capacity has not held pace with increasing demand, leaving EDL to fall short with an average supply of 15 hours of electricity per day. The rest has been covered by private generators at a price of electricity three to four times higher than the one offered by EDL. Considering this additional societal cost, a national think tank estimates the cost of the load not served to have reached 23 billion USD between 2009 and 2014[3]. Layering on top of the direct financial losses of EDL in this period, the electricity sector has cost the Lebanese economy an average of 5 billion USD per year since 2009[4].

2.2 Energy efficiency in residential buildings – an untapped potential

Despite the poor supply situation, a Lebanese citizen has the highest electricity consumption per capita in comparison to other MENA countries[5]. On a kWh/GDP basis, a Lebanese citizen consumes more electricity than an American or EU citizen, calling for improvements in energy efficiency at the consumer level. The residential sector consumes 30%[6] of the electricity generated. With the potential of energy efficient buildings to reduce energy consumption by 60% compared to the status quo, 1 billion USD per year could be saved if a nation-wide residential building retrofit strategy was implemented. International experience shows that the first step for a successful energy efficiency in buildings strategy is to focus on accelerating energy efficiency in new residential buildings. Given Lebanon's high new construction rate (5% per year), tackling energy efficiency in new residential building construction can potentially save 60 million USD per year[7] to the government budget.

2 MoE/UNDP (2015). Fossil Fuel Subsidies in Lebanon: Fiscal, Equity, Economic and Environmental Impacts. Beirut, Lebanon

3 Elie Bouri and Joseph El Assad (2016), The Lebanese Electricity Woes: An Estimation of the Economical Costs of Power Interruptions

4 Navigant own calculation based on source 1 and 2

5 AUB Policy Institute (2017), Assessing Solar PV's Potential in Lebanon

6 Ministry of Energy (2018) First Energy Indicators Report for the Republic of Lebanon – February 2018

7 Navigant own calculation based on energy efficiency potential in buildings, current consumption of residential buildings in Lebanon, current economic losses of the electricity sector in Lebanon. The number reflects savings assuming that all new buildings are built in a BAU approach.

3. STAKEHOLDER: PROJECT DEVELOPERS

3.1 Contextual information: Whom did we interview?

Twenty-one project developers including contractors, engineers and architects were interviewed in Lebanon during the summer of 2017 to gather their views on the drivers and barriers to accelerate energy efficiency in the building sector. These developers represent a good proportion of the market share for new building construction in Lebanon.

3.2 Status quo: The role of project developers in the decision-making process for energy efficiency

The survey showed that the vast majority of project developers interviewed consider energy efficiency in heating and cooling in their work. It plays an important role in the design and construction of new residential buildings:

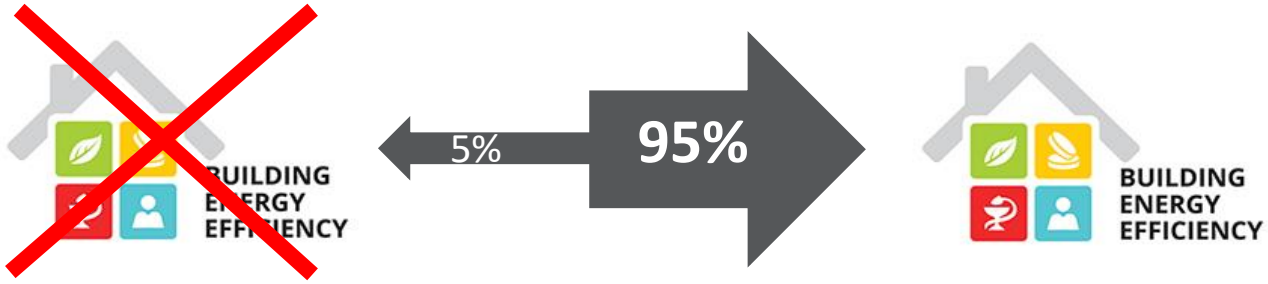

Figure 1 Share of project developers opting for energy efficient designs in their residential projects (n=21)

However, the pool of project developers interviewed tend to serve middle-income to high-income customers, with a majority serving higher-income customers. Project developers who served high-income customers confirmed that they are taking the decision regarding the heating and cooling systems of the buildings from concept to implementation while some of those serving middle-income customers need to involve the client in the design stage to confirm the choice on the heating and cooling equipment and others leave it for the customer to retrofit after construction. Project developers who served low-income customers were unfortunately not interested to participate in the survey. Energy efficiency in heating and cooling is most likely not considered in this segment at the design phase since apartments need to be sold at least-cost price.

Economic viability assessments

Most companies represented in the survey (>70%) prepare cost-effectiveness calculations for heating and cooling systems before installing them, while the rest base their decisions on their past experiences. Although this method is not optimal, two-thirds of those who carry out assessments use payback period calculations for the assessment of the economic viability of energy efficient measures. Their preference for this method mainly comes from it being seen as easier to explain to the customers. Whereas in Egypt or Jordan less than 5% of project developers were conducting a net present valuation calculation, 30% of the interviewed companies who carried out economic calculations used this method in Lebanon. Most of them prepare the calculations only because it is a requirement for the NEEREA loan. Compared to the payback method, the advantage of the NPV calculation is that it considers the whole lifecycle of the measure, as well as the time value of money, which is a key criterion to communicate with financial institutions.

3.3 Policy recommendations: How to accelerate ambitions for energy efficiency of heating and cooling in new residential buildings

I. Update Lebanese Building Code to include an energy efficient code for heating and cooling. The code becomes mandatory for all new buildings construction.

Rationale: Engineers in Lebanon frequently oversize heating and cooling systems, prioritizing safety and comfort for the owners or tenants over efficiency. The heating and cooling demand of the building is rarely conducted with software models, taking into account exogenic dynamic parameters that influence final heating and cooling demand e.g hourly temperature variation, wind speeds, space occupancy etc. Calculations are based on business as usual common experience. In addition, control systems are often not designed to optimize the operation of heating and cooling systems and cut energy costs but are only used for monitoring purposes.

Implementation: To implement the proposed update of the Lebanese Building Code, we propose that the Lebanese Standards Institution (LIBNOR), the Orders of Engineers and Architects of both Beirut and Tripoli (OEA), the Lebanese Center for Energy Conservation (LCEC) and the Higher Council for Urban Planning cooperate and ensure the implementation of the building code. LIBNOR would take the lead to create Lebanese efficiency standards for the building code. The code shall require engineers to submit a detailed calculation of the heating and cooling demand of the building, considering passive and active measures in energy efficiency and limiting safety factors to international ASHRAE standards. LCEC would support LIBNOR in preparing the codes and LIBNOR would form a technical committee to review the new codes. The Higher Council for Urban Planning would be responsible to inspect designs for compliance with the code and/or inspect site for compliance with construction. The five organisations would cooperate already to update the double wall ordinance following the roadmap of the National Energy Efficiency Action Plan 2016-2020 of Lebanon (NEEAP). LIBNOR initiated the process two years ago and is at a percentage of completion (PoC) of 40%. The plans are to finalize as a first draft by 2019. The support of international consultants can be requested on demand from the parties.

Impact: Reviewing the building code is crucial for accelerating energy efficiency measures at the design level. This recommendation is the starting point for other recommendations such as enforcement, incentives differentiation and accelerating the permitting process as it sets the rules for energy efficiency measures and designs.

II. Strengthen enforcement systems in the construction phase, applying severe penalties to the project developer and his contractors for non-compliance to the energy efficiency building code.

Rationale: In most construction projects, an initial plan is first presented for the authorities and then undergoes multiple modifications without being notified to the authorities again. In addition, municipalities' inspectors lack the engineering knowledge to inspect the compliance of innovative energy efficient solutions e.g. air to water heat pumps.

Implementation: The OEA, the Ministry of Interior and Municipalities and the Higher Council for Urban Planning form an independent body of certified inspectors. This third-party will have the responsibility to ensure a reliable and unbiased inspection and a correct enforcement of the building code for new buildings. The Ministry of Interior and Municipalities must grant the authority to this party to set penalties for non-compliance. The OEA is responsible to certify the inspectors. International consultants can support the OEA for the certification process if requested.

Impact: This recommendation is likely to have a high impact as it ensures the implementation of the energy efficiency measures stated at the design level and for which the developers benefited from incentives.

III. Differentiate financial incentives between energy efficiency projects, offering highest incentives for projects with highest degree of ambition.

Rationale: Financial incentives currently exist in Lebanon for applying energy efficiency measures. The current framework is independent from the level of energy savings. In addition, the financial calculations are simplistic. There is no standard baseline to compare the benefits of the energy efficiency measures to, which makes it difficult to benchmark the applications and screen best in class measures.

Implementation: LCEC is to develop a standard tool that conducts the cost benefit calculations of different energy efficiency measures, following a) user specific engineering input on the heating and cooling demand of the building b) market survey of the capital cost of the energy efficiency measures and their related operational savings c) technical efficiency of the measures. The tool will be apt to categorize the measures in Bronze, Silver or Gold packages according to the Net Present Value (NPV). Measures with lowest NPV are sorted in Bronze, highest NPV in Gold. Higher incentives (e.g increasing grace period, lower interest, increasing floor area) should be granted to Gold packages.

Impact: This measure is likely to have a high impact, as energy efficiency measures with highest NPV are the measures that save the highest amount of energy over lifetime. However, often with longer payback periods, these measures do not get chosen. If incentives existed to promote these measures, engineers are more likely to choose the technologies with highest impact.

IV. Digitalize the permitting process.

Rationale: Bureaucratic procedures slow down the permitting process and increase cost on the side of project developers. Once an energy efficiency building code is put in place, the process of assessment for compliance with the new code and enforcement needs to be as transparent and clear as possible. Thus, the need to digitalize the whole process to ensure adequate enforcement.

Implementation: Identify funding and third party to prepare an online platform and application system to be adopted by the relevant authorities in collaboration with the OEA, the Higher Council for Urban Planning and local authorities. This third party will be responsible to computerize the building design review and permitting process by implementing new software with online applications and machine verification processes. In this process, faster measures can be implemented for projects with energy efficiency measures. Lessons can be learned from the Ministry of Finance and Ministry of Telecommunication where digitalization has proven to enhance operation.

Impact: Decrease administrative burden for applying energy efficient measures, increase transparency at the permitting level and accelerate the rate of new energy efficient constructions in the country.

4. STAKEHOLDER: BANKS

4.1 Context: Whom did we interview?

Eight representatives from financial institutions were interviewed, mainly commercial banks. The commercial banks selected represent members of the top 10 banks in Lebanon with the highest market share. They are the most reliable banks in the sector but most importantly they are banks that are involved in financing energy efficient projects through the NEEREA subsidised loans.

4.2 Status quo: Are you offering low interest loans to energy efficient projects? If yes, what triggered you to do so and how is your experience when it comes to lending money for energy efficiency measures?

All the interviewed banks give green loans to their customers. This action started in most of the banks with the deployment of the NEEREA initiative. Some banks stated that they face some internal barriers that keep them from investing more in green projects such as the lack of technical experts at the bank. Since 2010, the banks have grown a better understanding in the energy efficiency sector and are working with a more selective group of clients that they have identified as worthy in the field. Productivity is increasing and most banks have witnessed no defaults in payment.

NEEREA is a Lebanese financing mechanism developed by BDL. This mechanism started operating in November 2010. It is dedicated to the financing of green projects in Lebanon. Since its initiation, NEEREA has become the cornerstone for energy efficiency and renewable energy development in Lebanon. Since its implementation, NEEREA has financed more than 780 projects with a total sum exceeding USD 460 M up to June 2018. This instrument provides low interest rate loans (between 1% and 2%) for projects under USD 20 M. and long repayment periods of up to 14 years to the residential, non-profit, commercial and industrial sectors.

The NEEREA loan is an interesting product to the banks since BDL provides additional liquidity at low interest rates. The additional liquidity could be used by the banks for other purposes like housing loans, car loans, personal loans and investment in treasury bills, which usually provides higher interest rates. However, it should be noted that this arrangement between BDL and the commercial banks is constantly under revision.

The loan that is most sought after is a solar photovoltaic (PV) loan that has an average amount of USD 20 K. The biggest amount taken by a home owner was USD 120 K, repaid over 10 years (this is based on the interviewed banks, other banks may have higher figures). Building developers have taken the highest amount with one loan reaching USD 20 M to be repaid over 14 years. The loans given can cover multiple energy efficiency measures such as insulation, double glazing, shading elements, mechanical ventilation, PV plants and LED lamps. Securities that are requested by banks range from a minimum salary range where monthly debt should not exceed 33% of your income, to job contracts and mortgages for high amounts. No loans have been granted directly to Energy Services Companies (ESCOs) as the business model is not yet fully developed and understood in Lebanon. Loans could be granted directly to the project owner but not the ESCOs as per the interviewed banks.

4.3 Policy recommendations: How to accelerate ambitions for energy efficiency of heating and cooling in new residential buildings?

I. Raise awareness of the end user on the social, economic and environmental benefits of energy efficient and renewable energy solutions in the building sector and the NEEREA applications.

Rationale: Lack of awareness on the added benefits for the country for every kWh saved or produced with renewable power compared to business as usual and how reduction in energy subsidies could translate in improved public services. Lack of awareness on the impacts of climate change in Lebanon for future generations. Lack of awareness of end-users on the existence of the NEEREA loan and the possibility to retrofit their residences to reduce their energy consumption.

Implementation: The Ministry of Energy and Water and the BDL should lead a nation-wide campaign to alter the customer mindset and drive market demand for NEEREA loans from the end-user. Advertisements should raise the awareness of citizens in their role in reducing the public debt of the country by reducing their energy consumption by investing today in energy efficient and renewable solutions. A national website grouping all information on the potential of energy efficiency measures in residential households and the contacts of certified ESCOs able to implement these measures should be built. Lessons from the campaign "Deutschland Macht's Effizient" (Germany goes for Efficiency) can be transferred. To be most effective at changing traditional ideologies, the campaign should target universities and schools and introduce curriculums on impacts of climate change and mitigation measures. Finally, all new public buildings should have at their entrance their Energy Performance Certificate and market how energy efficient solutions are reducing the energy bill of the building and saving CO_2 emissions. This measure has been taken in Germany and proven to be effective at raising awareness.

Impact: Increasing awareness of the end-user, driving increasing applications for NEEREA loans, which in turn pushes project developers to apply energy efficient solutions

II. Build a legislative framework that offers incentives for end-users to purchase an energy efficient house.

Rationale: The NEEREA loan does not offer a low interest loan for end-users who wish to purchase an energy efficient apartment/household available in the market. It offers a low interest loan for investing in single energy efficient or renewable energy measures in your own property and for project developers that plan to take energy efficiency measures in a project to be sold to a client. Hence there is no direct incentive for an outside buyer to buy an energy efficient apartment. If a project developer is able to raise funds from investors without a NEEREA loan to implement energy efficient solutions in his new project, the existence of direct incentives for end-users in purchasing an energy efficient house would facilitate considerably the sales of his apartments. To avoid the BDL from excessive subsidies, new apartments built by a project developer who benefitted from a NEEREA loan cannot benefit again from direct low interest loans to end-users.

Implementation: The BDL issues a circular to commercial banks similar to circular 316 issued in 2010. Citizens can benefit from a low interest loans to purchase energy efficient apartments under the condition that the project developer did not benefit previously from a NEEREA loan and that the apartment is certified according to an international or local certification scheme approved by the BDL. In this regard, the development of a mandatory energy certification and labelling for residential units upon sale or purchase would prove to be well needed.

Impact: Increase directly market demand for energy efficient houses in the country.

III. Offer training and capacity building to support credit officers in understanding the impact of low interest loans on business opportunities in energy efficiency, with a focus on efficient heating and cooling technologies.

Rationale: Because of the non-conventionality of the cash flows of energy efficient assets, bankers do not understand how to value energy efficient solutions and considers their applications similar to normal goods, instead of depreciable assets.

Implementation: Training bankers in understanding the impact of bank loans on the value of energy efficiency measures and how to categorize these from least to highest impact with respect to financial indicators. This training goes in line with recommendation III from project developers in differentiating incentives for energy efficient measures with respect to ambition.

Impact: Providing such training will improve the ability of bankers to turn energy efficiency lending into innovative banking products, reducing lending risks and opening new market segments, e.g. ESCOs.

IV. Implement faster methods for loan approvals.

Rationale: The application for a NEEREA loan can be time consuming. Applications need to go first through a commercial bank, then to BDL for approval and then BDL transfers the technical report to LCEC who acts as the technical arm for BDL and reviews the applications. The application is then reviewed and shared back and forth between the consultant in charge of the application and LCEC. Bankers lacked the knowledge to take an educated opinion once they received the application and transfer any issue to LCEC. Since there existed no list of eligible technologies and products that could qualify for a NEEREA loan at the time when the loan was initiated, every application came with a new technology from a certain supplier. LCEC had to cross check quality of supply and ensure that applications from the consultants are complete and up to standard, which may have caused delays in application approval.

Implementation: The European Investment Bank (EIB) and the Agence Francaise de Development (AFD) are introducing a new financing mechanism in Lebanon known as Lebanese Energy Efficiency and Renewable Energy Financing Facility (LEEREFF). LEEREFF will benefit from NEEREA lessons and offer an easier application process and faster approval process. The process will include a pre-qualified list of technologies that will have a simplified standardized approval method. The international consultant GFA is commissioned to implement the mechanism and train bankers to understand the different facets of an application and take informed decisions themselves to reduce the workload on LCEC. A similar effort should add to the LEEREFF experience in upgrading the process for loan approvals and integrate it within the NEEREA mechanism.

Impact: As per GFA, LEEREFF loan applications are expected to take less than 2 months, which will accelerate the uptake of energy efficient measures in the country. A more simplified approach to NEEREA could even reduce further the approval process on loans.

5. STAKEHOLDER: PUBLIC AUTHORITIES

5.1 Context: Whom did we interview?

Sixteen representatives of the public sector were interviewed, spanning from municipalities to research institutes and ministries along with EDL. These interviews tackled the ministries with highest relevancy to the project such as the Ministry of Energy and Water and the Ministry of Environment, municipalities which represent the local authorities that seek to implement and oversee building codes for buildings under their jurisdiction and EDL who is in charge of production and distribution of electricity in Lebanon. These entities were considered as the most relevant in the public sector as they deal directly with energy related issues and will have an effect in energy efficiency in residential buildings.

5.2 Status quo: Does your authority consider setting energy efficiency targets in its future strategy?

Due to the diversification of roles of the interviewed participants from the public sector, multiple tendencies concerning the energy efficiency target were noticed as the participants did not work at the same level.

Ministries have set goals where they are trying to reach their targets within predefined time frames. The Ministry of Energy and Water has a target of reducing the consumption by 1.5 TWh by 2020 which represents 4.83% of the total consumption in 2020[8] as detailed in the NEEAP. This target was set based on "The Policy Paper for the Electricity Sector" and assumes that the yearly growth for the electricity consumption in Lebanon is 7%. Along with the NEEAP, the National Renewable Energy Action Plan for the Republic of Lebanon (NREAP) was developed in order to elaborate a plan on how to reach the 12% renewable energy target. On the other hand, the Ministry of Environment is applying the Montreal protocol and the Kigali amendment concerning the refrigeration gases used in the refrigerating equipment. These protocols aim to ban the use of certain refrigeration gases where a ban on import is or will be applied to gases that are defined in the Montreal protocol and Kigali amendment as having a high impact on the ozone layer or a high global warming potential. The Republic of Lebanon, led by the Ministry of Environment, published Lebanon's Intended Nationally Determined Contribution under the United Nations Framework Convention on Climate Change (INDC report) including unconditional targets of 15% of the power and heat demand in 2030 generated by renewable energy sources and 3% reduction in power demand through energy-efficiency measures in 2030 compared to the demand under the business-as-usual scenario. These targets could reach 20% and 10% respectively upon the provision of additional international support[9].

Other public authorities such as LIBNOR and the Industrial Research Institute (IRI) are trying to help in their corresponding field. LIBNOR is currently working on developing a green building code. This code is developed by a committee headed by a representative from LIBNOR and contains specialists from all the sectors who can bring an additional input to the code. Representatives of the Industrial Research Institute (IRI) showed great interest in cooperating with green building projects but mentioned that their laboratories need to be expanded and updated in order to perform tests on the products that are entering the market.

[8] NEEAP 2016-2020, The Second National Energy Efficiency Action Plan for the Republic of Lebanon

[9] Lebanon's Intended Nationally Determined Contribution under the United Nations Framework Convention on Climate Change, Republic of Lebanon, September 2015

One of the eight interviewed municipalities has joined the Covenant of Mayors for Climate & Energy setting a target of 40% reduction in CO_2 and GHG emissions by 2030. Other municipalities did not have a clear goal concerning energy efficiency although most of them encourage energy efficiency as much as their authority permits.

5.3 Policy recommendations: How to accelerate ambitions for energy efficiency of heating and cooling in new residential buildings?

I. Develop Minimum Energy Performance Standards (MEPS) for heating and cooling equipment being imported in the country.

Rationale: One of the main barriers project developers were facing in implementing energy efficient solution was the fear to lose competitive edge compared to other developers, who chose low cost equipment to sell apartments at minimum upfront cost to their customers. By banning the import of technologies that do not respect minimum energy performance standards (MEPS) from entering the market, authorities can ensure to project developers the same level playing field. In addition, MEPS would facilitate the sales of efficient equipment in retail stores especially if energy labelling is introduced.

Implementation: LIBNOR would start developing standards for the performance testing of energy efficient appliances that enter the Lebanese market and for the local manufacturing. LCEC, adopting LIBNOR's standards, develops MEPS and a support scheme to facilitate the proliferation of energy efficient products in the market. After completing these steps, the Council of Ministers issues a decree to make the MEPS mandatory. Testing facilities at the IRI have to be developed and a labelling program, using EU labelling schemes, has to be put in place.

Impact: If implemented, this recommendation will have a high impact as it would guarantee a minimum threshold of efficient products in the country.

II. Regulate laws that enables municipalities to offer incentives for energy efficient buildings beyond the double wall ordinance.

Rationale: Municipalities are bound by legislation which restricts their rights to give explicit incentives to energy efficient buildings. The current building code provides one limited incentive for energy efficiency in buildings. This incentive is strictly for the usage of double wall, where the surface occupied by the double wall is not considered in the allowable investment factor, which allows to build more on the same plot of land.

Implementation: Update the law in order to give municipalities a bigger role in the permitting procedure. The municipality as a local authority, will have a better insight on the projects that are being developed under its jurisdiction. After giving the municipalities this power, they could give incentives for new buildings that are more environmentally friendly by prioritizing their applications and giving them incentives such as higher investment opportunities. This needs to be combined with the need to strengthen enforcement systems in order to discourage any free-riders.

Impact: By offering additional incentives to project developers implementing energy efficiency solutions, municipalities can spur market demand.

III. Develop a solar ordinance that mandates new residential buildings to have solar water heaters on their rooftop in accordance with space availabilities, otherwise mandate the installation of a heat pump.

Rationale: With the absence of a solar ordinance, real estate developers do not find themselves obliged to equip their buildings with Solar Water Heaters (SWH). This problem makes it difficult for the end user to purchase and install a SWH as he will have to provide a space on the roof along with installing the relevant network for the SWH to reach his household.

Implementation: LCEC is currently developing a solar ordinance in cooperation with the Higher Council of Urban Planning. The solar ordinance will enforce a minimum SWH installation in new buildings. This will be combined with the need to install air-to-water heat pumps in buildings with limited roof availability. After reaching an agreement between both sides, the ordinance will go along the legislative pass in order to become mandatory and to be included in the Lebanese building code. A strong enforcement system needs to be developed as well as intensive capacity building activities for engineers in order to familiarize them with the new requirements.

Impact: Higher share of hot water needs (and to a lesser extent space heating needs) covered by renewable energy.

6. STAKEHOLDER: SUPPLIERS

6.1 Context: Whom did we interview?

The consortium contracted the market research institute Growth from Knowledge (GfK), as an external partner to conduct a market survey with 300 residents in Lebanon and 50 suppliers and retailers of heating and cooling technologies for residential buildings. The goal was to gather the view of each group to understand what drives or hinders them to import/invest in energy efficient and/or renewable energy based heating and cooling technologies.

6.2 Status quo: What are the current heating and cooling technologies being imported and sold to residential consumers?

Lebanese suppliers and retailers are importing most of their technologies from China (80%) followed by South Korea and Germany. Their orderbook in selling higher energy efficient technologies did not change in the last five years, but has been observing a slightly decreasing trend.

The majority of interviewed suppliers and retailers import and sell single split air source heat pumps (55%), with an average Coefficient of Performance (COP) of 4.8 varying between 3 and 6. Electric resistance heater and electric fans are the second most sold technology in the Lebanese market, followed by multi-split air source heat pumps with an average COP of 5.4 varying between 3 and 6. Air conditioners and Chillers that are used only for cooling represented a share of 25% in the suppliers and retailers portfolios. Regarding boilers systems, only 12% of the interviewed pool were selling them, the majority selling condensing boilers (80%).

Most of the interviewed suppliers did not sell water heating technologies. A quarter were selling instantaneous water heaters and a very small share solar thermal. It is important to note that suppliers selling solar PV were not interviewed, which can explain why a very small share was selling solar thermal.

A detailed breakdown of imported heating and cooling technologies with their respective efficiency levels is illustrated in figure below.

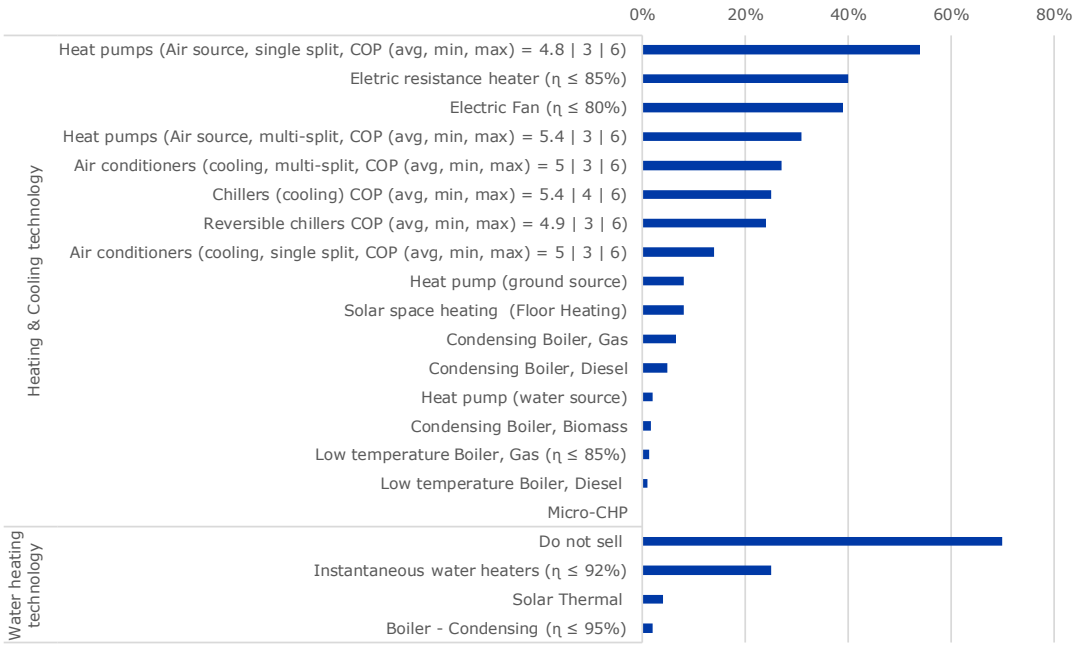

Figure 2 Market distribution shares and efficiencies of space heating and cooling technologies and water heating technologies in Lebanon (n=50 suppliers)

6.3 Policy recommendations: How to accelerate ambitions for energy efficiency of heating and cooling in new residential buildings?

I. Improve electricity supply in Lebanon in order to increase electricity prices to the consumers and improve the business case of energy efficiency technologies.

Rationale: Electricity tariffs levels are set below cost recovery in Lebanon. The cost of electricity generation by EDL reached 22.73 US c/kWh while electricity tariffs ranges from 2.33 to 13.33 US c/kWh depending on consumption bands. Tariffs need to be gradually increased with the improvements in electricity supply. This will give a boost for energy efficiency measures, which will pay back faster and have a higher NPV compared to a baseline.

Implementation: The Policy Paper for the Electricity Sector, published by the Ministry of Energy and Water, includes a specific plan to gradually restructure and increase the electricity tariff in conjunction with the increase of supply. It also includes the adoption of special tariffs for low income consumers and productive sectors, and to implement Time of Use (TOU) tariffs in conjunction with the implementation of Automatic Meter Reading (AMR) schemes. These tariffs are to be regularly reviewed to reflect actual costs without causing further deficit to the National Treasury.

Impact: Increasing awareness of consumers on their energy consumption. Improvement of the business case of energy efficient measures. Improvement of revenues of energy utilities. Electrification of heating sector. Decrease in use of boilers.

II. Incentivize suppliers to import energy efficient technologies by facilitating import procedures.

Rationale: One of the main barriers suppliers were facing in importing energy efficient technologies was the fear to lose competitive edge compared to other suppliers, who choose low cost equipment to sell at minimum upfront cost to their customers. By banning the import

of technologies that do not respect the MEPS from entering the market, authorities can ensure to suppliers the same level playing field. In addition, MEPS would facilitate the sales of efficient equipment in retail stores.

Implementation: The first step would be to impose high fines on products not meeting requirements or producers' labels, then to enforce MEPS to ban products with low energy performance. Furthermore, to upgrade IRI laboratory facilities to facilitate the testing procedures and standards, then to upgrade IRI's testing facility to test energy performance measures (IRI to follow international standards and certifications to reduce the level and time of testing), and to increase its capacity in order to decrease response time. In the meantime, LIBNOR would prepare standards for efficiency requirements. Products that are already certified from accredited laboratories abroad, and that have the correct energy performance labels would benefit from reduced testing requirements.

Impact: Ensuring European labelling or equivalent on products entering the market will impose a certain minimum level of safety and performance. Giving Incentives to products with an energy efficient European label (or equivalent) will ensure that importers target the right quality of technologies.

III. Finalize MEPS for heating and cooling equipment and build capacity at the supplier's floor staff level on the economic and environmental benefits of energy efficient technologies imported in the country.

Rationale: Our interviews with 300 consumers in Lebanon proved that the biggest driver for them to purchase an energy efficient heating or cooling technology at a retail store is the ability of the vendor to present convincing arguments to defend the case. Vendors should guide customers in their purchase, explaining that the benefits of energy efficiency pays off over the lifecycle of the equipment and how the present value of the technology should be their decision factor for a profitable investment. They should inform them about the possibility of financing mechanism to cover the additional upfront cost. The second factor driving consumers in Lebanon to purchase energy efficient technologies was the presence of an energy efficiency label, hence the importance of finalizing the MEPS in Lebanon.

Implementation: Intensive capacity building activities for the suppliers' floor staff level is needed to equip them with the correct knowledge to better sell and favour heating and cooling technologies with higher energy efficiency even at higher costs, informing consumers about available financing options. This needs to be combined with a labelling scheme and a widespread public awareness campaign.

Impact: Increasing demand for energy efficient products and wider use of available financial incentives.