# MED-ENEC

## Energy Efficiency in the Construction Sector in the Mediterranean

ENPI/2009/224-969

Technical Assistance for Employment Impacts of EE measure implementation

**Economic effects of increasing energy efficiency in Israel**

February 2016

# Disclaimer

The contents of this publication are the sole responsibility of the author and can in no way be taken to reflect the views of the European Union.

The information in this study has been carefully researched and diligently compiled. Nevertheless, neither MED-ENEC nor the consortium partners accept any liability or give any guarantee for the validity, accuracy and completeness of the information provided. They assume no legal liabilities for damages, material or immaterial in kind, caused by the use or non-use of provided information or the use of erroneous or incomplete information.

This study contains links to third-party web sites. The linked sites are not under the control of MED-ENEC and MED-ENEC is not responsible for the contents of any the mentioned website links or any link contained in a linked site.

MED-ENEC further refers to the disclaimers and the legal notices of the EU Commission and GIZ:

http://europa.eu/geninfo/legal_notices_en.htm#disclaimer

http://www.gtz.de/en/rechtliches/691.htm

Information for this report was collected from mid-June to end of September 2015. The report reflects the information collected during this period relevant. Later changes cannot be anticipated.

**Acknowledgements:**

**Author : Dr. Ulrike Lehr**

**Contributors : Anke Mönnig, Rachel Zaken, Edi Bet-Hazadi**

# Table of Contents

## List of Figures



## List of Tables

# 1 Executive Summary

## 1.1 Background

For many years, Israel had few domestic conventional energy resources. The discovery of large gas reserves in the Mediterranean and the exploration of said reserves has changed the picture. Israel developed from a country which meets its fossil fuel needs fully from imports to a country considering gas exports in the near future. Electricity generation plants today run increasingly on natural gas as opposed to coal several years ago.

However, the new natural gas findings are not limitless with a volume of approximately 900 billion cubic meters. Electricity demand is growing and will continue to grow in the future, driven mainly by three factors.

a) Population growth: Israel's population is still growing with high fertility rates;

b) Increasing degree of being equipped with electrical devices: Rising living standards of social groups, which are thus far underequipped with electric appliances parts and changing climatic conditions due to climate change lead to the projection of increasing percentages of households being equipped with e.g. air-conditioners. Israel already experiences increased temperatures and frequency of heat waves.

c) Additionally, temperature peaks during the summer days requires more electricity for cooling office spaces, but also hospitals, schools and universities.

Energy efficiency can be regarded as a source of energy. As such, it is among the least environmental harmful sources of energy and the least expensive. Reducing electricity consumption saves primary energy inputs, decreases a country's energy dependence and often a country's dependence from imported fuels. Acknowledging this, the Ministry of National Infrastructures, Energy and Water Resources in Israel has developed the NEEP, the National Energy Efficiency Program. This program aims at reducing electricity consumption between the years 2010-2020, and it states:" this will save the construction of power plants with an overall capacity of 3,400 Megawatts, and will allow us to meet the government's efficiency objectives. In economic terms, this means the saving of approximately U.S$ 4.25 billion." (NEEP 2010) Today, in 2015, as half of the time horizon of the program has passed, it is time to evaluate the economic impacts of the past five years and estimate the upcoming development. While the energy savings are stated clearly in the NEEP, economic effects in terms of jobs and value added are not included. Therefore, this contribution focuses on estimating employment from energy efficiency according to the NEEP, considering additional investment in energy efficiency triggered by the measures described in the NEEP.

The economic approach behind the estimate is straightforward. Energy efficiency measures have employment effects along the value chain. The different phases along the value chain are: planning, at least in the case of larger measures, producing efficient gadgets and equipment, selling/handling the imports, installing new equipment. In each phase, our approach additionally considers inputs and employment thereof. All these activities cause employment in Israel inasmuch the activities, e.g. production and services are domestic. Imported goods cause employment in the countries they are produced in.

The inputs to domestic production and services are obtained from Israel's input-output tables, provided by the Central Bureau of Statistics. Input-output tables provide information on the inter-industrial linkages of production in an economy and thus allow for the calculation of indirect employment. The underlying idea is that additional production in one sector triggers production in all sectors which produce intermediary input for this production. The effect perpetuates through the economy. Solar water heaters produced in Israel, for instance, are built with inputs from other industries (tank: metal fabrication and coating, glass: cover, electrical devices: cables) which partly are produced in the country, too. Solar water heater expansion therefore leads to additional employment in these industries. Additional effects come from installation, wholesale and planning, plus the inputs to these services. We developed a simple macro driven IO- model for Israel (e3.isr) to estimate and forecast future employment.

For the ex-post analysis, capacities installed in the past are observable. Future installations are taken according to the NEEP. Investment, i.e. the costs of new equipment or of the improvement of buildings, the share of imports and domestically produced goods and the costs of sales were estimated with the help of experts from Israel. Our thanks goes in particular to Rachel Zaken and Edi Bet-Hazavdi from the Division for Resources Infrastructure Management, Ministry of Energy and Water Resources in Israel.

The COP21 negotiations and their globally welcomed results lead to the definition of a second scenario, called the Post Paris Scenario, because the Government of Israel has pledged additional support and funds for measures which exceed the scope of the NE. However, since the use of the funds is not yet as detailed as the NEEP, the Post Paris Scenario should be read more as a sensitivity.

## 1.2 Conclusions

Annual investment in measures to increase the efficient use of electricity in households, public administration, buildings, industry, trade, agriculture and the water sector on average amounts to 1.4 million NIS. The amount increases over time. Almost 2/3 of the investment goes to new energy efficient buildings, residential and commercial. The remaining third is spent on efficient appliances in the private, commercial, industrial and public sector. A large share of these appliances are imported so that the economic impact of efficient appliances comes from installation and whole sale of the equipment. Most appliances such as fridges or stoves do not need operation and maintenance from an expert, thus employment effects in O&M are also low.

The other important driver of economic effects is the additional budget from energy savings. Without detailed data on the use of this additional budget, we assume that part of it is spent according to the historic consumption pattern in the households' case. Industry and public domain use the savings to refinance the investment in energy efficiency.

With these assumptions the measures from NEEP and cross sectional activities lead to a plus of 5,645 people in the year 2020. The additional employment rises with increasing investment along the time path, and increasing returns from energy savings. The impact on economic sectors reflects the heavy focus on buildings: the largest effect is in the construction sector.

The Post Paris scenario assumes additional investment in energy efficiency, but mainly targeting industry, local authorities, commercial and public purposes. For energy efficient household appliances, a new regulation is planned and this will lead to a slower deployment of the efficient appliances than before. Monetary support has led to early replacements in the NEEP scenario. Without further data, we assume that the additional funds and support are distributed in the same pattern as before – without the support of household appliances. The Post Paris Scenario leads to additional employment of almost 3,200 people, so that the overall employment from increased efficiency and energy savings reaches 8.8 thousand jobs.  Additional employment is found in the construction sector, whole sale and trade as well as all entertainment, sports and cultural activities. The construction sector is involved in several activities: energy efficient buildings, installation of appliances and improvement of energy efficiency in hotels, local authorities, public and commercial buildings. Whole sale and trade is gaining from two drivers: firstly, all appliances have to be imported/ sold and traded and secondly, the additional budgets are spent on consumptive uses. The latter three sectors are good examples of this: additional household budget are spent on cultural or sporting events and entertainment. The effects compare well to the literature. For Germany, effects from efficiency increase were estimated to be around 200,000 persons, but additional investment amounted to more than 20 billion Euro per year at the peak. Tunisia, on the other hand, has an efficiency component in its Solar Plan. The Solar Plan creates 6,000 additional jobs, from roughly 1 billion Tunisian Dinar (around 400 million Euro) investment. This, however includes renewables as well. The Tunisian labor productivity is much lower than labor productivity in Israel, therefore employment effects from roughly the same amount (1.3 billion NIS convert into roughly 300 million Euro) are relatively low.

At least two conclusions can be drawn from this exercise and the international comparison: Firstly, producing energy efficiency equipment tailored to the special needs of Israel could lead to more job opportunities in the respective industries. As long as most equipment is imported, effects on the labor market are low. Secondly, given the challenge of increasing energy demand, the effort of the energy efficiency plan is not ambitious enough. Energy security is not about resources and reserves alone. It also is about infrastructure, investment in additional capacities and enhancing the grid. Especially at peak times this can be a costly challenge and energy efficiency the less costly option.

## 2 Methodology

OECD and IEA have issued a comprehensive volume on the economic effects of energy efficiency (OECD/IEA, 2014). The chapter on macro-economic effects states: "(….) economy-wide effects occur at national, regional and international level in relation to impacts that result from energy efficiency policies. (…) In general, the macroeconomic impacts of energy efficiency are the product of two types of effects associated with energy efficiency measures:

- Investment effects being the results derived from increased investment in energy efficiency goods and services

- Energy demand or cost reduction effects, which comprise the effects arising from the energy demand reduction (or reduced costs) associated with actually realizing an improvement in energy efficiency."

OECD/IEA (2014) then gives an overview of the type of models being used to capture the economic effects of additional energy efficiency. They list models based on different approaches, but most include the use of input-output-tables to model the impact of efficiency measures on the level of industries and economic sectors. This is in accordance with the literature on measuring employment effects of renewable energy increases (for an overview and methodological recommendations on RE see IEA-RETD 2013).

The approach applied in the following is also based upon IO-theory. Employment from additional investment in energy efficiency is estimated as direct employment (investment* labor intensity of the respective sector) and indirect employment from the Leontief approach (see below) using input-output–tables. This allows to take a deeper look into the economic structure of Israel and the interlinkages of production between different sectors. Thus, the approach not only yields estimates for direct employment from additional investment, but takes into account local value chains and indirect employment through the provision of inputs. The more a country is industrialized – and integrated, the more relevant this aspect.

A simple model can be derived from these ideas, being based upon statistical data including input output data, employment data, national accounts and projection on GDP growth and population development. The approach and the model are described in more detail in the following.

### 2.1 The Leontief approach

The Leontief function determines domestic production from inter-industrial demand and final demand. It describes economic output as the sum of intermediate demand between industries and domestic final demand. Equation [1] shows the reduced form of the Leontief function. The Leontief-inverse $(I-A)^{-1}$ – with A as input coefficient matrix and I as identity matrix – is a matrix with input necessary for the production of one unit of output in the columns. In general, elements on the diagonal of the inverted matrix are larger than one, all other elements are smaller than one. This reflects the fact that each sector also produces for itself, for other sectors and for final demand. Final demand for one additional car, for instance, leads to the production of this car. But, this production needs inputs from the automotive industry (gearbox, axis etc.), therefore the multiplier has to be larger than one (the car itself from the car company and the supplies from the automotive industry). From other industry also inputs are needed, usually of smaller impact than the whole car: tires from the rubber industry, seats from textiles etc. The respective coefficients are smaller than one.

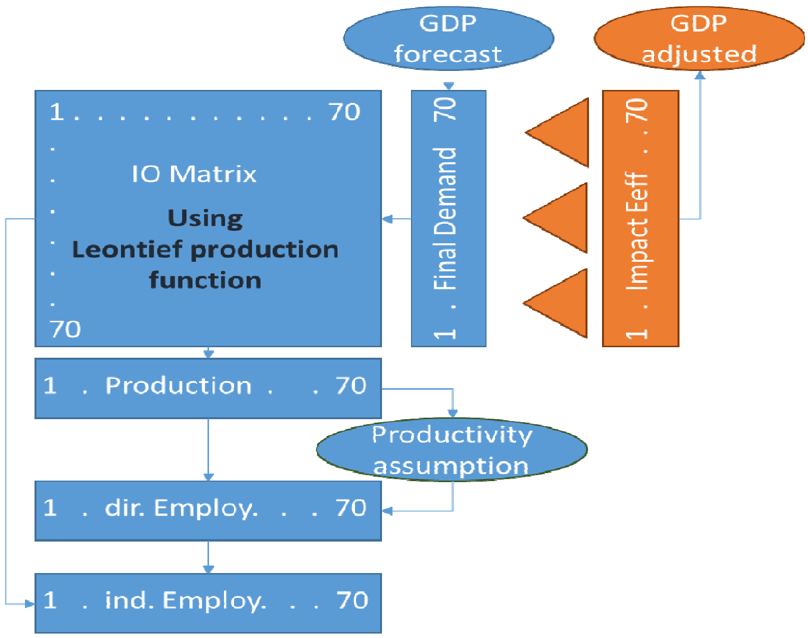
[1] $$y = (I - A)^{-1} \cdot fd$$

To model efficiency, one has to start one step earlier, because there is no such sector as an efficiency sector. It is a cross-cutting activity and we have to distribute additional final demand for energy efficient equipment to the respective sectors. The main effected sectors are the sector that produces electrical equipment, the construction sector, selected services and others. Savings from energy efficiency enter the above equation through changes in final demand. We assume that these saving enter a household's budget and will be spent following the same consumption pattern as consumption had before the savings occurred.

## 2.2 Constructing the static-dynamic IO-model for Israel

The main elements of the input-output based macro-economic model for Israel are shown in Figure 1. The blue shaded boxes illustrate the basic economic construction. The orange shaded boxes represent the inputs from the energy efficiency scenario and how they enter the model.

**Figure 1: Main elements of the model**




Source: own illustration

The model is constructed in a top-down manner. Top-down approaches are driven by the development of an aggregate quantity, such as GDP. The impacts of GDP development are then influencing the development on the sub-aggregate level. In the case of Israel, a GDP forecast from the literature (OECD 2015) is used to project the country's economic development to the future. Based on this growth path, GDP components, such as consumption, exports, imports or governmental consumption, grow according to their proportion. Structural information for 70 sectors is obtained from statistical information for each GDP component. In the projection, this structure remains constant. This means that the contribution of consumption to overall GDP remains constant over time. Also, the production structures remain constant. The domestic input-output table of Israel and the application of the Leontief production function are used to derive production by 70 sectors.

Sectoral employment is forecast by using sector specific production growth rates and by applying an overall productivity growth assumption. It is assumed that employment is positively correlated to production and that productivity grows.

Productivity is measured as output per worker or per workers hour. The higher this ratio is, the more productive a country is. If more output is generated with less workers, then everybody either has to work less to maintain the same level of wealth or can attain a higher level of wealth with the same amount of labor. Productivity increases in all countries over time, due to learning, technological progress or changes in production, such as scale and scope effects. However, the literature reveals that productivity growth in Israel is not as dynamic as it could be. Labor productivity in Israel is below the average of other developed countries (Ha'aretz 2012). The reasons are multiple. Ben David (2013) names the increasing shadow economy as well as poor human and capital infrastructure. Productivity growth in the last years was highest after the world financial crisis (with 3.7% in 2010), before the crisis and after 2010 it was around 3.1% per year. 2012 (-3.4%) is an statistical artefact from the update of labor statistics, which led to a sharp increase in the labor force data, and is not considered in the following. In the projection, we set labor productivity increase at 2.9% per annum.

Indirect employment is calculated by using an application of the Leontief multiplier. By multiplying (left-hand sided) the employment coefficient (*b*) with the Leontief inverse, production-induced indirect employment results.

[2] $$y = b * (I - A)^{-1}$$

Additional investment in energy efficiency measures directly adds to final demand in equation [1]. The degree to which final demand is affected depends on local content and imported quantities of more efficient appliances and equipment. Construction works, for instance, is typically domestic labor. The higher the share of imports in the relevant investment goods, the lower the impact on domestic employment and production.

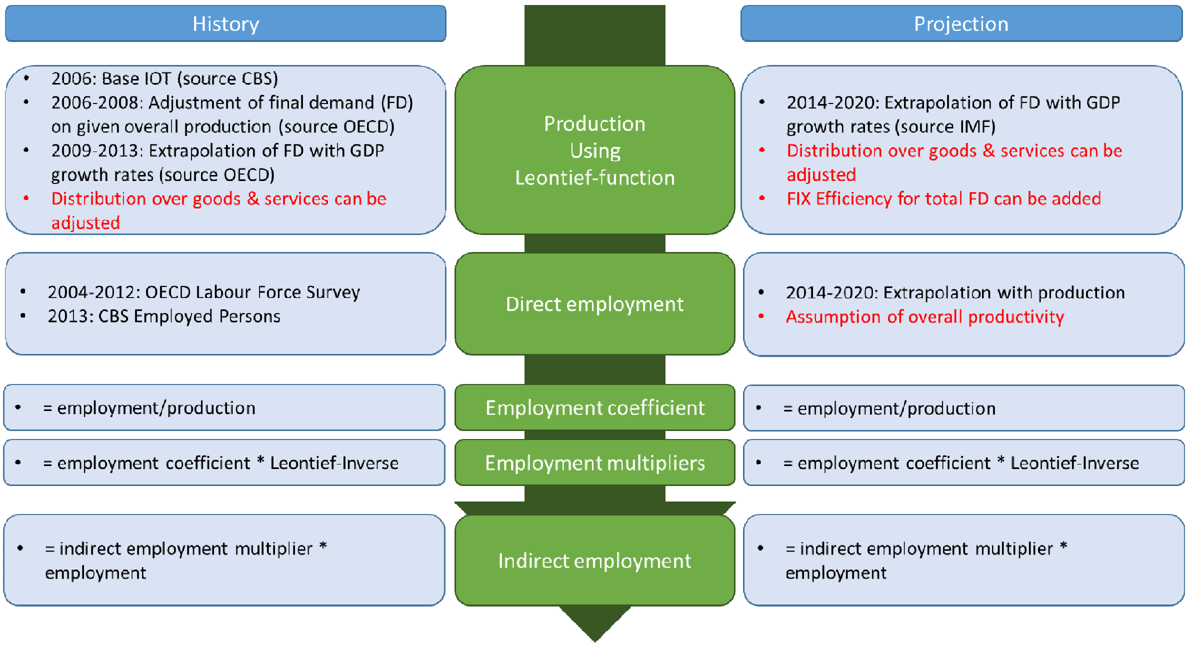
Based on the efficiency scenarios (see below for a detailed description), employment effects follow from the model as outlined above. Additional investment in energy efficiency can be sector-specific and each sector can be explicitly addressed.

According to the transmission mechanism described before, final demand positively determines production (directly and indirectly). Production influences labor demand, shifting the economy to a higher employment level. Again, employment demand is gauged with labor supply. A new level of unemployment results. Including efficiency investment, GDP is higher.

In

the detailed methodology with the database used is summarized. The graph shows the approach for the ex-post analysis on the left, which mainly has to construct the historical database and isolate the effects of additional energy efficiency. The procedure for the projection is shown on the right hand side of figure 2.

**Figure 2: Detailed methodology – summary and database**




Source : own illustration

Table 2 gives an overview of the dataset and the sources used for the model e3.isr. Some adjustments and assumptions were necessary to construct a complete and consistent database with time series for sectoral production and employment for the years 2006 to 2013.

First, the input-output table for 2006 had to be inverted in order to meet the requirements for solving the Leontief equation (equation [1]).

Next, employment data was disaggregated to match the IO table. The sectors of the IO table are given in Table 1.

**Table 1: Economic sectors in the IO table**

| | | | | | |
|---|---|---|---|---|---|
| Agriculture, hunting, forestry and fishing | Basic metals | Chemicals and chemical products | Electrical machinery and apparatus n.e.c | Post and telecommunications | Computer and related activities |
| Construction | Fabricated metal products except machinery and equipment | Rubber and plastics products | Motor vehicles, trailers and semi-trailers | Hotels and restaurants | Research and development |
| Food products, beverages and tobacco | Other non-metallic mineral products | Machinery and equipment n.e.c | Other transport equipment | Other Business Activities | Education |
| Mining and quarrying | Textiles, textile products, leather and footwear | Radio, television and communication equipment | Manufacturing n.e.c; recycling | Finance and insurance | Public admin. and defense; compulsory social security |
| Coke, refined petroleum products and nuclear fuel | Wood and products of wood and cork | Medical, precision and optical instruments | Wholesale and retail trade; repairs | Real estate activities | Health and social work |
| Electricity, gas and water supply | Pulp, paper, paper products, printing and publishing | Office, accounting and computing machinery | Transport and storage | Renting of machinery and equipment | Other community, social and personal services |

Source : own compilation.

Employment was denoted to each of the above sectors. Two different data sources were used: For the years 2006 to 2012, total employment was given by the OECD dataset on Employment by activities and status (ALFS). 2013 was provided by the CBS. Additionally, the CBS data source also provided the number of employed persons on very detailed level of industries. Starting from this very low aggregation level, the number of employed persons were aggregated according to the IO industry structure for 2013. In a next step, the employment structure from year 2013 was adapted to the years 2006 to 2012. By assuming a constant employment share, the time series of structural employment was constructed.

Further, total final demand had to be adjusted to overall production. This is often necessary in order to account for different revision status of data sources. By using the Leontief-function (see equation [1]), final demand was adjusted to the revised total production value given by the OECD STAN Database for Structural Analysis (Rev.3) for the years 2006-2008. Production values were not available for the subsequent years. Alternatively, GDP was used as a proxy to extrapolate production value until 2013. GDP was taken from the OECD database Total final demand was adjusted to the newly retrieved production value.

In terms of sectoral differentiation of total final demand, the current model assumes constant shares by industries. However, for scenario analysis, the industry shares can be altered.

**Table 2: Data summary**

| Description | Source | Dataset | Year | Unit | Price concept | Classifi-cation | Sectors |
|---|---|---|---|---|---|---|---|
| Employment | OECD | Employment by activities and status (ALFS) | 2004-2012 | Persons, thousand | - | ISIC Rev. 3 | 18 (ad-justed to 70) |
| Employment | CBS | Employed persons by indus-try | 2013 | Persons, thousand | - | ISIC Rev. 4 | Adjusted to 70 |
| Input Output table | CBS | | 2006 | Mill. NIS | Nominal | ISIC Rev. 4 | 70 |
| GDP fore-cast | IMF | World Economic Outlook Database April 2015 | 2014-2020 | Bill. NIS | Nominal | - | - |
| Population | OECD | Historical population data and projection (1950-—050) | 2004-2020 | Persons, thousand | - | - | Total, age 15-64 |
| Civilian Labour Force | OECD | ALFS Summary tables 2015 | 2004-2013 | Persons, thousand | - | - | - |
| Total pro-duction | OECD | STAN Database for Struc-tural Analysis | 2004-2008 | Mill. NIS | Nominal | ISIC Rev. 3 | Total |
| GDP | OECD | Gross domestic product | 2004-2013 | Mill. NIS | Nominal | - | Total |

Source : own compilation.

# 3 Scenarios

## 3.1 Baseline scenario

Extrapolation and projection until 2020 starts from 2014. The top-down approach requires a GDP growth stimulus which is taken from the IMF world economic database from April 2015. All other transmission channels as well as the assumptions explained above remain the same.

In the basic economic model, final demand is driven through GDP growth rate. The sectoral distribution remains constant. Adjustments can be implemented if necessary. Again, by using the Leontief production function with its constant input coefficients, sectoral production is retrieved. Indirect employment by 70 sectors is determined through multiplying employment coefficients with the Leontief inverse.

The development on the labor market is gauged with the population forecast for Israel from OECD. By assuming a constant participation rate (civilian labor force divided by population 15-64 years), labor supply is projected until 2020. The unemployment rate is unemployment, as the difference between total employment and total civilian labor force, divided by the labor force.

### 3.2 The scenarios for more energy efficiency

To estimate the impact of additional energy efficiency on Israel's economy, we developed a scenario for the economic drivers from efficiency measures. The main drivers are:

- Investment in more efficient appliances and buildings
- Savings from reduced energy consumption

Additional investment has positive effects on the economy through a variety of channels along the value chain of the efficiency technology[1].The main data were taken from the National Energy Efficiency Program – Reducing Electricity Consumption 2010 – 2020 (NEEP). The NEEP defines energy saving potentials for seven sectors and a cross-sector activity bundle. Savings, measures and technologies are specified for households, industry, the commercial and public sector, local authorities, a building program, the water sector, and agriculture. Total saving in electricity by 2020 is estimated at 25,066 million NIS (6.04 billion Euro) (NEEP p9). The largest share of saving is in the households sector with 47.2% of all savings, followed by commercial buildings and the public sector and the industrial sector.

The main driver for employment from the energy efficiency plan is the investment in new appliances, better buildings or more efficient processes. To develop consistent sector-specific scenarios for the estimate of employment from efficiency measures, we need to determine the share of imports and domestic production among these measures, the share of whole sale trading, and the share of installation works within each measure. Employment, as described above, stems from domestic activities. Imported goods create employment in the respective industries abroad. Discussions with Israeli Experts led to estimates of the shares of domestic production triggered by investment in the respective sectors.

Most households in Israel own a refrigerator (100%), a washing machine (96%), a stove (92%) and a TV (88%)[2] (2013). 86.6% of all homes are air conditioned with a rising tendency; the NEEP expects 1.5% growth per year. Dryers and dishwasher, too, will exhibit growth rates, the former 0.5%; the latter 2.0% per year. Total investment of households in efficient technologies has been more than 250 million NIS in 2012 and 2013. From then, it stabilizes

---

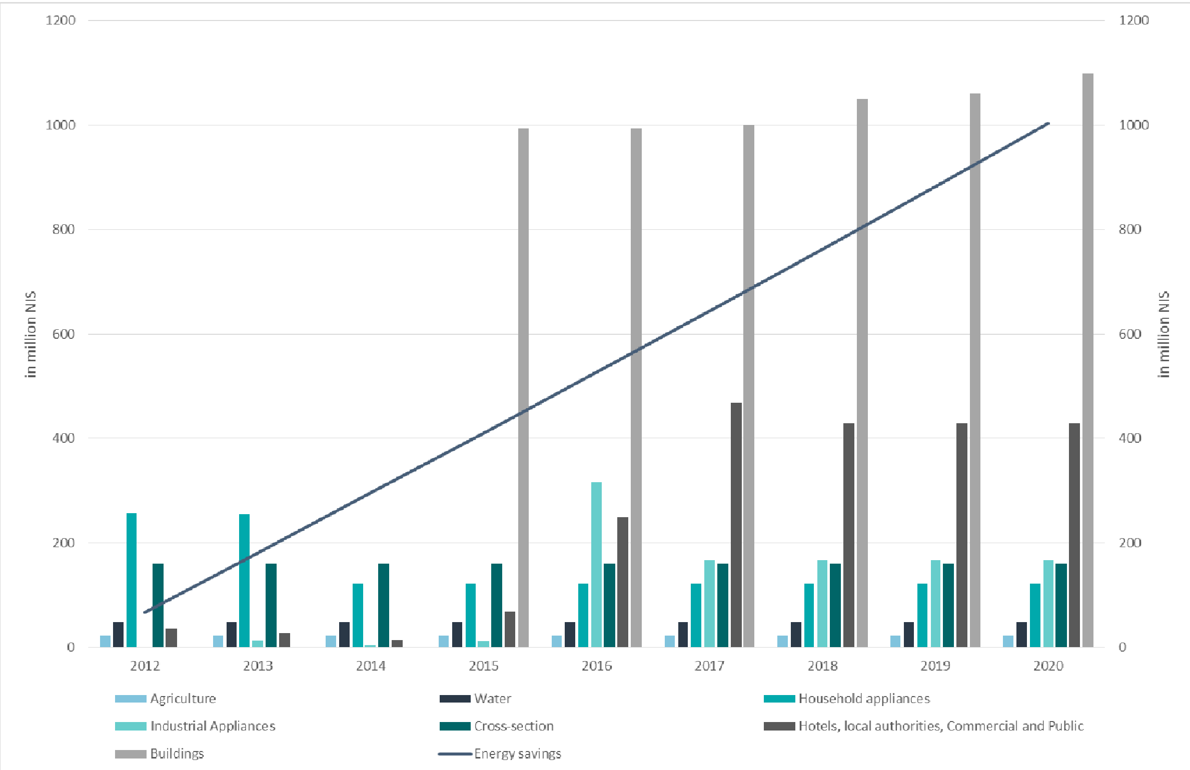
[1] In the following we call any efficiency increasing measure an efficiency technology, be it insulation of buildings or less consuming A/Cs etc.

[2] http://cbs.gov.il/publications15/1613/pdf/t21.pdf; Central Bureau of Statistics web site

around 120 million NIS. From this amount mostly whole sale activities and installation translates into employment. Israeli production of efficient household devices is only 5% of final demand. Therefore the total demand impact on the different sectors (electrical appliances; retail and wholesale) yields close to 90 million in the past and almost 43 million NIS annually until 2020 in the future.

The same holds true for electrical appliances used in industry, hotels, public buildings etc. only regarding installation and sales, this gives a small additional demand of 20 – 40 million NIS per year. The largest single impact comes from additional investment in houses, here we have a domestic additional demand of close to 1 billion NIS each year (NEEP). Including agriculture, the water sector and cross-sectional activities, we find the impact from additional demand triggered by investment of more than 2.5 billion NIS.

**Figure 3: Annual Investment and Accumulated Savings in Million NIS**




Source: NEEP and own calculation.

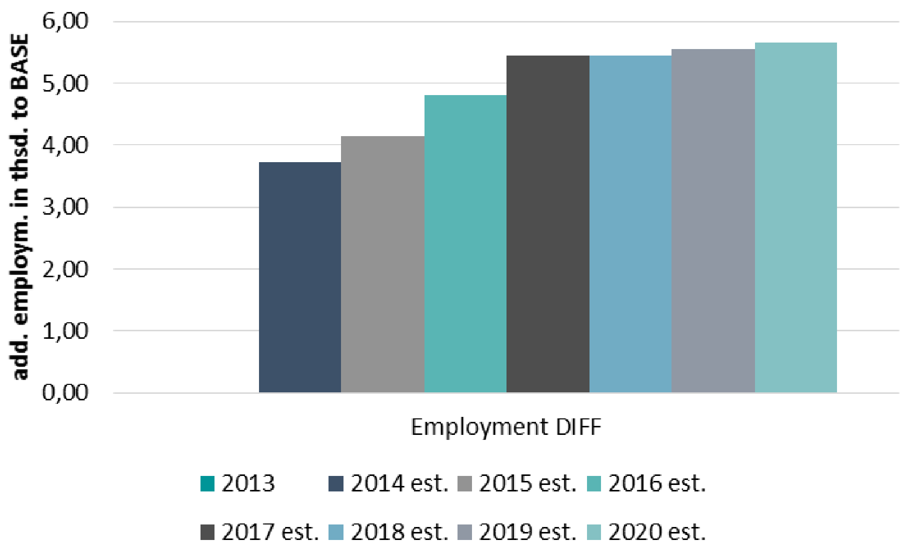
Figure 3 gives an overview of the expected investment and savings from the additional energy efficiency. Investment in household appliances has been high in the past, but slows down in the future. Investment to increase the energy efficiency in private buildings carries the largest weight, followed by investment in efficiency in hotels, office space, public buildings etc. Industrial appliances and cross-sectional activities contribute to the investment to a larger degree than the activities in the water sector and the agricultural sector. Savings accumulate over time (line in figure 3), because investment in the past leads to annual savings in the following years.

# 4 Results

## 4.1 The Efficiency Scenario

With the above assumptions (5% of all appliances domestically produced, sales 10% of price tag, installation 20% of price tag) additional efficiency measures lead to a plus of 5,200 people in 2015. Productivity gains are bringing the jobs/ million NIS spent a little bit down, but investment picks up towards 2020 and savings from energy efficiency cumulate, therefore, by 2020, jobs from energy efficiency amount to almost 5,645 by 2020. Figure 4 shows the results for all years.

**Figure 4: Additional employment from efficiency increases compared to a baseline (1000)**

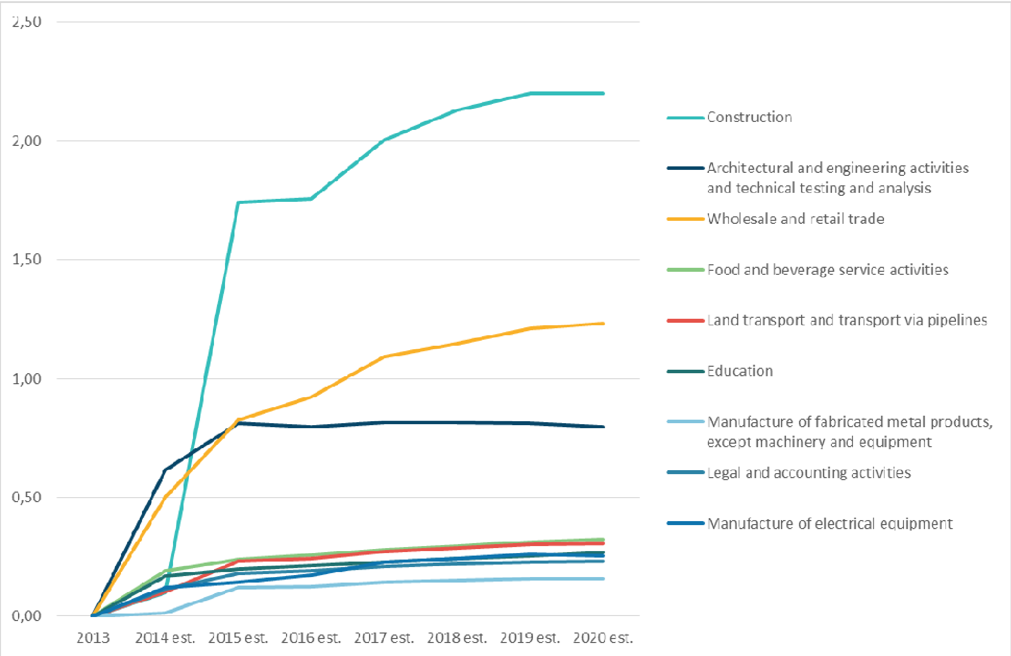



Source: Own calculation.

Figure 5 looks into the economic structure and shows the ten highest employment effects on an industry level. The largest effect is in the construction sector. In 2015, 40% of efficiency-induced employment gains are located in the construction sector alone. That is around 1,700 people. By 2020, the additional employment effect is reduced to 1,500 persons, mostly due to productivity gains. The second largest employment effect takes place in the sector of architectural and engineering activities which is closely related to the construction sector. This sector provides inputs to construction in terms of design and planning. In terms of energy efficiency, one may think about specialized services for the right design for an energy efficient building. The architectural and engineering sector accounts for roughly 20% of additional employment which equals in 2015 a plus of 800 employed persons. Unlike to the construction sector, the employment effects here start earlier (2014) and keep increasing a year longer as well. This effect is due to preliminary planning tasks for construction work performed in this sector. The planning of energy efficient buildings is crucial for the success of the actual energy savings later on. In terms of qualifications, specialists are needed, which might require special training. The quality of the construction work affects the quality of the living conditions in the building afterwards. The list of faulty construction, with airtight rooms leading to the development of mold, thermal bridges causing losses etc. is endless.

Additional to these two building related sectors, the wholesale and retail trade sector exhibits additional employment of 360 persons in 2015. The positive employment effects due to efficiency measures in this sector result on the one hand from additional private consumption due to energy savings. On the other hand, the effects are induced by an additional demand for trade services such as the import of efficiency technology etc. In total, 67% of additional employment demand is concentrated in these three sectors. Other positively affected sectors are the transport sector and the legal and accounting sector. Also the manufacturing sector is positively affected but to a much lower extent: Fabricated metal products, electrical equipment and basic metals are those sectors that also need additional employment to meet the demand for more energy efficiency technology.

**Figure 5: Top-10 industries with highest employment effects**

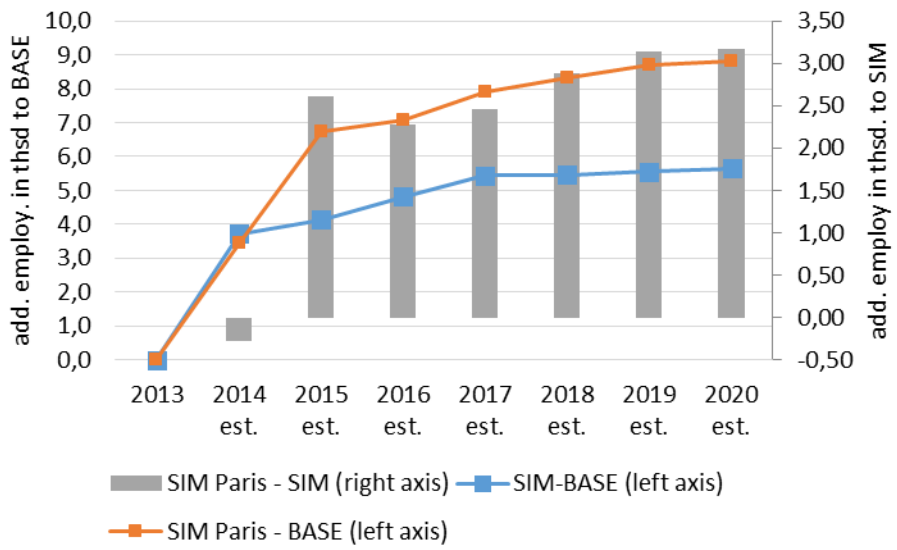


Source: Own calculation.

## 4.2 Post-Paris – Post-COP21 scenario

After the agreements reached in COP21 in Paris in December 2015, several countries reacted with new plans concerning the reduction of GHG emissions. From the Israeli Authorities, a rough outline of the new plans is already known, while details remain to be decided. To simulate the effects of the additional investment planned by the Israeli Government, we assume in the following, that additional investment will go to all purposes except households and will exhibit a similar structure as before. The results are a remarkable 3.2 thousand jobs. Figure 6 compares the development of the two simulations to the baseline and to each other.. Employment picks up visibly after 2018, because additional savings from investment in 2017 reinforce the effect.

**Figure 6: Employment effects generated by the Post Paris investment path**



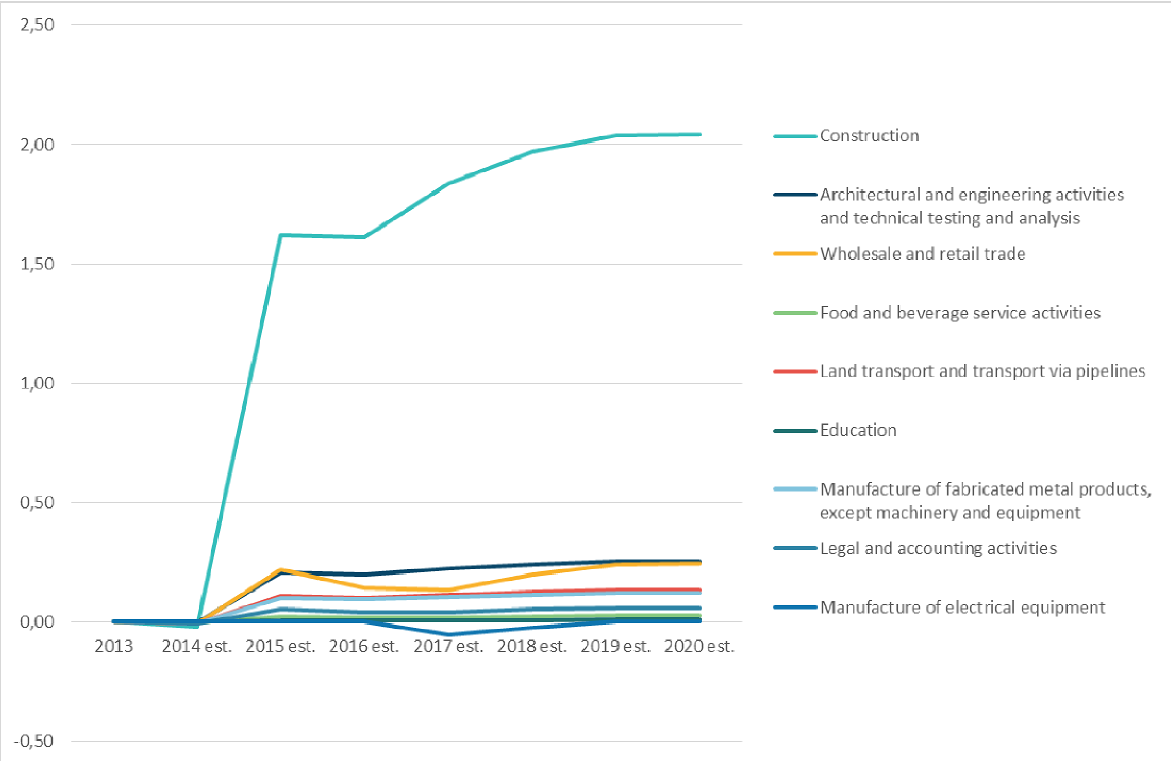

Source: Own calculation

The distribution over the most relevant sectors differs slightly from the NEEP simulation, because the Post-Paris scenario has a large emphasis on industrial energy efficiency as well as on an increase in public building, hotels etc.

The figure shows a comparison for the sectors with highest employment increase between the NEEP scenario and the Post Paris scenario. Since appliances for households are not funded in the Post Paris Scenario and households go back to the replacement cycle for the investment into efficient appliances, the impact on the sector which produces these appliances in the first years of the scenario is lower.

While household appliances have been partly manufactured in Israel, industrial equipment is largely imported.. Construction remains the sector which carries the largest impact, followed by architectural services need for the energy efficient building and retrofit.

**Figure 7: Top-10 industries with highest employment effects in the Post Paris scenario (in 1000 people)**




Source: Own calculation

## 5 Summary and Key Recommendations

Energy efficiency is often called the least expensive form of energy, and for sure it is among the least environmental harmful. Investing in energy efficiency saves resources, avoids THG emissions and at least currently in most countries of the world, it lowers the dependence on fossil fuels. Therefore, investment in the energy efficiency measures foreseen in the National Energy Efficiency Plan in Israel will benefit the environment and the consumers. In the above analysis, a tool has been developed to explore further benefits in terms of economic effects and employment.

It turns out that the effects seem rather small. How do they compare to case studies from other countries? Results with a similar modelling approach have been obtained for increased efficiency in Germany and for gains from the Tunisian Solar Plan. The latter comprises, as the name indicates, renewable energy expansion plans in addition to the increase of efficiency.

The increase in energy efficiency has been modeled for Germany in Pehnt et al. 2011, Lutz et al. (2011) and Lehr et al. (2011). Further, a forthcoming study for the German Environmental Protection Agency (Lehr et al. 2016) developed a scenario for the transition to a more efficient world in Germany.

The latter finds up to 220.000 people working towards that goal. Germany has a population of more than 82 million and a labor force of more than 40 million. 0.55% of the workforce work towards making Germany more efficient. How does that compare to the results presented above? Israel has a population of roughly 8 million people, i.e. one-tenth of Germany. The employment effect of energy efficiency therefore is only around 0.1% of the work force, although labor productivity in Israel is lower with $36.7 per working hour in Israel as opposed to more than $60 per working hour in Germany. In the sectors concerned with energy efficiency, however, productivity is roughly the same. Per capita spending in Germany on energy efficiency is 5 times higher than in Israel. This explains the higher number of jobs created from energy efficiency.

Tunisia, on the other hand, has a lower productivity than the countries compared above. In terms of GDP per capita, the three countries rank roughly 4:3:1 (Germany: Israel: Tunisia). With total investment of the equivalent of 500 million Euro, more than 7,000 jobs are created. The difference is mainly driven by lower productivity. Almost half of the jobs stem from efficiency measures, the other half of investment goes to renewable energy technologies.

Looking at the measures in the three case studies, we find that the construction sector is dominant in all three countries. In Israel and Tunisia, energy needs for cooling are lowered by improving buildings and reducing thermal loss; Germany tries to reduce the need for heating during winter time. The main fields for increasing efficiency activities are similar in all three countries, water and agriculture are included neither in Germany nor in Tunisia.

Energy efficiency often does not receive the attention it deserves, because it is associated with saving, thriftiness and consumers are afraid to have to give up the well-deserved comfort. However, today energy efficiency comes with high tech applications and modern technologies, such as smart homes, where the house reacts to the needs of the inhabitant instead of wasting energy. The Government of Israel reacted to the COP 21 results by pledging more funds to energy efficiency. If the high-tech appliances needed to fulfill this pledge were made in the country, more additional employment could be found in high-tech sectors.

## References

OECD (2015): Economic Outlook No. 96 – November 2014. OECD Annual Projection.

OECD/IEA (2014): Capturing the Multiple Benefits of Energy Efficiency.

IEA-RETD (2013): EMPLOY, Study commissioned by IEA-RETD, prepared by Barbara Breitschopf and Carsten Nathani.

Ha'aretz (2012): OECD: Israelis Work More, but Less Productive Than Workers in Other Developed Countries, by Hila Weisberg, 12.August, 2012, (accessed 11.12.2015)

Lutz, C., Lehr, U. & Pehnt, M. (2012): Volkswirtschaftliche Effekte der Energiewende: Erneuerbare Energien und Energieeffizienz. Osnabrück, Heidelberg.

Lehr, U., Lutz, C., Pehnt, M., Lambrecht, U., Seefeldt, F., Schlomann, B. & Fleiter, T. (2011): 20% by 2020? Economy-wide impacts of energy efficiency improvement in Germany. GWS Discussion Paper 11/2, Osnabrück.

Pehnt, M., Schlomann, B., Seefeldt, F., Wenzel, B., Lutz, C., Arens, M., Duscha, M., Eichhammer, W., Fleiter, T., Gerspacher, A., Idrissova, F., Jessing, D., Jochem, E., Kutzner, F., Lambrecht, U., Lehr, U., Paar, A., Reitze, F., Thamling, N., Toro, F., Vogt & Wünsch, M. (2011): Energieeffizienz: Potenziale, volkswirtschaftliche Effekte und innovative Handlungs- und Förderfelder für die Nationale Klimaschutzinitiative. [zitiert als Ifeu, Fraunhofer ISI, Prognos & GWS (2011)] Endbericht des Projektes „Wissenschaftliche Begleitforschung zu übergreifenden technischen, ökologischen, ökonomischen und strategischen Aspekten des nationalen Teils der Klimaschutzinitiative“, Heidelberg, Karlsruhe, Berlin, Osnabrück, Freiburg.