Impact of the upcoming energy efficiency standards and labelling programme on local manufacturers and suppliers of home appliances in Jordan

United Nations Development Programme (UNDP)
National Energy Research Centre (NERC)
Global Environment Facility (GEF)

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Abbreviations

AC	Air conditioner
ARRA	American Reinvestment and Recovery Act
BAU	Business as usual
BLY	Bachat Lamp Yojna
BOCM	Bilateral Offset Credit Mechanism
CAPEX	Capital expenditure
CDM	Clean Development Mechanism
CDM EB	Clean Development Mechanism Executive Board
CEEF	Central & Eastern Europe Fund
CEEP	Chiller Energy Efficiency Project
CER	Certified Emission Reduction
CFC	Chlorofluorocarbon
CFI	Commercial financial institution
CFL	Compact fluorescent lamp
DC	Direct current
DISCOM	Distribution company
DOS	Department of Statistics
EBRD	European Bank for Reconstruction and Development
EC	Energy conservation
EE	Energy efficiency
EESL	Energy Efficiency Standards and Labelling
ESCo	Energy Service Company
ETS	Emissions Trading Scheme
EU	European Union
GEF	Global Environment Facility
GHG	Greenhouse gas
HCST	Higher Council for Science and Technology
HH	Household
IEA	International Energy Agency
IECC	International Energy Conservation Code
IFC	International Finance Corporation
IFI	International financial institution
IPCC	Intergovernmental Panel on Climate Change
IRR	Internal rate of return
JEDCO	Jordan Enterprise Development Corporation
JRC	Joint Research Centre

JREEF	Jordan Renewable Energy and Energy Efficiency Fund
JSMO	Jordan Standards and Metrology Organization
JUMP	Jordan Upgrading and Modernization Fund
MAC	Marginal abatement cost
MACC	Marginal abatement cost curve
MENA	Middle East and North Africa
MEPS	Minimum Energy Performance Standard
NAMA	Nationally Appropriate Mitigation Action
NEPCO	National Electric Power Company
NERC	National Energy Research Centre
NGO	Non-governmental organization
NPV	Net present value
PUF	Polyurethane foam
S&L	Standards and Labelling
SDTC	Sustainable Development Tax Credit
SEAD	Super-efficient Equipment and Appliance Deployment
SME	Small or medium enterprise
SSC-PoA	Small-scale Programme of Activities (CDM)
SWOT	Strengths, Weaknesses, Opportunities and Threats
tCO_2e	Tonnes of carbon dioxide equivalent
UNDP	United Nations Development Programme
USAID	United States Agency for International Development
VAT	Value-Added Tax
WBI	World Bank Institute

Glossary of terms

Appliance	A device designed to perform a specific task, typically in a domestic setting.
Business as usual	The assumption that future trends in the home appliances market, and by extension current carbon emissions levels, follow the precedent set in the past and no change of policies will take place. The trajectory of the home appliances market, measured by characteristics such as annual sales, electricity consumption and greenhouse gas emissions that would prevail in the absence of project-related interventions.
Clean Development Mechanism	A scheme that enables developed countries and companies to obtain carbon credits by investing in greenhouse gas emission reduction or removal projects in developing countries. These credits can be used to offset emissions and bring a country or company below its mandatory target.
Eco-Design	An approach to the design of products that accords special attention to the environmental impacts of products during their entire lifecycles.
Energy Conservation	Reducing energy through using less of an energy service. It differs from efficient energy use, which means using less energy for a constant service. For example, switching off lights is an example of energy conservation, whereas a low energy-consuming lighting appliance is an example of energy efficiency. Energy conservation and efficiency are both energy reduction techniques.
Energy Efficiency	Using less energy to provide the same output/service.
Energy Efficiency Class	The energy efficiency of an appliance is rated in terms of a set of energy efficiency classes. For example, under the EU labelling scheme for washing machines, energy efficiency classes range from A+++ to D, with A+++ being the most energy efficient and D the least.
Energy Efficiency Ratio	A measure of the relative efficiency of a heating or cooling appliance, such as an air conditioner, that is equal to the unit's output in watts divided by its consumption of energy, measured in watts. The EER of an air conditioner, for instance, is defined as watts (cooling) / watts (electrical).
Energy Security	A term for an association between national security and the availability of natural resources for energy consumption.
Energy Efficiency Standards & Labelling (EE S&L)	EE S&L are key mechanisms to promote energy efficiency, especially in relation to household appliances, lighting products, vehicles and other mass-produced consumer and commercial energy-using equipment. They can also play an important role in making consumers aware of the importance of energy efficiency. By definition, energy efficiency standards and labels (EE S&L) are sets of procedures and regulations that, respectively, prescribe the minimum energy performance of manufactured products (energy efficiency standards) and the informative labels on these products indicating their energy performance (labelling).
Energy Performance	The amount of energy that is consumed by a product in performing a specified task.
Emissions Trading Scheme	A framework for facilitating the trading of emissions permits between businesses and countries as part of a cap and trade approach to limiting greenhouse gas emissions.
Internal rate of return	The discount rate often used in capital budgeting that makes the net present value of all cash flows from a particular project equal to zero. Generally speaking, the higher a

	project's internal rate of return, the more desirable it is to undertake the project.
Label	Labels are useful for conveying visual information about EE standards to customers and providing information about a product's energy performance.
Marginal abatement cost curve (MACC)	Displays the cost of a set of options available to reduce greenhouse gas emissions or other pollution.
Minimum energy performance standard (MEPS)	An energy performance benchmark that a product must meet or exceed before it can be sold to consumers.
Net Present Value (NPV)	The economic value of an investment, expressed in terms of the discounted net cash flows generated by the investment over a defined period of time.
Primary fuel	An energy source found in nature and which has not been subjected to any conversion or transformation process. Examples include wood, coal and natural gas.
Standard	Two different meanings of "standard" are involved in an EE S&L programme. The first refers to "testing standards": these are standards that determine the energy consumption of an appliance under defined conditions (in a test laboratory). The second meaning refers to target limits on energy performance. These standards define minimum energy efficiency or maximum energy use limits for appliances, based on a specified test protocol.
Subsidy	A benefit given by the government to groups or individuals, usually in the form of a cash payment or tax reduction. The subsidy is typically given to remove some type of burden and is often considered to be in the public interest.
SWOT	A tool that identifies the **s**trengths, **w**eaknesses, **o**pportunities and **t**hreats of a project or organization.
Technology	The application of knowledge to production. It comprises processes (organizational and management practices and production processes), knowledge (tacit and codified) and products and machines (physical equipment and artifacts). Processes and knowledge are sometimes referred to as "software" and products and machines as "hardware".
Transition period	Under the context of the current study, transition period means the time given by government to manufacturers and suppliers of home appliances. It is the time between government ratification of an S&L scheme (standards and labels are set for adoption) and the mandatory implementation of the S&L programme (no appliances without an energy label can be sold).
Value Added tax	A tax on the estimated market value added to a product or material at each stage of its manufacture or distribution.
White goods	Household appliances such as refrigerators and washing machines.

Executive summary

1.0 Background

Electricity in Jordan is generated primarily (around 80%)[1] from natural gas imported from Egypt and from oil imported primarily from Iraq and the Kingdom of Saudi Arabia. Driven by socio-economic development in Jordan, electricity consumption is increasing at a rate of approximately 5% per annum.[2] This growth trend, coupled with high reliance on imported energy, is putting sustained pressure on the energy security of Jordan.

To improve energy security, the Government of Jordan has taken concerted actions to enhance energy utilization efficiency without simultaneously compromising economic growth. The introduction of energy efficiency standards and labelling (S&L) for home appliances is one such action. The introduction of standards and labels is expected to increase the share of energy-efficient appliances in the Jordanian market, resulting in significant benefits:

1. Increased energy security by reducing the demand for imported primary fuel for electricity generation.
2. Annual cost savings for the Government of Jordan (through avoided capacity additions for electricity generation).
3. Augmented investment in the manufacture of energy efficient appliances.
4. Reduction in Jordan's greenhouse gas (GHG) intensity (i.e. tonnes of CO_2 emitted per $GDP).

Supported by the United Nations Development Programme (UNDP) and the Global Environment Facility (GEF), the Jordan Standards and Metrology Organization (JSMO) has been entrusted with the responsibility of developing the S&L scheme for the country. The draft scheme prepared by JSMO is closely aligned with the European Union's (EU's) S&L scheme.

A key criterion for a successful S&L programme is to ensure that local manufacturers and suppliers[3] are ready and capable of supplying/servicing energy efficient appliances (with appropriate labels) in the market. The current study has been commissioned to assess the operational and financial impact of the proposed S&L programme on manufacturers and suppliers.

The major deliverables of the study are:

a. An assessment of the energy efficiency performance level of appliances currently sold in the Jordanian market compared with the upcoming S&L regulations.
b. The development of a marginal abatement cost curve for energy efficient appliances.
c. An assessment of operational and financial impacts on local manufacturers and suppliers.
d. Recommendations for local manufacturers and suppliers to overcome identified barriers.

The study covers manufacturers and suppliers of appliances deemed to have the highest shares of electricity consumption arising from home appliances (air conditioners, freezers, refrigerators and washing machines) sold in the Jordanian market.

Primary research, consultation with relevant stakeholders through interviews, workshops and secondary analysis have formed integral elements of the study. The results obtained from primary research have been thoroughly cross-checked through secondary data analysis.

2.0 Key findings

[1] Annual report 2011, NEPCO.
[2] NEPCO: Year 2011 figures.
[3] Suppliers: includes suppliers and importers of home appliances.

Jordan is in an advantageous position to roll out the S&L programme with minimal domestic impact, as most of the appliances sold in the Jordanian market are imported (~80%) and can adapt to new energy efficiency standards with relative ease. However, local manufacturers will have to undertake certain changes in product design, assembly line configuration and supply chains. Additionally, local manufacturers will require support in terms of the availability of facilities for testing the energy efficiency ratings of their appliances.

Estimated market share of locally manufactured appliances

Through stakeholder discussion, it is estimated that local brands manufactured in Jordan account for approximately 20% of the market. The remaining 80% of Jordan's home appliance market is supplied by imported brands.

Energy performance level of appliances compared with upcoming energy efficiency regulations

The draft S&L standards published by JSMO broadly follow EU S&L standards (of 2012). To assess the energy efficiency performance of appliances available in Jordan, they were compared to the EU S&L standards.

Primary research reveals wide variations in energy efficiency performance across the range of models available (when compared against the EU S&L standards)[4] in the Jordanian market. Imported appliances sold by multinational brands are, in general, more energy efficient than locally-manufactured appliances.

For most imported products, the energy efficiency class varies between "C" and "A+++", whereas locally-manufactured appliances can be categorized between "E" and 'A". If class "A" is considered to be the minimum energy performance standard (MEPS), most of the current locally-manufactured appliances in Jordan will not meet this requirement. The energy classes and corresponding energy consumption of each appliance are listed in Annex VIII.

Transition period

The Jordanian home appliance S&L scheme has been drafted, building on progressively more detailed communications with local manufacturers since 2012. Introduction of the scheme is expected in mid-2014. Local manufacturers have expressed some concerns about the imminence of this introduction, though international experience suggests that the informational lead-time that has been provided should serve to facilitate rapid business adaptation and compliance with the new standards.

Expected market response to S&L programme

Accurate prediction of future market response to the S&L programme is challenging and depends on qualitative as well as quantitative considerations. However, a consumer survey on energy efficient home appliances conducted by NERC[5] provides an indication on the probable market response. Around 41% of the total respondents declared their unwillingness to buy energy efficient (EE) appliances in the future. Price seems to be the main obstacle that deters consumers from switching to EE technology, and this is specifically mentioned as a barrier by 47% of the respondents.

Although immediate incremental cost seems to be a barrier, the marginal abatement cost curve (MACC) analysis shows that all energy efficient appliances pay for themselves over their life-cycles. The average payback period varies between appliances: air conditioning (AC) has an average payback period of 1-2 years; refrigerators around 3 years; and freezers and washing machines 4-6 years.

Household appliance energy level consumption and expected savings through the S&L programme

[4] Under the EU labelling scheme, rating of the energy efficiency of a labelled appliance is based on a set of energy-efficiency classes from A+++ to G on the labels, with A+++ being the most energy efficient and G the least efficient. However, for some appliances the rating is from A+++ to D and for others from A to G.

[5] Survey of Consumer Behaviour and Preferences Regarding Energy Efficiency Home Appliances - Consolidated Report "Survey Results – National Level" 2012: NERC.

The household sector is the single-largest electricity consumer in Jordan, with a 41% share of total electricity consumption[6]. The four appliances (ACs, freezers, refrigerators and washing machines) considered for this study contribute to almost three-quarters (73%) of total residential sector electricity consumption.[7]

If class "A" rated appliances were to replace all of the class "D" rated appliances in use, the estimated energy savings by 2028 would be around 1,200 GWh. This would result in a 32% reduction in energy consumption (kWh) and greenhouse gas (GHG) emissions compared with the BAU scenario[8] by 2028.

If class "A+" rated appliances were to replace all of the class "D" rated appliances in use, the estimated energy savings by 2028 would be about 1,600 GWh. This would result in a 39% reduction of energy consumption (kWh) and GHG emissions when compared with the BAU scenario by 2028.

3.0 Marginal Abatement Cost Curves (MACCs)

Marginal abatement cost curves (MACCs) are used in this study to assess the level of energy savings and GHG mitigation which a range of initiatives under the S&L programme would deliver at a given point in time, against a projected business-as-usual baseline level of electricity consumption.

3.1 MACC: Energy savings

A MACC can show how much electricity (in MWh) each appliance standard and label could save and the associated cost per MWh of electricity. Each measure is represented by a single bar on the MACC.

- The width of the bar represents the amount of abatement potential available from each S&L measure (in MWh/year). The total width of the MACC shows the total electricity savings available from all S&L measures.
- The height of the bar represents the unit cost of the S&L measure (the cost per MWh saved). S&L measures are ranked according to their unit cost. More cost-effective measures are on the left hand side and below the horizontal axis; these measures save money as well as electricity (for example, more efficient refrigerators). More expensive measures are provided on the right-hand side of the MACC. To assess which measures are available up to a given unit cost, a horizontal line can be drawn across the MACC to see which measures lie under this line.
- The area (height × width) of the bar represents the total cost of the S&L initiative: i.e. how much it would cost in total to deliver all of the electricity savings (MWh) from the S&L measure (or, for measures below the horizontal axis, how much money would be saved if all the electricity savings are achieved). The sum of the areas of all the bars in the MACC represents the total resource cost to deliver the total electricity saving (MWh) opportunities.

The MACCs presented here for appliance-level energy efficiency show *technical* electricity savings potential for the entire local appliance market. Two scenarios are considered for developing the MACCs.

Scenario 1: All appliances shift from energy efficiency class "D" to "A"
Scenario 2: All appliances shift from energy efficiency class "D" to "A+"

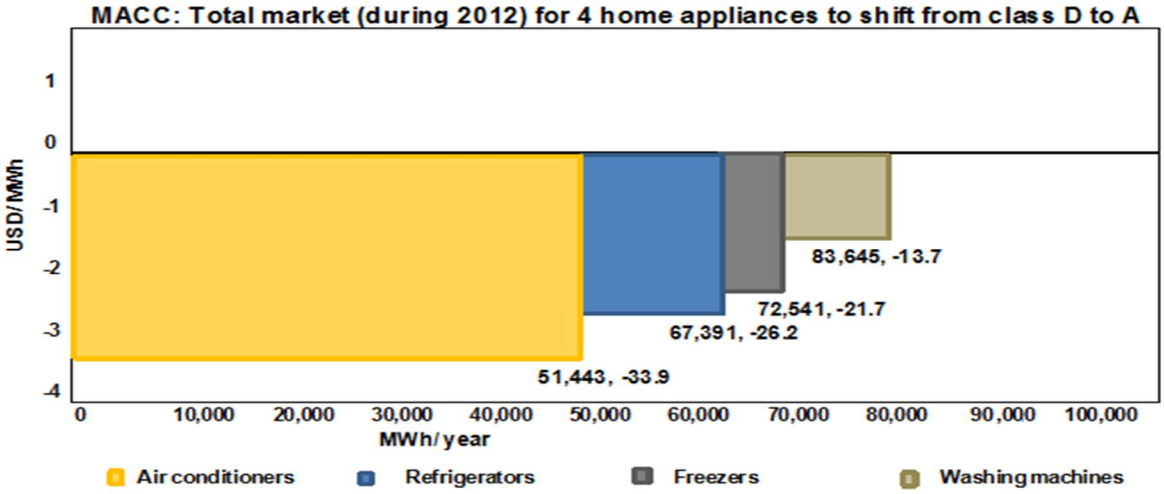
The entire Jordanian Local Market (LM) is considered for these two cases. The MACCs are presented below:

Scenario 1: All appliances shift from energy efficiency class "D" to "A"
For ACs and refrigerators, the marginal abatement cost (US$/MWh) is -$33.92/MWh and -$26.15/MWh, respectively. A negative MACC means that the measures are self-financing: cost savings of $33.92/MWh and $26.15/MWh are generated annually for ACs and refrigerators respectively, and both offer

[6] NEPCO 2011, http://www.dos.gov.jo/dos_home_a/main/cd_yb2011/pdf/Electricity.pdf.
[7] Please refer to Annex VI for detailed calculations.
[8] BAU: without implementation of MEPS.

favourable returns on investment.[9] The energy-saving potential of freezers and washing machines is relatively low, but their marginal abatement costs are nonetheless negative. These measures are therefore also self-financing (from the consumer's perspective), though less financially attractive.

Figure 1: MACC for scenario 1 - Electricity savings and associated cost

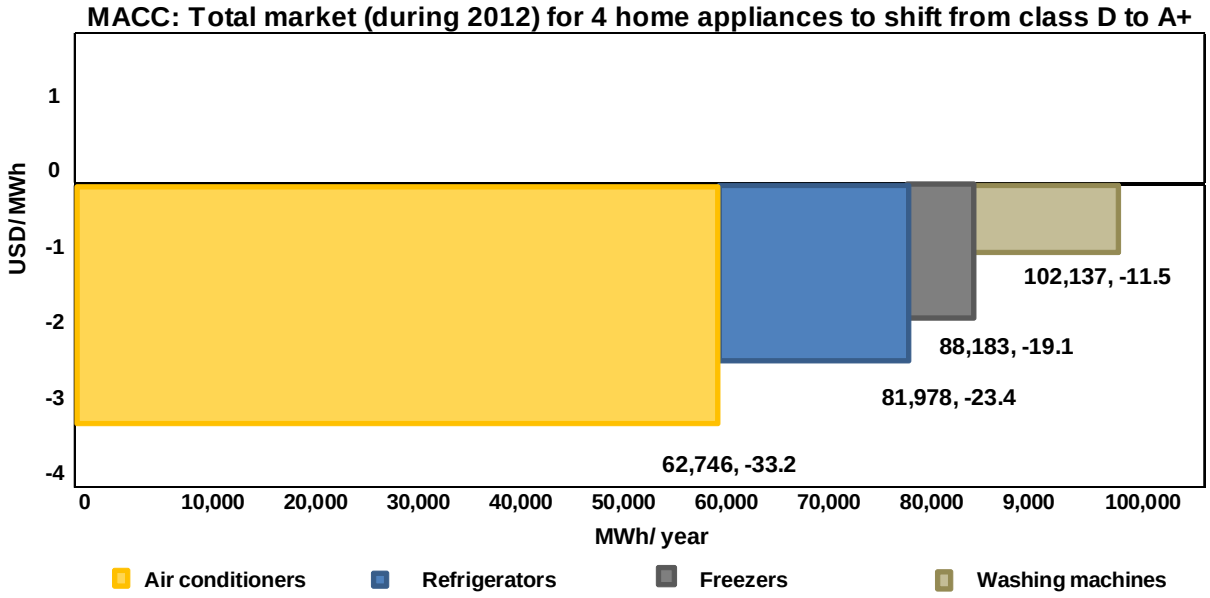


The total area enclosed by each rectangle indicates the total saving in monetary terms that can be achieved by a particular appliance by shifting from the "D" to the "A" category. For example, an energy efficiency shift for air conditioner units from the "D" to "A" category would enable a saving of $1.7 million every year. For all four appliances together, the total saving would amount to $2.4 million for 2012 alone. If we take the lifetimes of the appliances into consideration, the total savings would amount to $34.3 million.

Scenario 2: All appliances shift from energy efficiency class "D" to "A+"

For ACs and refrigerators, the marginal abatement cost is -$33.15/MWh and -$23.44/MWh, respectively. A negative MAC means that the measures are self-financing: cost savings of $33.15/MWh and $23.44/MWh are generated annually for ACs and refrigerators respectively. The energy saving potential of freezers and washing machines is again relatively lower, but their marginal abatement costs are negative.

Figure 2: MACC for scenario 2 - Electricity savings and associated cost



[9] Estimated life span for AC, refrigerator, freezers and washing machines are 10 years, 10 years, 15 years and 15 years respectively.

The total area enclosed by each rectangle indicates the total saving in monetary terms that can be achieved by a particular appliance by shifting from the "D" to the "A+" category. For example, an energy efficiency shift for air conditioner units from the "D" to "A+" category would enable a saving of $2.1 million every year. For all four appliances together, the total saving would amount to $2.8 million for 2012 alone. If we take the lifetimes of the appliances into consideration, the total savings would amount to $39.9 million.

Though immediate incremental cost seems to be a barrier, analysis using marginal abatement cost curves (MACCs) shows that all energy efficient appliances pay for themselves over their lifetimes. The average payback period varies between appliances: AC has an average payback period of 1-2 years; refrigerators around 3 years; and freezers and washing machines 4-6 years.

3.2 MACC: GHG abatement

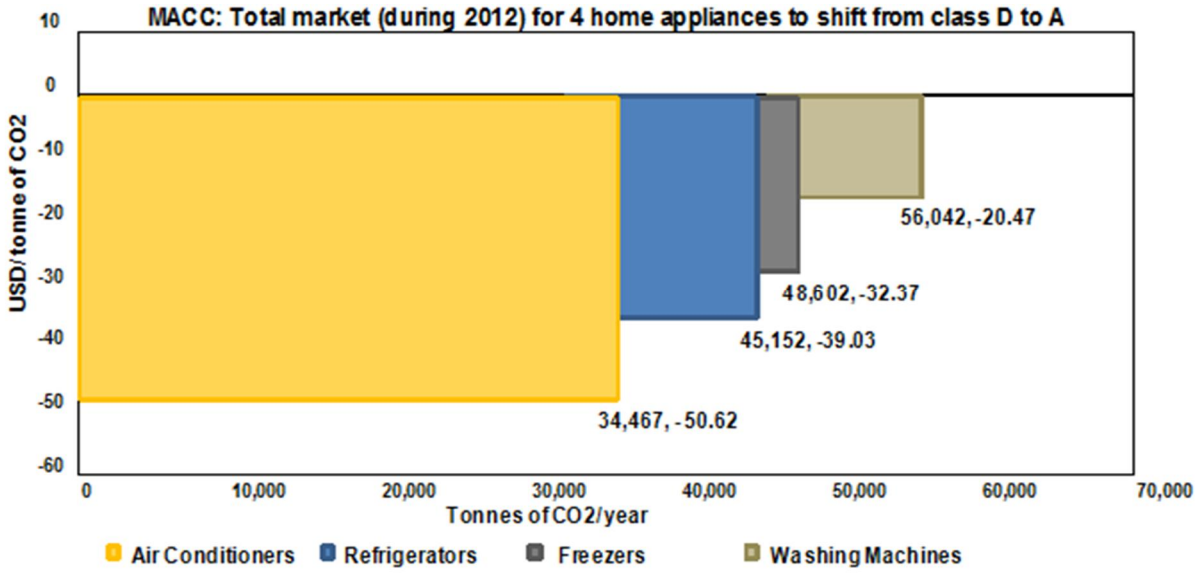
To understand the impact of the S&L programme on the cost of climate change, additional – abatement – MACCs have been developed. The MACCs presented below show how much CO_2 each initiative could save (i.e. the level of abatement potential) and the associated cost per tonne of CO_2.

Scenario 1: All appliances shift from energy efficiency class "D" to "A"
Scenario 2: All appliances shift from energy efficiency class "D" to "A+"

The entire Jordanian Local Market (LM) is considered for these two cases.

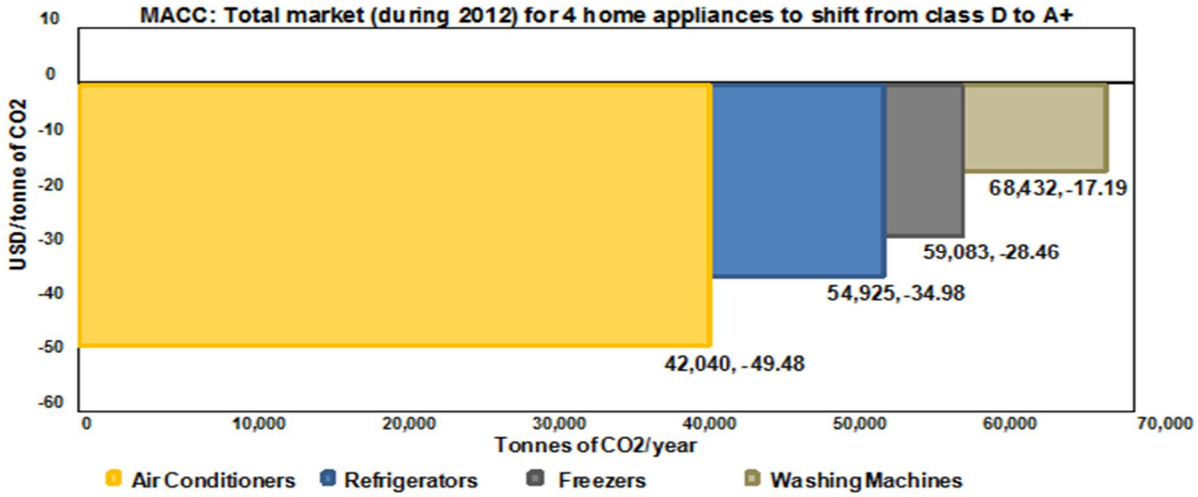
Scenario 1: All appliances shift from energy efficiency class "D" to "A"
For ACs and refrigerators, the marginal abatement costs are -$50.62/tonne of CO_2 (tCO_2) and -$39.03/$tCO_2$, respectively. A negative MAC means that the initiatives are self-financing and generate cost savings of $50.62/$tCO_2$ and $39.03/$tCO_2$ for ACs and refrigerators, respectively. Therefore, these are the most favourable abatement options. The GHG abatement potential of freezers and washing machines is relatively low, but their marginal abatement costs are nonetheless also negative. Therefore, these initiatives are also self-financing (from the consumer's perspective), but are less financially attractive.

Figure 3: MACC for scenario 1 – GHG abatement and associated cost



Scenario 2: All appliances shift from energy efficiency class "D" to "A+"
For ACs and refrigerators, the marginal abatement costs are -$49.48/tonne of CO_2 (tCO_2) and -$34.98/$tCO_2$, respectively. A negative MAC means that the initiatives are self-financing and generate cost savings of $49.48/$tCO_2$ and $34.98/$tCO_2$ for ACs and refrigerators respectively. Therefore, these are the most favourable abatement options. The GHG abatement potential of freezers and washing machines is relatively low, but their marginal abatement costs are nonetheless also negative. Therefore, these initiatives are also self-financing (from the consumer's perspective), but are less financially attractive.

Figure 4: MACC for scenario 2 – GHG abatement and associated cost



4.0 Operational and financial impact of S&L on local manufacturers and suppliers

4.1 Operational impact

Although there is an operational impact of the S&L programme on manufacturers and suppliers, the scale of impact varies. The following changes are expected in the operations of local manufacturers to enable them to comply with the S&L regulations:

- Changes required in the supply chain to source components needed for manufacturing energy efficient appliances
- Upgrades/modifications needed in existing production lines
- Insufficient technical know-how for manufacturing energy-efficient products
- Capacity building of employees involved in production and after-sales services
- Transition period required

For suppliers/importers that represent multinational brands, the operational impact will be much lower than for local manufacturers. The challenge for suppliers will be to modify future purchase orders from their respective international brands which already manufacture efficient appliances for the EU and other regions. Manufacturers, on the other hand, must consider purchase orders for input components as well as upgrading their production lines.

Additionally, there will be some operational challenges common to manufacturers and suppliers:

- Capacity building of retailers to promote sales of energy-efficient appliances
- Inadequate access to testing facilities

4.2 Other operational barriers

Readiness of local manufacturers

The study indicates that local manufacturers are capable of implementing the required changes in their production lines, but not on a fast-track basis. Although the manufacturers have been kept abreast of progress of the energy efficiency standards and on the implementation timeframe, they have nonetheless expressed concern at the potential difficulties associated with adjusting to the new market regime.

Availability of testing laboratories

Access to testing laboratories is essential for running an S&L programme. Jordan currently lacks access to well-equipped domestic test laboratories to test the energy efficiency performance of appliances as per the standards set by JSMO.

4.3 Financial impact

Of the operational impacts, the most significant is the production line upgrades for the local manufacturers. Estimates of the capital investment required to modify the production process are based on information obtained through primary research, secondary data analysis and assumptions.[10]

The estimated investments required by manufacturers to upgrade their facilities are shown in the table below:

Table 1: Estimated CAPEX requirement

Appliance	Current energy levels (as per EU regulations)	Expected energy levels (as per EU regulations)	Estimated net present value of capital investment (US$)[11]
ACs	D	A+	**422,000**
Washing machines	D	A+	**240,000**
Refrigerators	D	A+	**612,000**
Freezers	D	A+	**130,000**

Table 2 indicates that, in absolute financial terms, the investments required may not be significant. However, primary research indicates that, rather than finance being the issue, an inadequate transition period is perceived as the key challenge by local manufacturers.

In addition to the one-time expenditure to modify/upgrade the production line, there will be an increase in production costs due to sourcing of energy efficient components. The total increase in production cost will be the sum total of apportioned capital cost and increased component costs.

The estimated percentage increase in total production cost is shown in the table below:

Table 2: Estimated increase in total production cost

Appliance	Current energy levels (as per EU regulations)	Expected energy levels (as per EU regulations)	Estimated increase in production cost (%)
ACs	D	A+	**17%**
Washing machines	D	A+	**13%**
Refrigerators	D	A+	**20%**
Freezers	D	A+	**22%**

As indicated in Table 3, implementation of the S&L programme will lead to an immediate increase in production cost. Suppliers and manufacturers are concerned that the increase in production cost will be reflected in the retail prices of new appliances, thereby dampening consumer demand for new appliances. A survey of consumer behaviour and preferences conducted by NERC [11] in 2012 indicates that such consumer sensitivity to price rises might, indeed, be a problem.

5.0 Way forward

[10] ***Assumptions:*** Percentage share of local manufacturers is estimated to be 20%. Most of the components used for manufacturing energy efficient appliances will have to be imported. No major changes in the production/assembly line are envisaged. Freezer manufacturers also manufacture refrigerators. Therefore, the investment required to modify their freezer manufacturing lines will be additional to the investment they have already made to upgrade the refrigerator manufacturing line. Values represent investment per local manufacturer of home appliances. Payback period for the manufacturers on capital investment (fixed cost): 4 years. Default rate of return on the capital investment: 17.7%. Fixed cost as a percentage of total cost: 15%. Source: Annex X. The capital investment is considered for local manufacturers of a particular appliance

[11] Survey of Consumer Behavior and Preferences Regarding Energy Efficiency Home Appliances - Consolidated Report "Survey Results – National Level" 2012: NERC

The Government of Jordan is gearing up to implement an energy efficiency S&L programme for nine appliances.[12] This study focuses on analyzing the impact of the upcoming EE S&L regulations on the manufacturers and suppliers for four of these appliances – refrigerators, ACs, washing machines and freezers –since these appliances represent the majority of electrical power consumption in an average household. The study presents the following recommendations:

Transition period

The Jordanian home appliance S&L scheme has been formally drafted, building on progressively more detailed communications with local manufacturers since 2012. Introduction of the scheme is expected in mid-2014. Local manufacturers have expressed some concerns about the imminence of this introduction, though international experience suggests that the informational lead-time that has been provided should serve to facilitate business adaptation and compliance with the new standards

Research shows that there are considerable lead times built-in to the regulatory processes of the countries that implement MEPS, to enable the market to adjust to the specified requirements. Typically, a formal notice is given 2-5 years in advance of the proposed implementation. Since the Jordanian Government shared its plans on the S&L programme in early 2012, a mandatory S&L programme could conceivably be implemented in the country by 2015. Although most local manufacturing facilities may not require major changes in their assembly lines, they may need considerable time to adapt and stabilize their production lines to comply with minimum EE standards. Furthermore, suppliers and local manufacturers may require adequate time to streamline their supply chains..

Manufacturers and suppliers

Early responses to S&L programmes provide manufacturers and suppliers with a first-mover advantage in the market and allow adequate time to complete the modification of business processes. The Government of Jordan will initially allow manufacturers and suppliers a transition period to implement the S&L programme. Those who respond early will be able to establish their supply chains and production facilities to manufacture labelled appliances and take the required corrective actions (if needed) within the transition period. By the time mandatory regulations are implemented, these manufacturers and suppliers will be in a stronger position than their competitors, who may have started late.

Starting early will also help manufacturers and suppliers to plan the additional costs required to manufacture/import appliances in compliance with the energy efficiency standards.

Local manufacturers and suppliers can also leverage innovation that has already taken place in economies with mature S&L programmes. They can source components from suppliers that have existing facilities producing components for energy efficient appliances. To facilitate market transformation, local manufacturers and suppliers are advised to associate with consumer-awareness programmes that promote energy efficiency.

Executing agency (JSMO)

To ensure successful implementation of the S&L programme, JSMO has to have the right resources at its disposal. JSMO will have to support manufacturers/suppliers to develop adequate capacity to ensure their compliance with the programme, and enhance their awareness of the procedures, guidelines, testing methodologies, etc. required for its implementation.

Furthermore, JSMO will have to design appropriate operational frameworks and financial mechanisms to strengthen the S&L programme and accelerate penetration of energy efficient appliances.

For inclusion of locally-manufactured appliances within the S&L scheme, the appliances need to be tested against pre-defined standards laid down by JSMO. However, there are limited test facilities available in Jordan. Therefore, it is necessary to build new test facilities and/or to enable affordable access to existing test laboratories in other countries. This has to be carried out in a manner that makes the testing of appliances economically viable for local manufacturers.

[12] The nine appliances that will be subject to energy labelling are: electric tumble driers, combined washer-driers, electric lamps, electric ovens, dishwashers, refrigerators, washing machines, televisions and air conditioners.

Financial mechanisms

Financial mechanisms that are implemented globally and have been found to be effective for supporting energy efficiency programmes include:

a. ***Tax incentives:*** Taxation can be a powerful tool to stimulate energy efficiency by providing incentives for investment through tax exemption, capital gains tax, property tax, VAT, and accelerated or free depreciation.
b. ***Grants/Subsidies:*** Grant programmes (investment grants or interest rate subsidies) are often provided by governments to support the upfront cost of energy efficiency projects.
c. ***Lending programmes:*** Soft loans are provided by financial institutions and government lending agencies to cover the upfront costs of implementing energy efficiency projects.
d. ***Climate finance:*** Climate finance includes resources provided to projects that aim to reduce (or that are expected to reduce) greenhouse gas emissions; examples include the Clean Development Mechanism (CDM) and Nationally Appropriate Mitigation Actions (NAMAs).

Accelerated adoption of the S&L programme (with a shorter transition period) by local manufacturers may require the support of the Jordanian Government and/or bilateral/multilateral funding agencies. Most of the financial mechanisms listed above, with the exception of climate finance, create additional burdens on Government budgets.

1. Introduction

1.1 Background

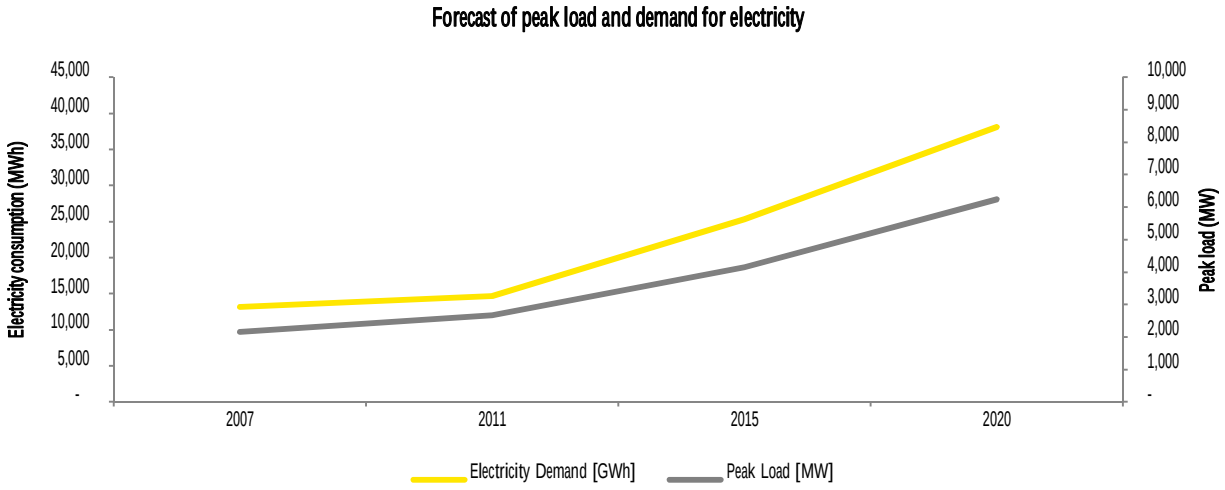
Jordan imports more than 97% of its oil needs and around 80% of the electric power generated in the country depends on natural gas imported from Egypt.[13] The country also depends on Saudi Arabia and Iraq for fuel oil.

Hashemite Kingdom of Jordan

According to the National Electric Power Company's (NEPCO's) 2011 data, electricity consumption in the country amounted to 13,535 GWh in 2011 against 12,857 GWh in 2010, an annual increase of 5.3%. The average electricity consumption per capita was 2,167 kWh in 2011 against 2,103 kWh in 2010, a growth rate of 3.0%. Peak demand is expected to continue to increase up to 6,238 MW by 2020, with an average annual growth rate of 8.5%, as shown in the following graph.

This high reliance on imported energy and increasing demand for electricity affects Jordan's energy security and it has become urgent for the country to find appropriate solutions.

Figure 5: Growth in electricity consumption and peak load growth in Jordan[14]



The residential sector is the single-largest consumer of electricity in Jordan, with a 41% share of the country's total electricity consumption,[15] and it is expected to increase with population growth, rising incomes and growing demand for household electrical appliances. Reducing the demand for electricity in the residential segment would help to reduce Jordan's growing demand for electricity. With this objective in mind, the Cabinet has approved the National Energy Efficiency Strategy[16], which proposes measures to reduce the burden of energy imports on Jordan's economy.

The proposed implementation of energy efficiency standards and labelling (S&L) for home appliances is one initiative included in the National Energy Efficiency Strategy. Exhibit 1 provides a brief introduction to energy efficiency standards and labelling.

[13] Annual Report 2011, NEPCO.
[14] Based on NEPCO's Planning Studies, Annual Report 2007.
[15] NEPCO 2011, http://www.dos.gov.jo/dos_home_a/main/cd_yb2011/pdf/Electricity.pdf.
[16] http://www.memr.gov.jo/Portals/0/energystrategy.pdf

Exhibit 1

Energy efficiency standards

Energy efficiency standards deal with measures and regulations required for prescribing the energy performance of energy-consuming products. The standards aim to achieve the following:

- Define testing protocols (test procedures)
- Determine the value of energy performance

Energy efficiency standards include Minimum Energy Performance Standards (MEPS), grading criteria and/or High Energy Performance Standards (HEPS).

Energy efficiency standards can be:

- Voluntary or mandatory
- Have technical standards or technical specifications

According to current plans, Jordan will adopt a mandatory MEPS scheme and a voluntary HEPS scheme.

Energy efficiency labels

Energy efficiency labels are attached to energy-consuming appliances or devices to showcase their energy performance to potential users. Generally, energy efficiency labels are divided into the following classifications:

- Endorsement label
- Comparative label (including categorical, continuous scale and information-only labels)

Energy efficiency labelling programmes may also be voluntary or mandatory.

Energy efficiency standards and labels (S&L) can be used together, with the standards providing a supply-side (manufacturer) push towards energy efficiency appliances and labels providing an additional demand-side (consumer) pull.

The primary objective of any energy labelling programme is to provide the consumer with an informed choice about energy saving, and thereby the cost-saving potential of a relevant marketed product. The introduction of the S&L programme in Jordan is expected to increase the share of energy-efficient appliances in the Jordanian market and result in the following direct benefits:

1. Increased energy security by reducing the import of primary fuel for electricity generation.
2. Annual cost savings for the Government of Jordan (through avoided capacity additions for electricity generation).
3. Augmented investment in the manufacture of energy-efficient appliances.
4. Reduction in Jordan's greenhouse gas (GHG) emissions (due to reductions in energy consumption).

To implement the programme in Jordan, the Jordan Standards and Meteorology Organization (JSMO) has been identified as the executing agency and has been entrusted with the responsibility of developing the S&L scheme. The draft scheme prepared by JSMO is closely aligned with the European Union's (EU's) S&L scheme. Developing an S&L scheme (similar to the EU's) will help Jordan create a common market with the EU, whereby manufactures/suppliers will be allowed to sell appliances across the EU and Jordan by using a single label.

JSMO has already started the step-wise process for implementation of the S&L programme for household appliances[17] to increase the share of energy-efficient appliances in the market.

1.2 About the study

[17] The Government of Jordan is gearing up to implement MEPS for thirteen electrical appliances, of which nine will also have associated energy labels.

The drivers for introducing the S&L programme in Jordan are:

- Improved energy security
- Creating a common market with the EU

To comply with the new S&L guidelines, local manufacturers and suppliers will be required to sell home appliances that meet minimum energy performance standards (MEPS). The expected MEPS for Jordan will be comparable to class "A" appliances manufactured in the EU.

Local manufacturers and suppliers are concerned that, with the introduction of MEPS in Jordan, their businesses will be adversely impacted. This has led to the National Energy Research Centre (NERC), with UNDP's support, initiating this study to address the concerns of stakeholders and assess the probable impact of the S&L programme on manufactures and suppliers of household appliances in the country.

The study will assist policy-makers in Jordan to evaluate the implications of the upcoming regulations on local manufacturers and suppliers. Four appliances (ACs, freezers, refrigerators and washing machines) are considered in this study because they contribute to around 73% of total residential sector electricity consumption.[18]

NERC and UNDP selected Ernst & Young to conduct the study, covering the following areas:

a. Assessing the operational impact on manufacturers and suppliers (product-level overview, not manufacturer-specific).
b. Assessing the financial impact on manufacturers and suppliers (product-level overview, not manufacturer-specific).
c. Analyzing the appliances currently available in the market and their performance levels relative to the upcoming energy efficiency requirements.
d. Assessing the impact of the S&L programme on the country's GHG emissions and development of a marginal abatement cost (MAC) curve.
e. Analyzing the overall changes Jordan's manufacturing industry will need to undergo, informed by other countries' experiences.
f. Assessing the impact on the second-hand appliance market (current and forecast market size).
g. Developing a plan to assist local manufacturers to comply with the new regulations, including financing options and cost-effective means of upgrading products when they manufacture more than one affected appliance.
h. Making actionable recommendations to local manufacturers and importers to reduce their financial burden of compliance with the new regulations.

[18] Please refer to Annex VIII for detailed calculation.

2. Approach and methodology

The objective of this study is to identify the probable impact of the implementation of the S&L programme on manufacturers[19] and suppliers of household appliances.

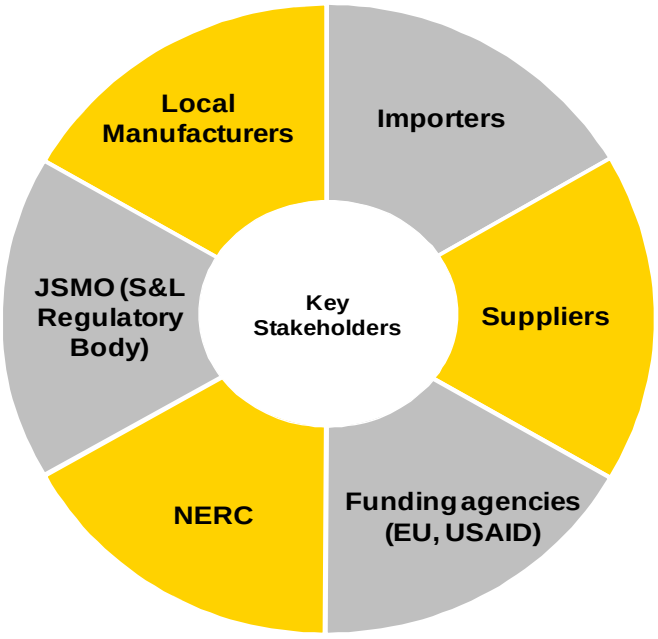
Approach for this study:

Step 1 - Desk research: To understand the Jordanian appliance market and implications of the upcoming implementation of the S&L programme in the country. In addition, desk research was conducted to understand the impact of the S&L programmes on manufacturers (including suppliers) and consumers in countries with ongoing S&L programmes (preferably for more than 5 years).

During this stage, information relevant to the study (through secondary research) was reviewed. Only information available in the public domain or provided by UNDP or NERC was used for the research.

Step 2 - Consultation: Relevant stakeholders were identified and stakeholder consultations were organized to gather their views on the impact of the upcoming S&L programme.
The consultative process was conducted through an initial stakeholder workshop organized in Amman, followed by questionnaire surveys and one-on-one discussions. However, the study does not include suppliers operating in the grey market.[20] Jordan's grey market is currently dominated by individual importers capturing a small share of home appliances.

Figure 6: Key stakeholders consulted



Step 3: Once the primary and secondary reviews were concluded, the information collected was analyzed. To reinforce the legitimacy of the primary data, they were validated against information collected through secondary research. After validation, the information gathered from primary research was analyzed and used to assess the impact of the S&L programme. During this stage, assessment of the probable country-level impact of the S&L programme on Jordan's GHG emissions, and its financial and operational impact on

[19] The definition provided by the Ministry of Industry and Trade used to identify locally-manufactured products is if a minimum of 30% value addition (with respect to production cost) happens within Jordan.
[20] An unofficial/ unregulated market.

manufacturers and suppliers, was undertaken. Barriers and recommendations were also identified during this stage.

Step 4: Marginal abatement cost curves were developed to estimate the long-term sustainability of the S&L programme in Jordan.

3. Analysis of current appliance market

3.1 Market data on appliances

During the preparation of the Jordan National Energy Efficiency Strategy, a baseline analysis was conducted by the Technical Committee under the supervision of the Ministry of Energy and Mineral Resources. As part of the Committee's activities, a long list of appliances was developed, representing all significant energy-using products in Jordan and the neighbouring Arab countries. From this list, four appliances (**air conditioners, freezers, domestic refrigerators and washing machines)** were selected for further analysis. These four appliances were selected on the basis that they are widely used in Jordan and consume more power than other appliances considered for energy labelling.

The Jordanian market for these products comprises multinational brands, including LG, Samsung, Sharp and BEKO; local brands, such as General Deluxe, National Refrigeration Co. and MEC; other imports, notably from China and Egypt; and the second-hand market. To estimate the size of the appliance market in Jordan, the following approach was used.

Step 1: Primary research

1. Questionnaire survey and one-on-one discussions with manufacturers, suppliers and retailers to understand their sales volumes and estimate total market size for these appliances in Jordan (Annex IX)
2. Statistical analysis of collected information.

However, while estimating the total sales volume across the country, wide variances were observed in the estimations made by respondents (manufacturers, suppliers, importers, etc.). The impact of data variation was minimized using statistical summary measures such as standard deviations and means. The values derived from statistical analysis were cross-checked against the information gathered from other stakeholders, including industry associations, to identify the market size of appliances sold in Jordan.

The table below presents the estimated annual market size during financial year 2012 for different appliances:

Table 3: Estimation of annual sales of appliances

Estimated sales during 2012 for Jordan	
Appliance	**Estimated annual sales**
Air Conditioners	57,671
Washing Machines	98,267
Refrigerators	93,816
Freezers	25,747

Step 2: Secondary research

The approximate annual market size calculated based on primary information has been validated against information available in the public domain. Data available from the Department of Statistics and a survey of consumer behaviour and preferences regarding energy efficiency home appliances (UNDP, 2012) were used to calculate the market size for household appliances in Jordan. The detailed calculation methodology is provided in Annex IX.

The market size for home appliances calculated using the data collected through secondary research is provided below:

Table 4: Estimated sales of home appliances during 2012 (gathered through secondary research)

Appliances Ownership	**Sales during 2011–12**
Washing machines	105,730

Appliances Ownership	Sales during 2011–12
Refrigerators	105,925

The market sizes calculated using primary and secondary data are comparable; hence, the market size calculated using primary data is used in subsequent sections of this report.

3.2 Share of imports and local manufacturing

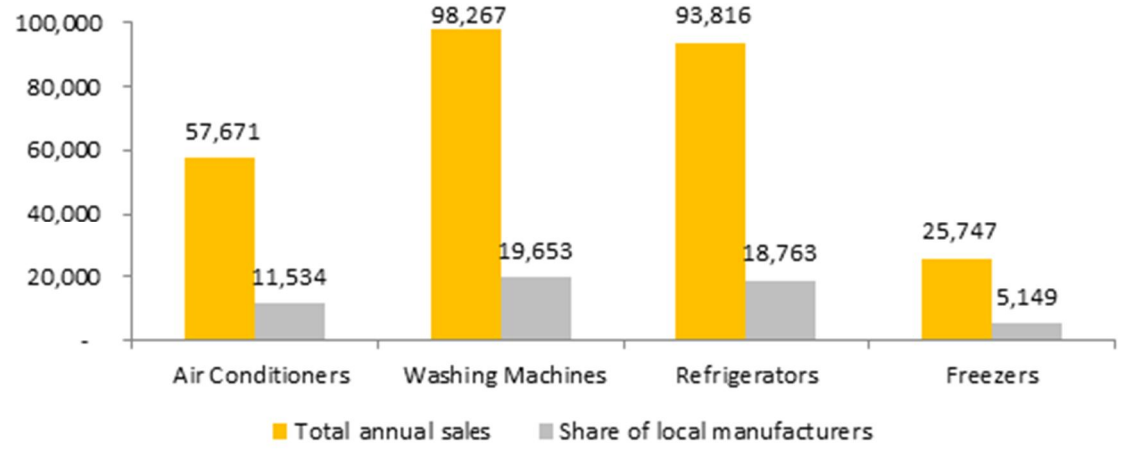
Presently, appliances manufactured locally do not account for a major share of the home appliances market and the sector is mainly catered for by imported brands.

Table 5: Brief list of local manufacturers and imported brands for home appliances

Local manufacturers currently active in the Jordanian market	Imported brands currently active in the Jordanian market		
General Deluxe	Samsung (South Korea)	LG (South Korea)	Carrier (US)
NRC	Gibson (US)	White Westinghouse (US)	Mitsubishi (Japan)
Mistral	Benkon (China)	Frigdaire (US)	Sanyo (Japan)
Petra	Hisense (China)	Nord (US)	Candy (Italy)
MEC	Beko (Turkey)	Sharp (Japan)	National (China)

During the discussions with stakeholders, it was understood that local brands manufactured in Jordan account for around 20% of the market. The remaining 80% of Jordan's home appliance market is catered for by imported brands. The figure below provides a reasonable estimate of the share of locally manufactured products in the country's market.

Figure 7: Estimated market share of local brands



However, validation through secondary research was not possible due to the limitations of reliable information available in the public domain.

3.3 Analysis of present appliance energy performance levels in Jordan: A comparison with the upcoming regulations

Jordan's appliance market is dominated by imported products, mainly from Korea. In the absence of an energy efficiency S&L programme in the country, the availability of energy-efficient appliances is currently low and sales are dominated by inefficient products. The principal reasons for the limited share of energy-efficient appliances in Jordanian home appliance market are:

- Higher sale price of energy-efficient appliances.
- Limited consumer awareness of home appliance energy efficiency.
- Limited understanding among retailers and consumers regarding life-cycle cost of energy-efficient appliances compared with inefficient appliances.

The current energy performance of appliances was compared with the EU's S&L standards so as to categorize them under an energy efficiency class. A description of the energy performance levels of appliances available in the Jordanian market, both for locally-manufactured and imported products, is provided in Annex IV. A graphical representation of the energy performance levels of electrical appliances sold in the country is given in Annex IV.

The information provided in Table 7 is based on representative samples collected through primary research. It is observed that the various models available in the Jordanian market are characterized by wide variation in energy efficiency performance. The current EU energy performance levels for the 4 appliances are provided in Annex IV.

Table 6: Analysis of current appliance energy performance level compared with upcoming regulations

Product	Imported/ Local brands	Energy performance	Comments
Air conditioner	Imported	**'C to A'**	Most air conditioners are categorized under the energy efficiency class "C" and few under "A".
	Local brands	**'E to D'**	The energy efficiency categories of local brands sold in Jordan range between class "E" and "D".
Washing Machine	Imported	**'A to A+++'**	Imported brands of washing machines are categorized under the classes "A" to "A+++," with "A" having the maximum share.
	Local brands	**'D to A'**	The energy efficiency class of local brands is categorized under the label brackets "D" to "A", with "D" being the baseline class.
Refrigerator	Imported	**'A to A+'**	Imported brands are categorized under the energy efficiency classes "A" to "A+".
	Local brands	**'D to C'**	Local brands are categorized under the energy efficiency classes "D" to "C".
Freezer	Imported	**'B to A+'**	Imported branded freezers are categorized in classes "B" to "A+". Their sales are dominated by brands categorized under "B".
	Local brands	**Within 'D'**	Local brands are categorized under the energy efficiency class "D".

For most imported products, the energy efficiency class varies from "C" to "A+++", whereas locally-manufactured appliances can generally be categorized under the energy efficiency classes "E" to "A". Considering class "A" as the minimum energy performance standard (MEPS), most of the locally-manufactured appliances currently on sale in the market will not meet the MEPS. Hence, the operational and financial impact will be higher for local manufacturers than for international suppliers / importers.

3.3.1 Baseline development for locally-manufactured appliances

It was observed that in the case of three appliances – air conditioners, freezers and refrigerators – the energy efficiency levels of most locally-manufactured products can be categorized under class "D" and these are assumed to be the baseline class.

However, some of the locally-made washing machine energy efficiency levels are comparable with the MEPS proposed by the upcoming Jordanian S&L programme. The higher efficiency of washing machines can be related to the water scarcity in the region, which forces manufacturers to use enhanced technology. However, in the case of locally-manufactured washing machines, the proportion of class "A" models is lower

than the proportion of class “D” models. Therefore, even for the washing machines, category “D” is considered the baseline class.

4. Impact assessment of introducing energy efficiency regulations for household appliances

A key objective of the study is assessing the operational and financial impact of the introduction of the S&L programme (MEPS) on local manufacturers and suppliers.

4.1 Operational impact

The findings of an appliance-level operational impact assessment are presented in this section. The operational impact of complying with the new MEPS is similar (but may not be identical) for all manufacturers and, therefore, a manufacturer-specific operational impact assessment is not required.

To understand the operational impact, local manufacturing facilities were surveyed. During the site surveys it was observed that, although the current technology used by local manufacturers is dated, they do have the know-how to upgrade their manufacturing facilities and produce appliances that can match the criteria prescribed in Jordan's S&L scheme. However, the manufacturers may require a suitable transition period to bring about a phased improvement of their production facilities.

4.1.1 Operational impact on manufacturers

Refrigerators and freezers
Refrigerators and freezers share similar components and production lines, and so the operational impact on these two products is expected to be similar. There are multiple options for improving the energy efficiency performance of refrigerators/freezers, including enlarging the heat exchange area, improving the efficiency of compressors (e.g. using improved materials to reduce motor losses) and incorporating variable speed compressors to adjust output, based on external conditions (low-level continuous operations being generally more efficient than start-stop operations), adaptive defrost and anti-sweat heaters, top-mounted condensing coils, direct-current (DC) fan motors, smaller-sized and separate compressors for fresh food and freezer storage, and improved gasket seals.

Jordan's S&L standards closely follow EU standards, and market information indicates that locally-manufactured refrigerators and freezers currently fall within the energy efficiency classes "C" and "D". Considering class "A" as the minimum energy efficiency performance standard (MEPS), the energy efficiency class of existing appliances will need to be improved.

Some appliances may require the refrigerant used to be changed from R134A to R410. R410 refrigerant is more volatile and needs a special handling system to address shop-floor safety issues.

This study envisages that most of the technical changes that will need to take place will be in factories where individual components such as compressors, motors, radiators and polyurethane foam (PUF) are manufactured. These components are currently manufactured outside Jordan. Typically, the manufacturers in Jordan integrate imported components on their manufacturing line. The manufacturing line includes the assembling, vacuuming, repairing, testing and packing lines. However, some modification will also be required to the assembly line, including an upgraded refrigerant storage and handling system.

Air Conditioners (ACs)
Energy-efficient ACs have designs which use efficient compressors, improved heat exchangers, fan blade designs and motor efficiency, and improved refrigerants and expansion valves. Variable-speed compressors allow for continuous low-level cooling, eliminating inefficient compressor cycling. Their variable-speed capability enables ACs to adjust their output smoothly with ambient conditions and improves the performance of their evaporator coils.

The modifications required in the window-type, split-type (only cooling) and reversible split-type ACs may be different. However, as in the case of refrigerators, local manufacturers of ACs in Jordan are mainly involved

in assembling imported components. They do not manufacture or design individual components such as compressors, heat exchangers or variable-speed drives.

Currently, locally-manufactured products fall under the energy efficiency classes “D” and “E”. Considering class “A” as the minimum energy efficiency performance standard (MEPS), major component-level modification will be required for locally-manufactured ACs. Since most of the components (such as compressors and heat exchangers) used by local manufacturers are imported, the implementation of MEPS will have a major impact on their supply chains.

The production facilities, which consist of the assembling, vacuuming, repairing, testing and packing lines, may not need to undergo any major changes. However, some modifications may be required in the assembly lines, and there may be a need for new refrigerant storage and handling systems.

Washing machines
Some of the locally-made washing machine energy efficiency levels are comparable with the MEPS proposed under the upcoming Jordanian S&L programme. However, the majority of washing machines manufactured in Jordan fall short of the prescribed MEPS.

To upgrade washing machines, modifications may be required in motors, washing drums, belt-pulley mechanisms, electronic circuit boards, programming of the machines, etc. As with other appliances, components used for manufacturing washing machines are imported from other countries and assembled in Jordan. The major components used to manufacture a washing machine include:

- A wash basket (or inner tub)
- The lid and outer surface
- An agitator
- Electric motors
- Electronic controls (timers, relays, transistors, water and temperature controllers, etc.)
- Hoses and water leakage insulators

Typically, a washing machine assembly line includes assembling, testing, repairing and packing lines. In the case of washing machines, modifications will be needed in their components – and hence in the supply chain. However, no major changes may be required in the assembly line.

4.1.2 Operational impact on suppliers

Suppliers and importers obtain appliances (in ready-to-sell condition) from multinational brands that have manufacturing bases in other countries. Some imported appliances are re-exported to neighbouring countries. In Jordan, most multinational brands are sold through suppliers’ own showrooms or large retail outlets.

After discussions with local suppliers and secondary research, it was observed that the operational impact on suppliers due to the introduction of the S&L programme for home appliances will be minimal. An importer or supplier can:

- Request overseas manufacturers to improve designs, substituting the current models with more efficient models that are already manufactured for other national markets.
- Shift alliance from an inefficient appliance manufacturer to an energy-efficient appliance manufacturer.

However, suppliers with a large number of non-complying models will need to make a concerted effort to obtain appliances which comply with Jordanian MEPS.

4.1.3 Other impacts

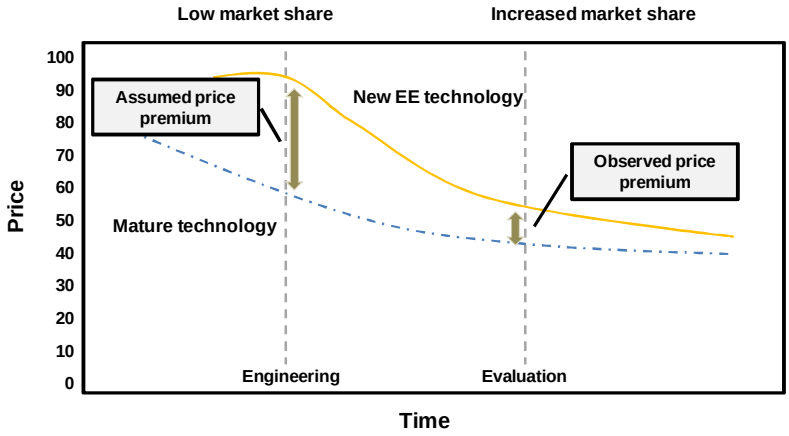
Impact on supply chain
Since most of the components used in local manufacturing are imported, introduction of the S&L programme and MEPS will have major impact on the supply chain.

All components originating from the US, the EU and Canada, which have similar stringent MEPS levels, will meet the proposed Jordanian MEPS criteria. However, it is possible that not all components imported from countries such as China and Egypt currently comply with the set standards. Therefore, local manufacturers may have to look for new suppliers of components within or outside the countries from which they are currently sourcing. It is understood that these operational modifications may be possible without any external assistance if the transition time for these manufacturers is adequate.

Expected market response to S&L programme

Accurate prediction of future market response to the S&L programme is not possible. However, a consumer survey on energy-efficient home appliances conducted by NERC[21] provides an indication of the probable market response. Around 41% of respondents declared their unwillingness to buy energy efficient (EE) appliances in the future. Price seems to be the principal obstacle preventing respondents from purchasing EE home appliances in the future, with 47% citing the high price of EE technology as the purchase barrier. This price sensitivity may, therefore, impact the number of appliances sold annually by local manufacturers and suppliers in Jordan.

Figure 8: Price impact of market growth for energy efficient technology



However, research shows that the probable dip in sales would be a temporary phenomenon as the prices of energy-efficient appliances stabilize. A study conducted by Dale *et al* (2002)[22] indicates that, in countries with mature S&L programmes, not only have the prices of energy-efficient appliances fallen in real terms but, where ex-ante studies made predictions about future costs, actual prices tend to be considerably lower than those forecasted.

Readiness of local manufacturers

The study indicates that local manufacturers are ready to implement the required changes in their production lines, but not on a fast-track basis. They may require a suitable transition period and expect support from the Government to meet the MEPS, based on the type of appliances to be produced.

Availability of test laboratories

Access to test laboratories is essential for running an S&L programme. Currently, Jordan lacks access to well-equipped domestic test laboratories and thereby lacks adequate facilities to test the energy efficiency performance of appliances as per the standards set by JSMO.

[21] Survey of Consumer Behavior and Preferences Regarding Energy Efficiency Home Appliances - Consolidated Report "Survey Results – National Level" 2012: NERC

[22] Dale, L. Antinori, C. McNeil, M. and McMahon, J. (2002) Retrospective Evaluation of Declining Price for Energy Efficient Appliances. Lawrence Berkeley National Laboratory, paper 9.55 presented at ACEEE 2002.

If S&L regulations are implemented in the absence of in-house testing facilities, manufacturers and suppliers would need to send appliances to the EU, Turkey or Egypt to be tested. This would not only be expensive but also cumbersome, and would be a major barrier for implementation of S&L regulations in the country.

Impact on product quality

The S&L programme is expected to result in the adoption of enhanced-quality materials and levels of controls, resulting in improved products that will be comparable with those manufactured in other economies with energy efficiency standards. In addition, the S&L programme will provide local manufacturers and suppliers with additional avenues for exports. The research indicates similar experiences in other economies after they have implemented an S&L programme. However, proper market surveillance and checks need to be in place to ensure accountability on the part of manufacturers and suppliers. To ensure compliance, JSMO's surveillance team has to be trained appropriately. The EU's experience[23] indicates that rigorous monitoring, verification and enforcement (MV&E) is imperative to ensure compliance with required product specifications.

Price elasticity

The degree to which demand for a good or service varies with its price is known as the price elasticity of demand. High elasticity indicates that demand is sensitive to changes in price, low elasticity signifies that there is little sensitivity to price changes, and zero elasticity means that demand does not vary with price. Secondary research shows that demand is normally less elastic in the long-run than in the short-run in the case of S&L programmes.

Impact on exports

With regard to appliance exports from Jordan, it is possible that the need to comply with domestic MEPS may increase the price of some appliances. However, suppliers and manufacturers may continue to make less efficient motors for export or import less efficient appliances to export to countries without MEPS requirements. Alternatively, an increase in energy efficiency could lead to a measure of competitive advantage in the export market, mainly in exports to economies where MEPS regulations are in place (for example, Syria, Egypt and Saudi Arabia) or are expected to be introduced in the future (for example, Iraq). Locally-manufactured energy-efficient products are projected to become more cost-effective due to their expected share increase in the export market.

Capacity building and awareness development

Research shows limited awareness of appliance-level energy efficiency among stakeholders such as consumers, retailers, employees of local manufacturers and JSMO officials involved in monitoring and verification-related activities.

[23] http://www.atlete.eu/index.php?option=com_content&view=article&id=121&Itemid=117.

4.2 Financial impact

The cost implications of improving the energy efficiency of appliances are a vital input for those involved in developing sustainable energy policies. Understanding the extent to which the requirement for more efficient appliances will impact the costs and prices of products is important for determining the pace and stringency with which policy measures are implemented, and is fundamental for undertaking cost-benefit analysis.

Generally, engineering cost is estimated for components required to improve efficiency in particular appliances. Typically, this methodology suggests that energy-efficient technology will be more expensive than conventional technology. However, there is an opportunity to verify this assumption in other economies. Tracking the efficiency and prices of appliances over a period of time provides the opportunity to measure trends and understand the true cost of introducing an S&L programme. This provides greater certainty of outcomes and also enables efficiency targets to be optimized on a least life-cycle cost basis for the benefit of policy-makers, manufacturers and consumers.

For this study, information was requested from manufacturers regarding their estimates of cost escalation after the introduction of MEPS in Jordan. Additionally, data available for other economies was also considered.

4.2.1 Impact on manufacturers

Due to the introduction of MEPS in Jordan, manufacturers may have to alter their assembly lines and also change their bill of materials for their supply chains. For local manufacturers, the impact will be on fixed and variable costs. From the analysis conducted in Section 4.1.1, it is understood that the one-time capital cost to be incurred by local manufacturers may not be substantial, as compared with the cost impact on their (component) supply chains. This increase in production cost will have an impact on the sales price of appliances. Estimated changes in the pricing structure for Jordan – without revealing confidential model-specific data – are provided in the table below:

Table 7: Price escalation for domestic brands following implementation of minimum energy efficiency standards

Appliance	Model	BAU Rating	Baseline Price (US$)	Target Rating	Target Price (US$)	Incremental Price (US$)	% incremental price
AC	X	D	381	A+	494	113	29.7%
	Y	D	522	A+	635	113	21.6%
	Z	D	663	A+	776	113	17.0%
W/M	X	D	254	A+	296	42	16.5%
	Y	D	353	A+	409	56	15.9%
Ref	X	D	282	A+	331	49	17.4%
	Y	D	409	A+	465	56	13.7%
	Z	D	338	A+	381	43	12.7%
Freezer	X	D	282	A+	353	71	25.2%

Information on the financial impact for manufacturers was collected from other economies with an existing S&L programme. The economies were selected according to two key criteria – the economy exhibits similar economic conditions to those of Jordan and/or the economy complies with similar energy efficiency standards to those proposed for Jordan. For ease of understanding, the appliance impact is shown below. Detailed analysis is provided in Annex XII.

Table 8: Assumed per unit price escalation for air conditioners

Country	BAU (kWh)	Baseline price (US$)	Target (kWh)	Target price (US$)	Price increment (US$)	Energy saving (kWh)	% Energy savings	% Price increment	Programme reference/ assumption
Room Air Conditioners — Window									
India	1,900	400	1,600	501	101	300	15.8%	25.0%	Tathagat

Country	BAU (kWh)	Baseline price (US$)	Target (kWh)	Target price (US$)	Price increment (US$)	Energy saving (kWh)	% Energy savings	% Price increment	Programme reference/ assumption
									and Anand, 2011
Mexico	3,000	491	2,500	611	120	500	16.7%	24.5%	US proxy
Room Air Conditioners – Reversible Split									
China	690	510	560	671	161	130	18.8%	31.4%	Shah *et al.*, 2012
EU	1,500	701	740	1402	701	760	50.7%	100.0%	
Mexico	2,000	430	760	1301	871	1240	62.0%	202.3%	
Russia	860	491	490	601	110	370	43.0%	22.4%	
Room Air Conditioners –Split – only cooling function									
Brazil	710	481	430	811	330	280	39.4%	68.8%	Jannuzzi, 2002
India	1,400	451	880	721	270	520	37.1%	60.0%	BEE Star Rating
Indonesia	1,400	451	1,000	601	150	400	28.6%	33.3%	India proxy
Mexico	1,400	430	640	891	461	760	54.3%	107.0%	US proxy

Table 9: Assumed per unit price escalation for washing machines

Country	BAU (kWh)	Baseline price (US$)	Target (kWh)	Target price (US$)	Price increment (US$)	Energy saving (kWh)	% energy savings	% Price increment	Programme reference/ assumption
EU	210	640	200	640	0	10	4.8%	0.0%	EC, 2007d
CHN	180	220	97	290	71	83	46.1%	31.8%	Retail Price Analysis Price.ea3w.com, 2011

Table 10: Assumed per unit price escalation for refrigerators [24]

Country	BAU (kWh)	Baseline price (US$)	Target (kWh)	Target price (US$)	Price increment (US$)	Energy savings (kWh)	% energy savings	% Price increment	Programme reference/ assumption
EU	240	830	200	921	91	40	16.7%	10.8%	EC, 2008
China	550	320	290	440	120	260	47.3%	37.5%	Retail Price Analysis Price.ea3w.com, 2011
India	675	0	432	0	0	243	36.0%		BEE Star label
South Africa	540	320	160	540	220	380	70.4%	68.8%	Eastern Europe Proxy (GfK, 2004)

[24] Refer to Annex X for detailed analysis:
Assumptions: Payback period for the manufacturers on capital investment (fixed cost): 4 years. Default rate of return on the capital investment: 17.7%. Fixed cost as a percentage of total cost: 15%. Source: Annex X. The capital investment is considered for local manufacturers of a particular appliance

[25] *Policies that Work: Introducing Energy Efficiency Standards & Labels for Appliances and Equipment* (Energy Charter Secretariat, 2009).

[26] Similar information (per unit price escalation) on freezers was not available.

Country	BAU (kWh)	Baseline price (US$)	Target (kWh)	Target price (US$)	Price increment (US$)	Energy savings (kWh)	% energy savings	% Price increment	Programme reference/ assumption
Brazil	360	391	220	510	119	140	38.9%	30.8%	Jannuzzi, 2002
Mexico	370	501	310	510	9	60	16.2%	2.0%	US proxy

"Retrospective analyses in various countries suggest that the introduction of energy efficiency standards and labels shows an increase in the efficiency of products in the market. Only the most efficient products command a premium price, and these are in part due to manufacturers at the expensive end of the market positioning their products."[25] There is a perception that high-efficiency products, labelled "A" (EU) or 6-star (in Australia), are high-quality goods. Normally, products are manufactured using the best available technology with the highest level of energy efficiency, which demands a price premium, but over time, with new innovation, the efficiency point at which there is a premium appears to increase.

Since limited information on production costs was available from Jordan's local market, analogy was drawn from various S&L experiences. Understanding from this analysis (refer to Annex XII for details) is used to estimate a range of price rises expected in the country after the implementation of MEPS.

Table 11: Estimated cost escalation

Appliances	Estimated cost escalation	Comments[26]
ACs	For 1% improvement in energy savings, cost escalation may be 1.5 to 2% (based on scheme and local ambient conditions)	Highest cost escalation
Washing machines	For 1% improvement in energy savings, cost escalation may be around 0.7%	Lowest cost escalation
Refrigerators	For 1% improvement in energy savings, cost escalation happens across a wide range between 0.7 to 1.7%.	Medium cost escalation
Freezers	For 1% improvement in energy savings, the estimated cost escalation may be between 1 to 1.7%	Highest cost escalation after ACs

The cost escalation estimated by local manufacturers is in line with trends observed in other economies. With the introduction of the S&L programme there will be an increase of the price of the appliances, a portion of which is due to incremental cost of manufacturing. As actual capital cost cannot be accurately calculated at this stage, a portion of the increased production cost is attributed to capital cost (refer to Annex X for details). The total cost of upgrading production lines for individual appliances (only for local manufacturers) in Jordan has been estimated as follows. The detailed calculation method is provided in Annex X.

Table 12: Estimated capital investment required[27] by manufacturers and expected recovery

Appliance	Estimated net present value of capital investment (US$)	Expected recovery of capital investment per year (US$)
ACs	422,000	156,000
Washing machines	240,000	89,000
Refrigerators	612,000	226,000
Freezers	130,000	48,000

[27] Rounded off to the nearest thousand.

5. Assessment of impact of standards and labelling programme on GHG emissions

For this assessment, it is assumed that all current appliances will be upgraded gradually to energy efficiency classes "A/A+" after the implementation of the S&L programme in Jordan. The present market mix is considered as the "Business as Usual" (BAU) scenario. Under the BAU scenario, the emission factors and energy supply are assumed to be constant. As described in Section 3.3 of this report, class "D" appliances are considered as the BAU case. The study therefore estimates energy and GHG savings by assuming the BAU as class "D" and the target class as "A/A+".

The estimation of energy savings and GHG savings for different appliances – ACs, freezers, refrigerators and washing machines – can be found in Annex XII.

5.1 Impact of the S&L programme on country-level GHG emissions

Air Conditioners (ACs)

Annual sales of air conditioners in the Jordanian market are currently around 57,671 and 48% of households have a minimum of one AC unit. Two scenarios are considered for calculating energy and GHG savings:

Scenario 1: Shift from class "D" to "A"
Scenario 2: Shift from class "D" to "A+"

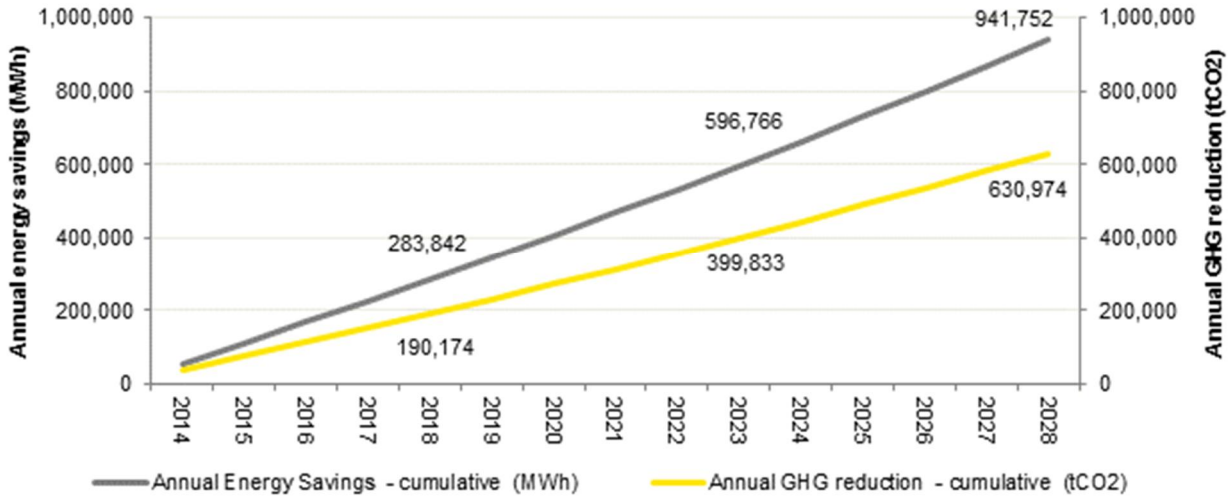
The assumptions for calculations of energy and GHG savings for air conditioners are:

- Market size: 57,671 (refer to Chapter 3)
- Annual market growth rate: 3%[28]
- Technology improvement factor: 1% per year
- CO_2 emission factor for electricity in Jordan: 0.67 tCO_2e/MWh[29]
- BAU efficiency class for ACs: "D"
- Assessment period: 15 years

[28] Comparable to annual population growth.
[29] Jordan's Second National Communication to the United Nations Framework Convention on Climate Change (UNFCCC), 2009.

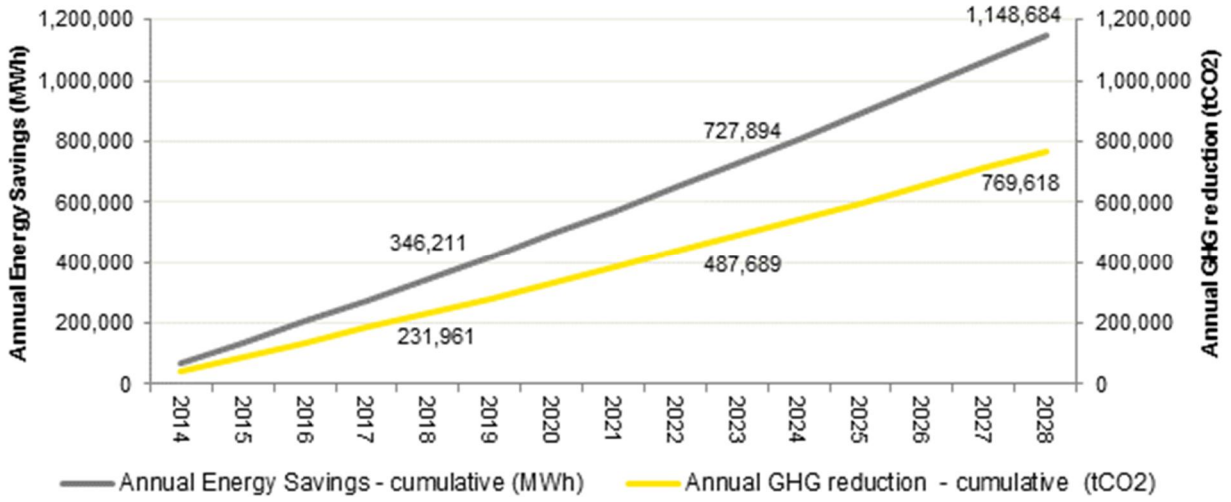
Scenario 1: D to A (ACs)
Expected energy and GHG savings in Jordan due to implementation of the S&L programme:

Figure 9: Estimated annual energy and GHG reduction (D to A) for AC



Scenario 2: D to A+ (ACs)
Expected energy and GHG savings in Jordan due to implementation of the S&L programme:

Figure 10: Estimated annual energy and GHG reduction (D to A+) for ACs



Washing machines
Annual sales of washing machines in the Jordanian market are currently around 98,267 and almost 100% of households have washing machines. Two scenarios are considered for calculating energy and GHG savings:

Scenario 1: Shift from class “D” to “A”
Scenario 2: Shift from class “D’ to “A+”

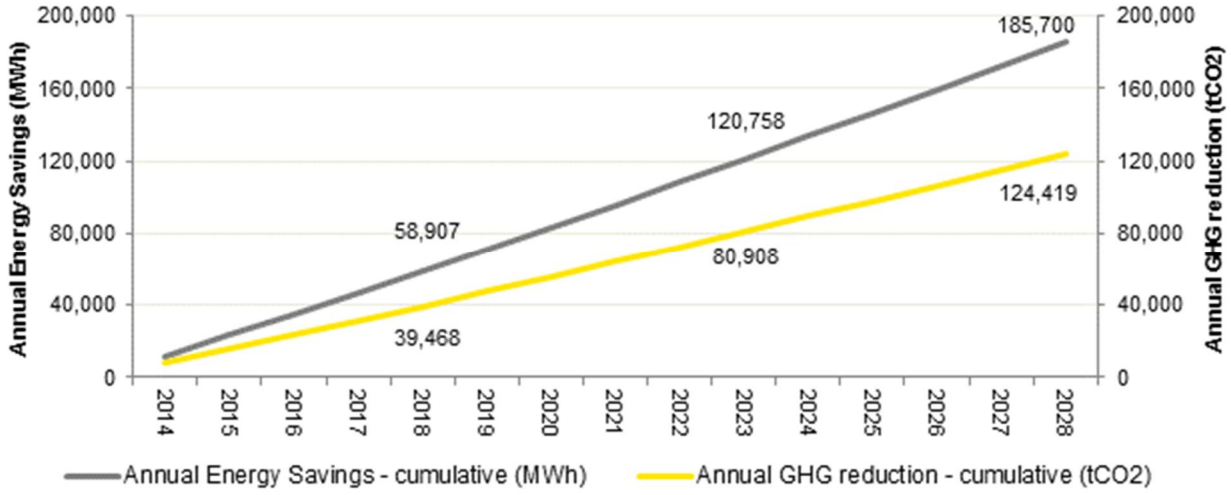
The assumptions for calculations for energy and GHG saving for washing machines are:

- Market size: 98,267 (refer to Chapter 3)
- Annual market growth rate: 3%
- Technology improvement factor: 1% per year
- CO_2 emission factor for electricity in Jordan: 0.67 tCO_2e/MWh
- BAU efficiency class for washing machine: “D”
- Assessment period: 15 years

Scenario 1: D to A (washing machines)

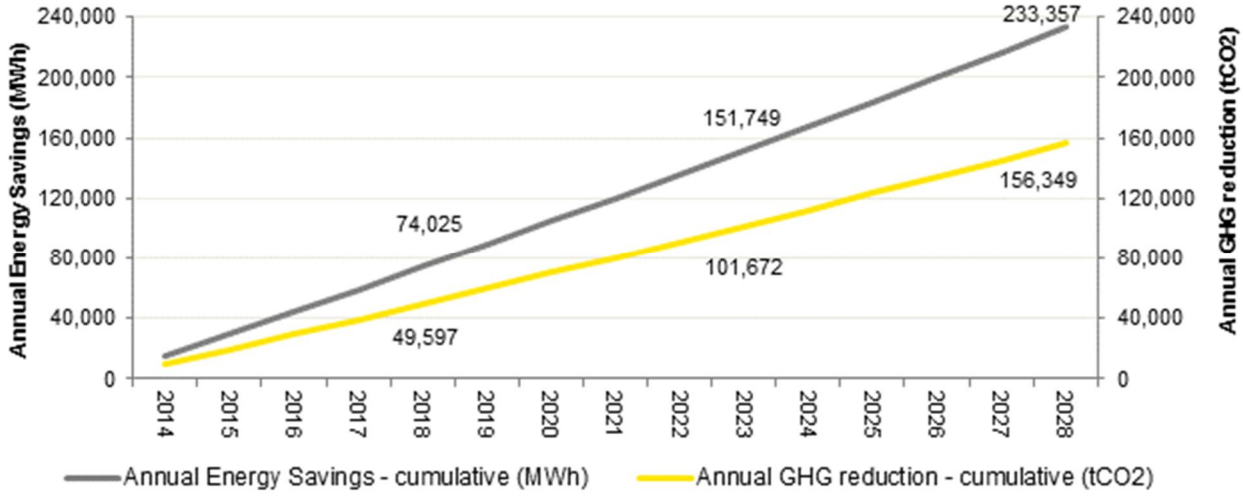
Expected energy and GHG savings in Jordan due to implementation of the S&L programme:

Figure 11: Estimated annual energy and GHG reduction (D to A) for washing machines



Scenario 2: D to A+ (washing machines)
Expected energy and GHG savings in Jordan due to implementation of the S&L programme:

Figure 12: Estimated annual energy and GHG reduction (D to A+) for washing machines



Refrigerators

Annual sales of refrigerators in the Jordanian market are currently around 93,816 and almost 100% of households have refrigerators. Two scenarios are considered for calculating energy and GHG savings:

Scenario 1: Shift from class “D” to “A”
Scenario 2: Shift from class “D” to “A+”

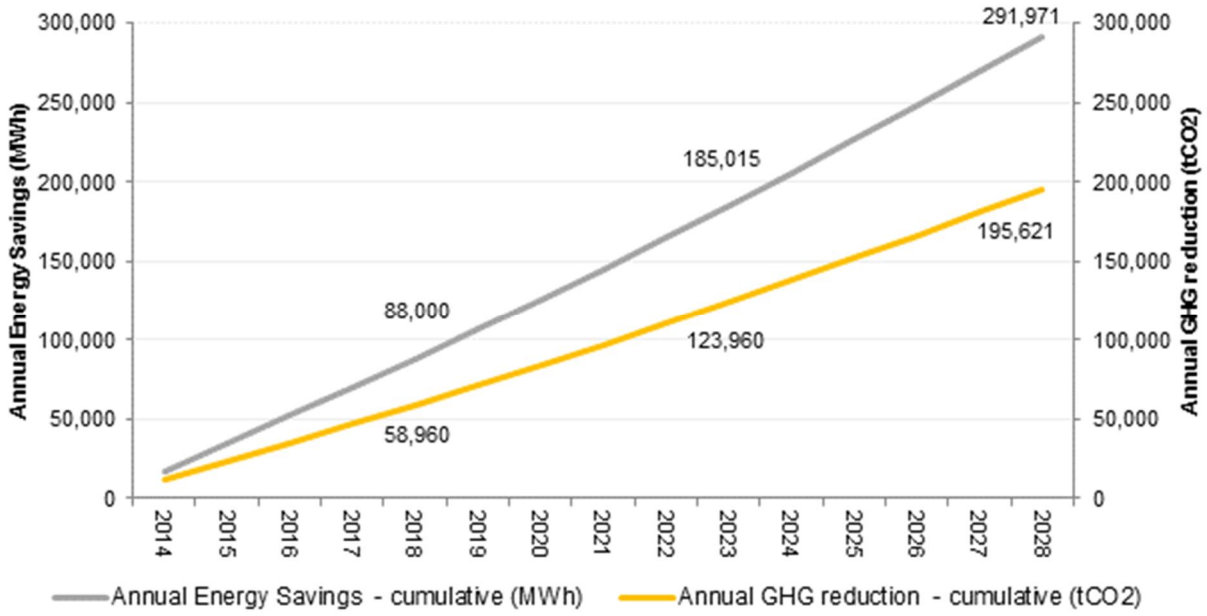
The assumptions for calculations for energy and GHG savings for refrigerators are:

- Market size: 93,816 (refer to Chapter 3)
- Market growth rate: 3%
- Technology improvement factor: 1% per year
- CO_2 emission factor for electricity in Jordan: 0.67 tCO_2e/MWh
- BAU efficiency class for refrigerator: “D”
- Assessment period: 15 years

Scenario 1: D to A (refrigerators)

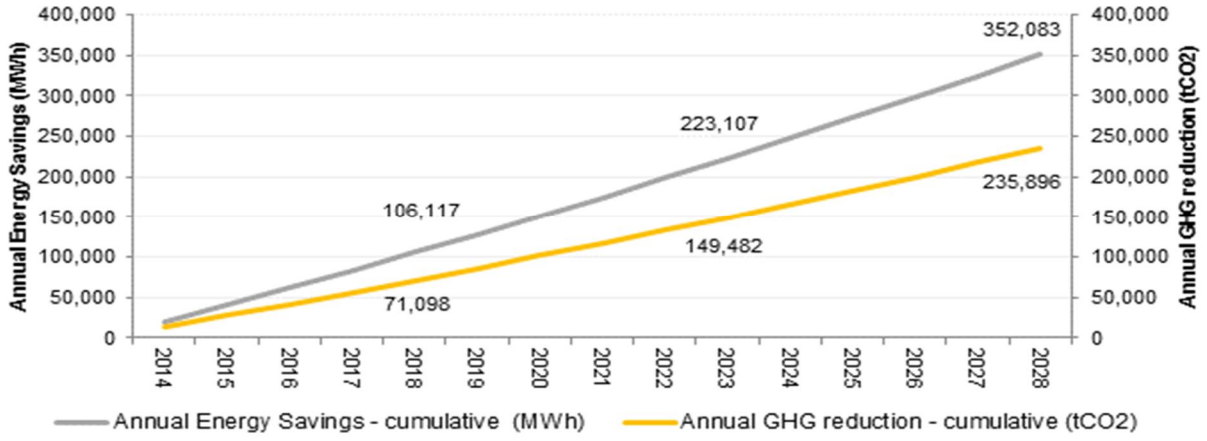
Expected energy and GHG savings in Jordan due to implementation of the S&L programme:

Figure 13: Estimated annual energy and GHG reduction (D to A) for refrigerators



Scenario 2: D to A+ (refrigerators)
Expected energy and GHG savings in Jordan due to implementation of the S&L programme

Figure 14: Estimated annual energy and GHG reduction (D to A+) for refrigerators



Freezers

Currently, annual sales of freezers in the Jordanian market are around 25,747 and around 25% of households have freezers. Two scenarios are considered for calculating energy and GHG savings:

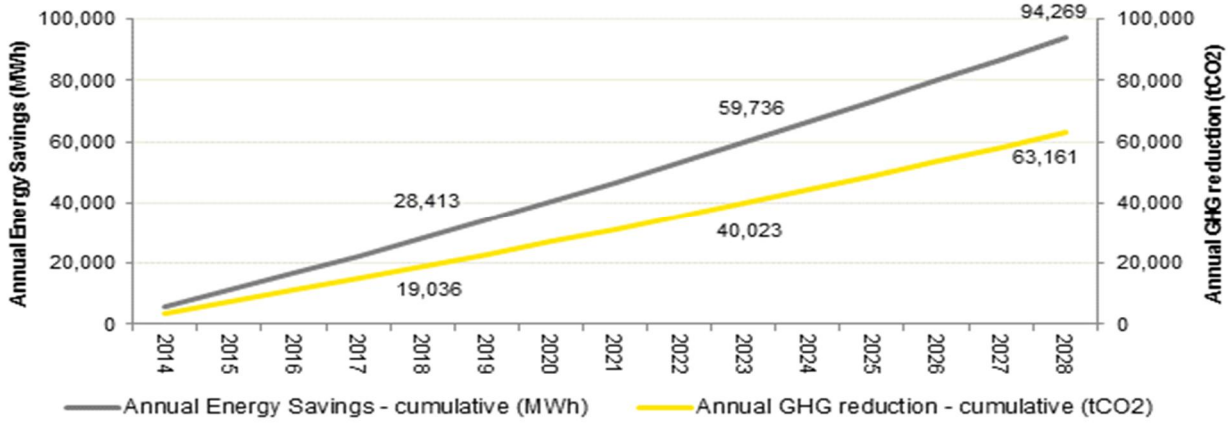
Scenario 1: Shift from class “D” to “A”
Scenario 2: Shift from class “D” to “A+”

The assumptions for calculations for energy and GHG savings for freezers are:

- Market size: 25,747 (Refer to Chapter 3)
- Market growth rate: 3%
- Technology improvement factor: 1% per year
- CO_2 emission factor for electricity in Jordan: 0.67 TCO_2e/MWh
- BAU efficiency class for refrigerator: “D”
- Assessment period: 15 years

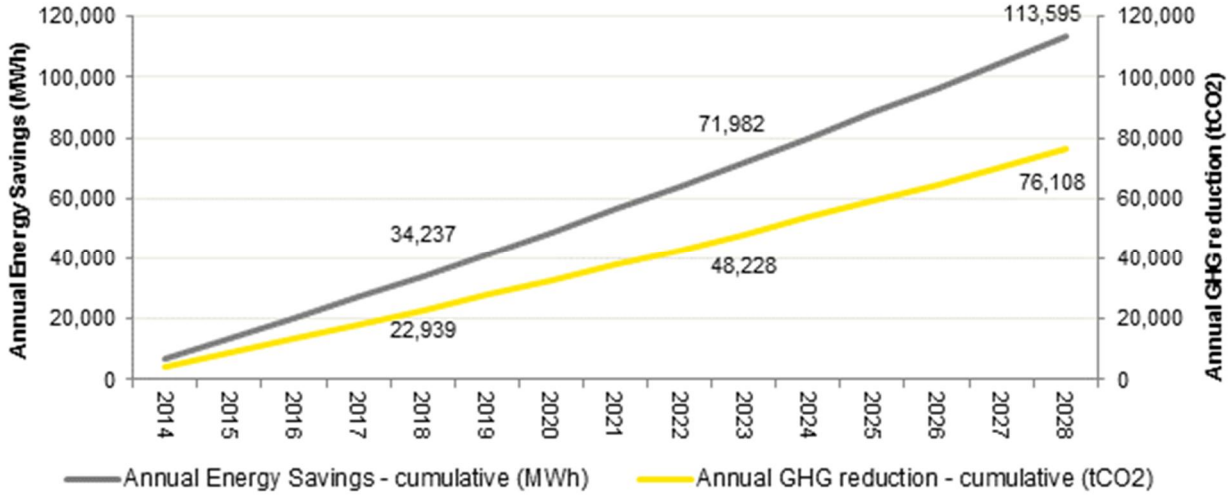
Scenario 1: D to A (freezers)
Expected energy and GHG savings in Jordan due to implementation of the S&L programme:

Figure 15: Estimated annual energy and GHG reduction (D to A) for freezers



Scenario 2: D to A+ (freezers)
Expected energy and GHG savings in Jordan due to implementation of the S&L programme:

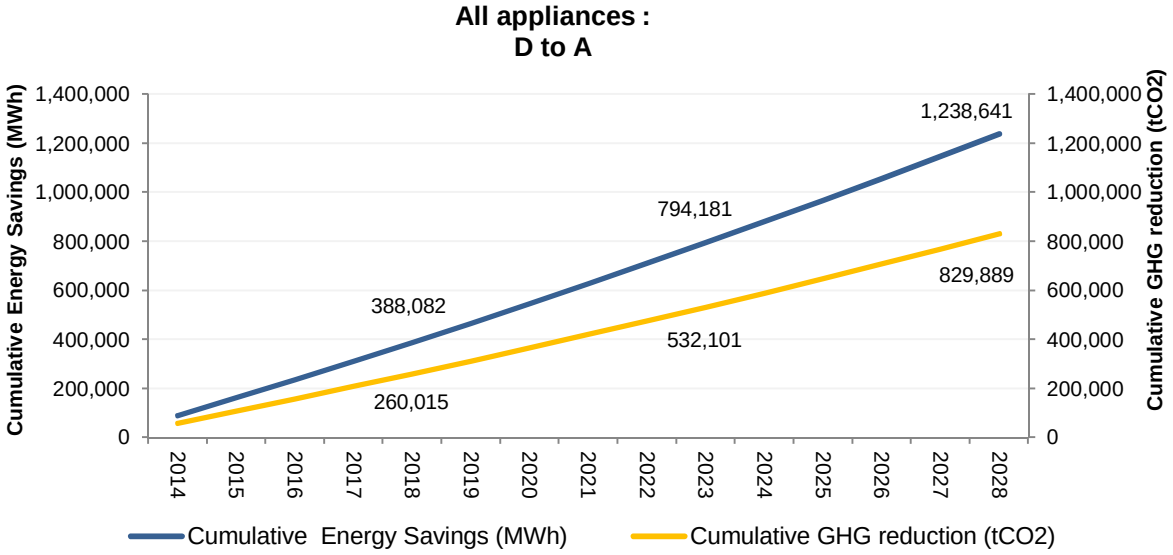
Figure 16: Estimated annual energy and GHG reduction (D to A+) for freezers



5.2 The overall impact of the S&L programme on country-level GHG emissions

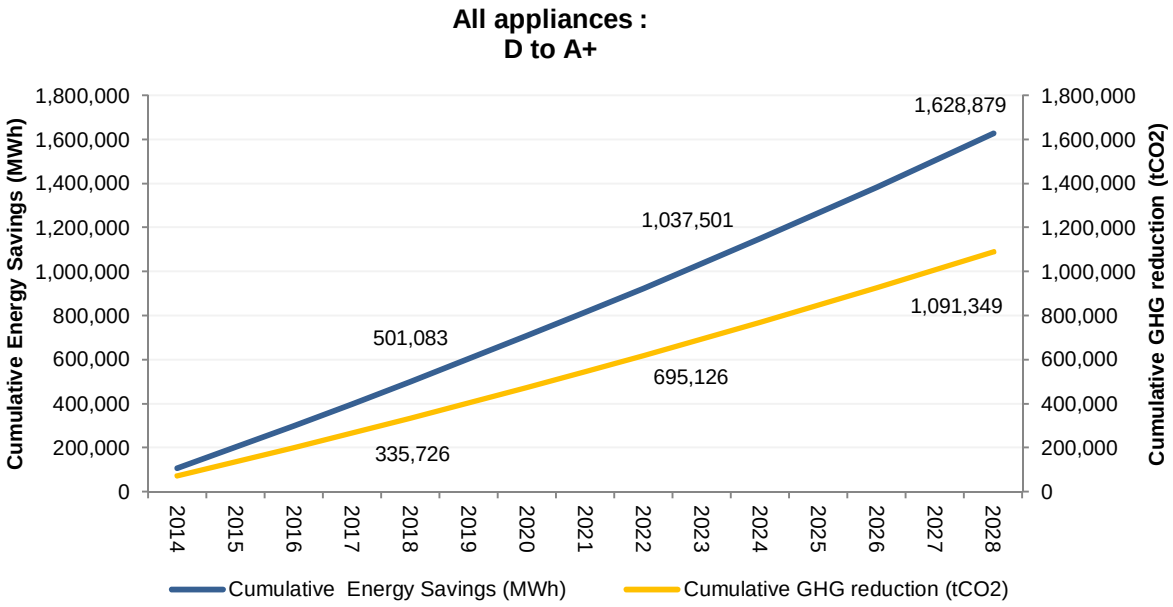
The composite graphs of annual energy savings and annual GHG reductions from all four appliances over their estimated lifetimes for the different scenarios – i.e. “D” to “A’ and “D” to “A+” – are shown below.

Figure 17: Estimated annual energy and GHG reductions (D to A) for all appliances



If class "A" rated appliances replace all class "D" rated appliances in use, the estimated cumulative energy savings by 2028 would be 1,238 GWh. This would represent a 32% reduction in the demand for energy (kWh) and a 32% reduction in GHG emissions by 2028, compared with the BAU scenario.

Figure 18: Estimated annual energy and GHG reduction (D to A+) for all appliances



If class "A+" rated appliances replace all class "D" rated appliances in use, the estimated cumulative energy savings by 2028 would be 1,628 GWh. This would represent a 39% reduction in energy consumption (kWh) and a 39% reduction in GHG emissions by 2028 compared with the BAU scenario.

5.3 Marginal Abatement Cost Curves (MACCs)

Marginal abatement cost curves (MACCs) are used in this study to assess the level of energy savings and GHG mitigation which a range of measures under the S&L programme would deliver at any given point in time, against a projected baseline level of electricity consumption. Each MACC builds in the expected lifetimes of the appliances: the estimated lifespan for ACs, refrigerators, freezers and washing machines are 10 years, 10 years, 15 years and 15 years, respectively.

5.3.1 MACCs: Energy Savings

A MACC can show how much electricity (in MWh) each appliance standard and label could save and the associated cost per MWh of the saved electricity. Each measure is represented by a single bar on the MACC.

- The width of the bar represents the amount of abatement potential available from each S&L measure (in MWh/year). The total width of the MACC shows the total electricity savings available from all S&L measures.
- The height of the bar represents the unit cost of the S&L measure (the cost per MWh saved). S&L measures are ranked according to their unit cost. More cost-effective measures are on the left-hand side and below the horizontal axis; these measures save money as well as electricity. More expensive measures are shown on the right-hand side of the MACC. To assess which measures are available up to a given unit cost, a horizontal line can be drawn across the MACC to see which measures lie under this line.
- The area (height × width) of the bar represents the total cost of the S&L measure: i.e. how much it would cost altogether to deliver all the electricity savings (MWh) from the S&L measure (or, for measures below the horizontal axis, how much money would be saved if all the electricity savings are achieved). The sum of the areas of all the bars in the MACC represents the total resource cost to deliver the total electricity-saving (MWh) opportunities.

The MACCs presented here for appliance energy efficiency through the implementation of the S&L programme show *technical* electricity savings potential for the entire local appliance market. Here, two scenarios are considered for the development of the MACC.

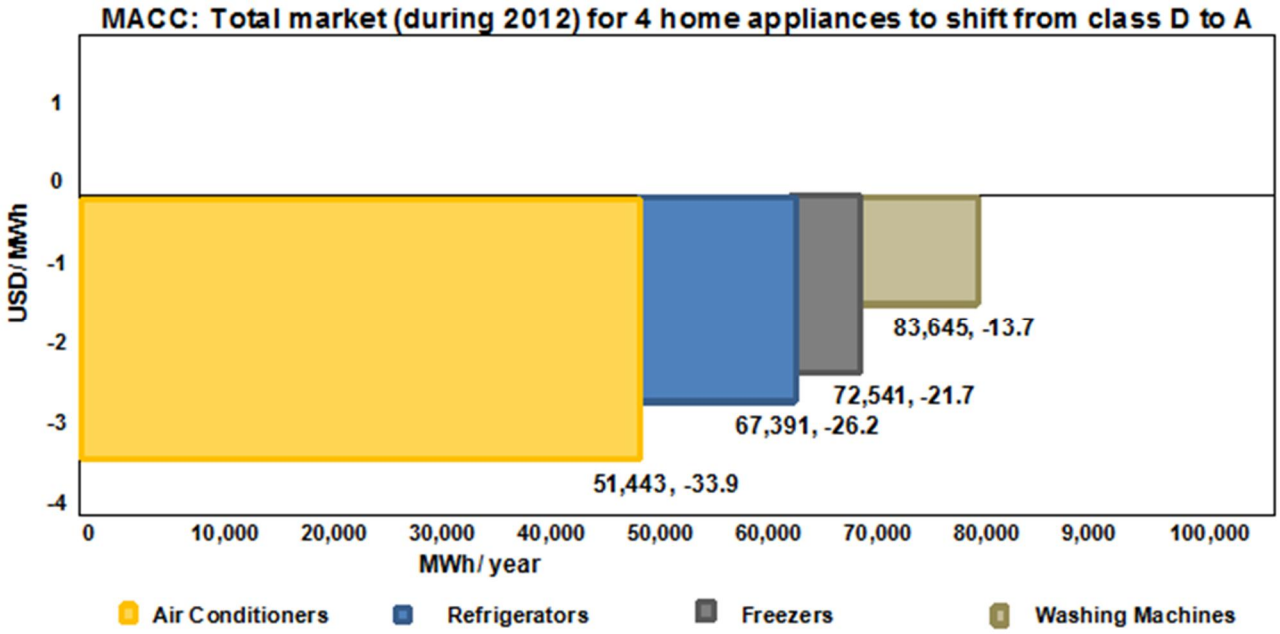
Scenario 1: All appliances shift from energy efficiency class “D” to “A”
Scenario 2: All appliances shift from energy efficiency class “D” to “A+”

The entire Jordanian local market is considered for these two cases.

Scenario 1: the shift of all appliances from energy efficiency class “D” to class “A”
For ACs and refrigerators, the marginal abatement cost is -33.92 USD/MWh and -26.15 USD/MWh, respectively. A negative MACC means that the measures are self-financing and generate cost savings of 33.92 USD/MWh and 26.15 USD/MWh for ACs and refrigerators respectively, and offer favourable returns on investment. The GHG abatement potential of freezers and washing machines is relatively low, but their marginal abatement costs are still negative. Therefore, these measures are also self-financing (from the consumer’s perspective), but less financially attractive.

The total area under the rectangle for each case indicates the total savings in monetary terms achieved by a particular appliance by shifting from category “D” to category “A”. For example, the shift from the “D” to “A" category for ACs would enable a saving of USD 1,744,903 every year. For all the appliances, the total saving would amount to USD 2,426,054 for 2012 alone. If we take the lifetimes of the appliances into consideration, the total savings would amount to USD 34,304,992.

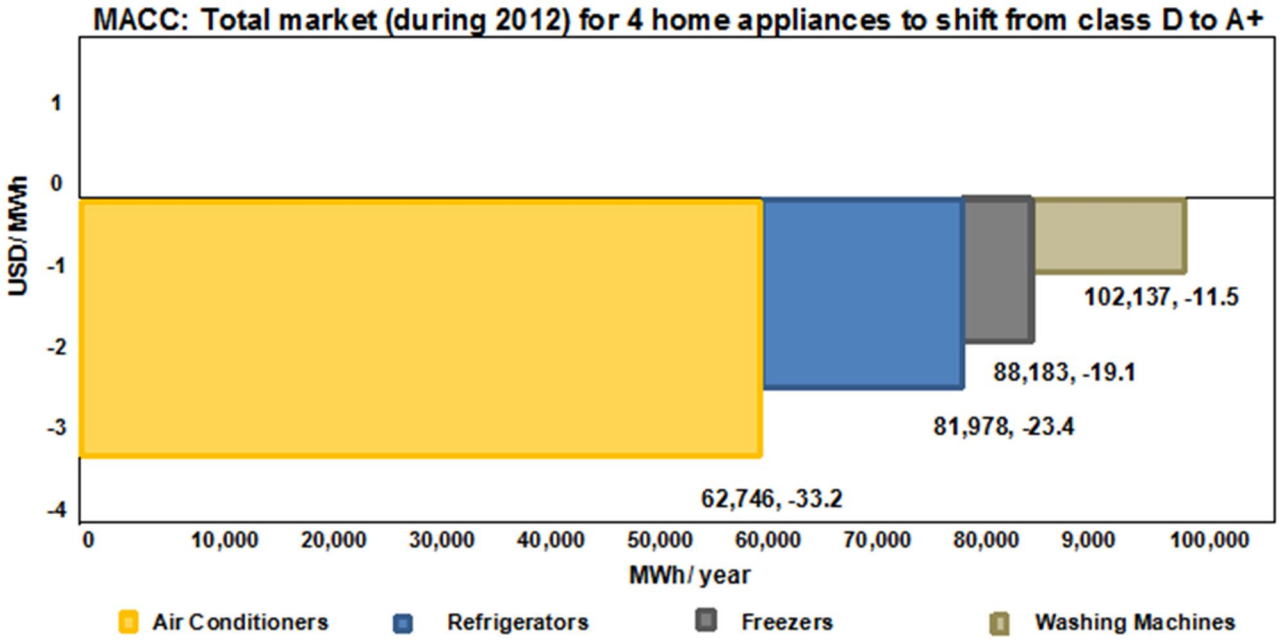
Figure 19: MACC for scenario 1 - Electricity savings and associated cost



Scenario 2: All appliances shift from energy efficiency class "D" to "A+"

For ACs and refrigerators, the marginal abatement cost (USD/MWh) is -33.15 USD/MWh and -23.44 USD/MWh, respectively. A negative MACC means that the measures are self-financing and generate cost savings of 33.15 USD/MWh and 23.44 USD/MWh for ACs and refrigerators respectively. Therefore, these are the most favourable abatement options. The energy savings potential of freezers and washing machines is relatively low, but their marginal abatement cost is still negative. Therefore, these measures are also self-financing (from the consumer's perspective), but less financially attractive.

Figure 20: MACC for scenario 2 - Electricity savings and associated cost



The total area under the rectangle for each case indicates the total saving in monetary terms achieved by a particular appliance by shifting from the "D" to the "A+" category. For example, the shift from the "D" to "A" category for ACs would enable a saving of USD 2,080,156 every year. For all the appliances, the total saving would amount to USD 2,809,922 for 2012 alone. If we take the lifetimes of the appliances into consideration, the total savings would amount to USD 39,895,023.

Though immediate incremental cost seems to be a barrier, analysis using marginal abatement cost curves (MACCs) shows that all energy-efficient appliances pay for themselves over their lifetimes. The average payback period varies between appliances: AC has an average payback period of 1-2 years; refrigerators around 3 years; and freezers and washing machines 4-6 years.

5.3.2 MACC: GHG abatement

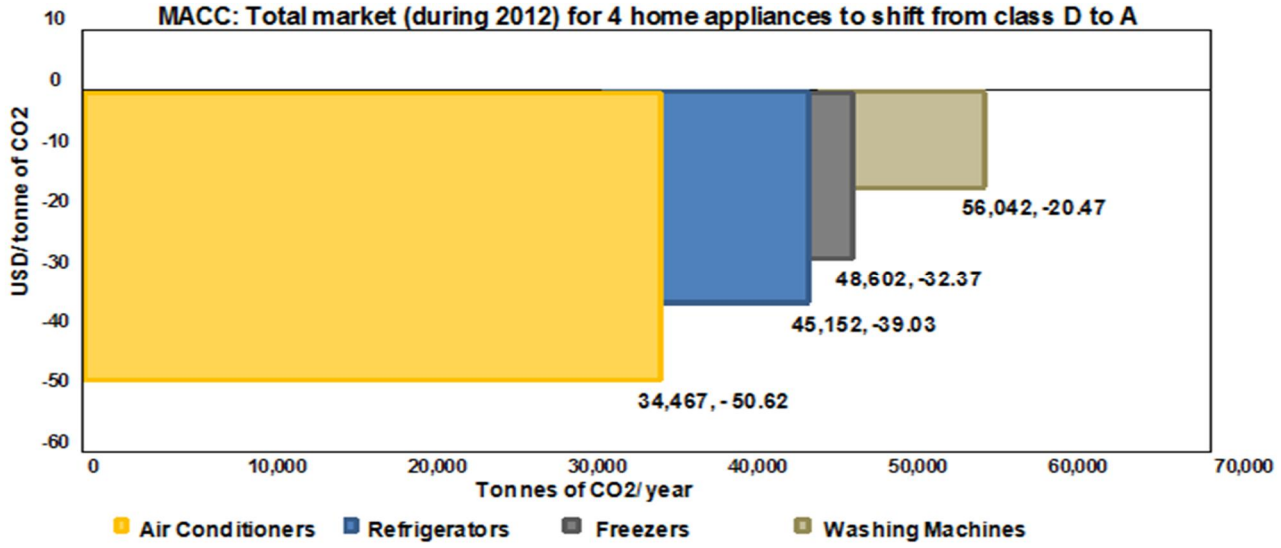
To understand the impact of the S&L programme on climate change, a second set of MACCs has been developed. These MACCs show how much CO_2 each measure could save and the associated cost per tonne of CO_2. The MACCs presented here for appliance energy efficiency through implementation of the S&L programme show technical abatement potential. Here, two scenarios are considered for the development of the MACCs.

Scenario 1: All appliances shift from energy efficiency class "D" to "A"
Scenario 2: All appliances shift from energy efficiency class "D" to "A+"

The entire Jordanian local market is considered for these two cases.

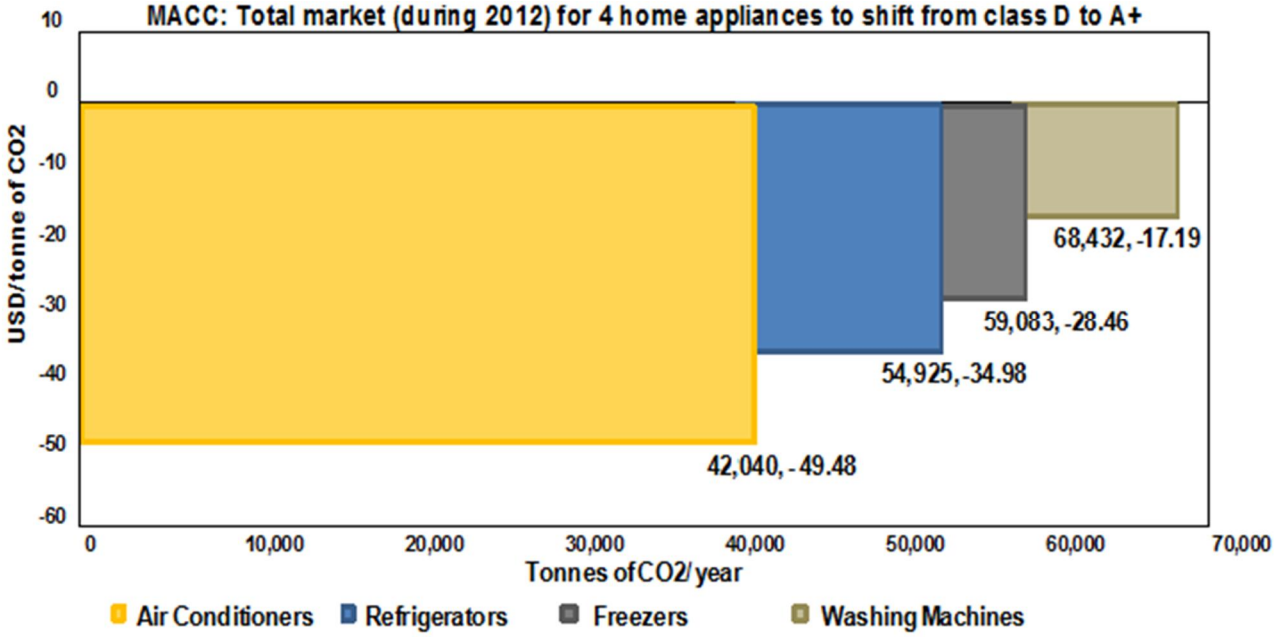
Scenario 1: All appliances shift from energy efficiency class "D" to "A"
For ACs and refrigerators, the marginal abatement cost is -50.62 USD/tonne and -39.08 USD/tonne, respectively. A negative MACC means that the measure is self-financing and generates a cost saving of 50.62 USD/tonne and 39.08 USD/tonne for ACs and refrigerators respectively. Therefore, these are the most favourable abatement options. The GHG abatement potential of freezers and washing machines is relatively low, but their marginal abatement cost is still negative. Therefore, these initiatives are also self-financing (from the consumer's perspective), but less financially attractive.

Figure 21: MACC for scenario 1 – GHG abatement and associated cost



Scenario 2: All appliances shift from energy efficiency class "D" to "A+"
For ACs and refrigerators, the marginal abatement cost is -49.48 USD/tonne and -34.98 USD/tonne, respectively. A negative MACC means that the measure is self-financing and generates a cost saving of 49.48 USD/tonne and 34.98 USD/tonne for ACs and refrigerators respectively. Therefore, these are the most favourable abatement options. The GHG abatement potential of freezers and washing machines is relatively low, but their marginal abatement cost is still negative. Therefore, these initiatives are also self-financing (from the consumer's perspective), but less financially attractive.

Figure 22: MACC for scenario 2 – GHG abatement and associated cost


MACC: Total market (during 2012) for 4 home appliances to shift from class D to A+
USD/tonne of CO2
10
0
-10
-20
-30
-40
-50
-60
0
10,000
20,000
30,000
40,000
50,000
60,000
70,000
Tonnes of CO2/ year
42,040, - 49.48
54,925, -34.98
59,083, -28.46
68,432, -17.19
Air Conditioners
Refrigerators
Freezers
Washing Machines

6. Review of the second-hand market

Information available on sales volumes of home appliances in second-hand markets is sparse. Jordan has a thriving second-hand market for automobiles but not for household appliances. Estimates indicate that the country's second-hand market for the four appliances surveyed is relatively small. Moreover, sales of second-hand household appliances is concentrated in rural areas. Immediate implementation of a MEPS scheme in Jordan (without adequate transition time) may result in a group of price-sensitive consumers turning to the second-hand market to purchase household appliances.

If there is a significant increase in the average prices of new energy-efficient appliances and no change in the cost of used models in the second-hand market, there may be an increase in the number of cost-sensitive buyers purchasing used appliances. The tendency of consumers to buy used appliances, in preference to purchasing new models, may increase slightly and may act to offset to some degree the projected energy benefits of the mandatory S&L programme. In the Jordanian context, this effect is judged likely to be moderate and to not significantly affect the projected benefits of the S&L programme.

NERC (2012) has conducted a consumer survey[30] to assess the impact of the S&L programme on the home appliance market. The study indicates that 15% of respondents will buy used home appliances if the market only offers costly energy-efficient home appliances. There may be an increase in the sale of second-hand appliances if an additional supply of used appliances is available to cater for the increased demand. However, since the price of new energy-efficient appliances will tend to fall over time, the additional demand in the second-hand market will also fall. This study does not foresee a long-term impact on the second-hand market due to the implementation of the S&L programme for EE home appliances.

[30] Survey of Consumer Behaviour and Preferences Regarding Energy Efficiency Home Appliances - Consolidated Report "Survey Results – National Level" 2012: NERC.

7. Actionable recommendations to assist manufacturers and suppliers

This chapter elaborates actionable recommendations that have been implemented to promote S&L or demand-side management programmes in other economies and their relevance to Jordan. The following are some recommendations for successful implementation of an S&L programme:

1. Early response to the S&L programme: manufacturers or suppliers taking first-mover advantage will benefit from adequate time to respond to the S&L programme through normal re-design processes, as compared to their competitors who respond too late.
2. Use of technological innovations in appliance-level energy efficiency from other economies with mature S&L programmes.
3. Sourcing from suppliers that have existing facilities for the manufacture of components of energy-efficient appliances.
4. Use of new and existing consumer awareness programmes developed to promote energy efficiency.

In addition to the recommendations given above, Government authorities are expected to play a pivotal role in successful implementation of the S&L programme in Jordan. They may provide support to domestic market players by developing appropriate operational frameworks and financial mechanisms to accelerate acceptance of the S&L programme in the country.

7.1 Operational framework

The operational framework may include[31]:

Policy development: A national policy framework for EE S&L, including:

- Policy objectives and targets
- Legal framework for enforcing compliance
- Defining organizational mandates, roles and responsibilities
- Approach to international harmonization of testing procedures, performance standards and label categories
- Mutual recognition of test results in a region

Introduction to the market: A national strategy for the introduction of EE S&L in the market:

- Education and training of supply chain stakeholders — suppliers, manufacturers, importers and retailers
- Enhancing awareness of consumers
- Promotional activities by the Government (in collaboration with manufacturers, retailers, consumer forum, utilities and NGOs)

Verification and enforcement: Organizations and procedures to check compliance with EE S&L legislation, including:

- Testing infrastructure to verify energy performance of products by setting up national test laboratories or providing access to laboratories in other countries
- Establishing procedures to verify the energy performance of products, including rules on obtaining products for testing, allowed test “tolerances” and legal follow-up on non-compliance
- Establishing procedures to verify sale of products (allowed by standards and properly labelled) in retail channels
- Training of inspectors to verify retail channels

Capacity building and awareness development

A proper plan for capacity building and awareness needs to be prepared with the initiation of the S&L programme in the country. The focus areas would include:

[31] *Policies that Work: Introducing Energy Efficiency Standards and Labels for Appliances and Equipment* (Energy Charter Secretariat,2009).

a. Production facilities

There will be changes in the manufacturing facilities and the local manufacturers will have to train their employees accordingly. Proper training is required to ensure that the manufactured products comply with the regulations. Furthermore, manufacturers need to train their after-sales workforces so that issues arising after sales are addressed effectively.

b. Retailers

Manufacturers need to guide retailers and ensure that they and their staff are adequately trained to handle queries regarding labelled products and are able to effectively communicate the advantages of these goods to consumers.

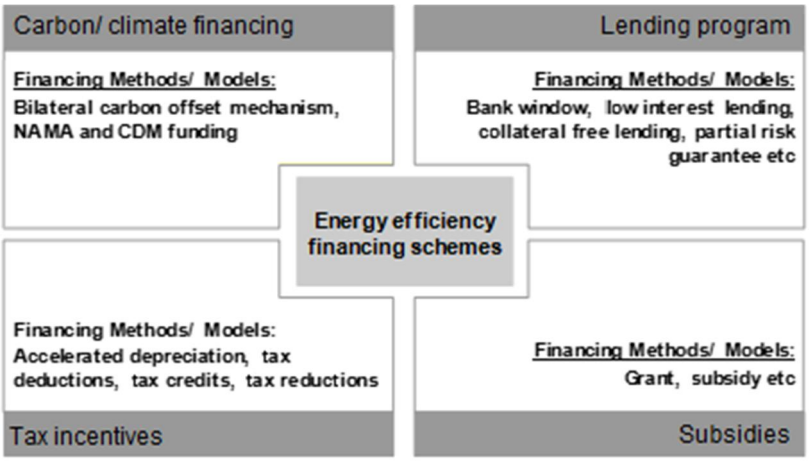
c. Consumers

Manufacturers should launch awareness campaigns that target consumers and highlight the benefits of using labelled products vis-à-vis non-labelled ones. These campaigns will be retailer-, importer- and manufacturer-led as opposed to Government-led. To ensure that the programme is effective, private sector-led campaigns that directly target brand loyalty and awareness are significant factors that tend to result in private sector-led campaigns being more effective than public sector-led ones. This helps to increase the acceptability of labelled appliances in the market.

7.2 Financing mechanism to support S&L programme

The financing options used globally and found to be effective for the implementation of energy efficiency programmes are given below:

Figure 23: Types of financing options



The major barriers and enablers that are encountered by countries that have implemented each of the above financing options to promote energy efficiency include:

Table 13: Financing options for appliance-level energy efficiency

Financing mechanism	Key barriers	Identified enablers	Country initiatives
Tax incentive	► Free riders ► Negative impact on Government budget	► Creation of a prioritized list of eligible technologies and appliances ► Accumulation of public funds by introducing energy efficiency and dispersing funds collected among beneficiaries ► Careful drafting of policies and regulations to discourage free riders	► Tax credit – France ► VAT reduction – France ► 10% tax deduction in 2011 – Korea ► 0% customs duty on Energy Star products from 2013 – Turkey and Caicos Islands
Subsidies	► Free riders ► Negative impact on	► Careful drafting of policies and regulations to discourage free riders;	► Introduced non-revolving fund to bring down interest

Financing mechanism	Key barriers	Identified enablers	Country initiatives
	Government budget	administering these stringently	rates – US
Lending programmes	► High risk perception ► High transaction costs ► Collateral ► Weak repayment ► Lack of knowledge and confidence in savings	► Partial risk guarantee funds for EE investment ► New funding mechanism such as revolving funds for lending to support energy efficiency ► Development of standard operating manual for bankers to dispense EE funds ► Creation of a list of eligible technologies and appliances	► Energy efficiency lending – Japan ► Partial risk guarantee fund (PRGF), Credit Guarantee Fund Trust for Micro and Small Enterprises (CGTMSE) – India ► Fonds de Garantie des Investissements de Maîtrise de l'Energie (FOGIME) – France ► On-bill financing – US
Carbon/ climate financing	► High transaction costs ► Non-availability of upfront funds ► Currently low carbon prices	► CDM Programme of Activities (PoA) ► Nationally Appropriate Mitigation Action (NAMA) ► Other carbon market standards and initiatives	► CDM – India, China, Brazil, etc. ► Bilateral Offset Credit Mechanism (BOCM) – Japan

7.2.1 Tax incentive

Taxation can be a powerful tool to stimulate energy efficiency by providing incentives through tax exemption and incentive regimes related to capital gain tax, property tax, VAT and accelerated or free depreciation.

Taxation of energy can be a motivator for users (especially large energy consumers) undertaking energy efficiency actions. For detailed examples, see the Joint Research Centre (JRC) report on Voluntary Agreements[32]. In addition, in some countries, such as the Netherlands and Sweden, a tax shift was witnessed, imposing increased taxes on natural resources and environmental polluting activities, and using the revenues to reduce taxation related to labour (e.g. income tax). Similar analogies, such as levying a carbon tax on polluters, can be implemented and the funds collected used to provide tax relief for manufacturers and suppliers of energy-efficient appliances. This may accelerate investment in energy efficiency without placing an additional burden on the exchequer.

Accelerated depreciation on investments in energy-efficient equipment motivates companies to invest in developing energy-saving technologies. The Dutch Vamil scheme is an example of successful accelerated depreciation of designated equipment placed on a green fiscal list. Similarly, France has an accelerated depreciation scheme to promote industrial energy efficiency.

Another form of tax allowance is a tax credit, whereby, in addition to normal rules for tax allowances, a percentage of the investment cost of approved technologies can be used to offset corporate profit taxes. Exemption of reduced rates of taxation on corporate profits is occasionally provided for environment-friendly activities. France and Italy have established tax credits to promote energy efficiency in the country.

A regime of differentiated VAT may either function as an encouragement to efficiency improvements or discourage inefficiency. For instance, in some countries, VAT for environment-friendly products related to energy savings is reduced (e.g. in the Czech Republic).

7.2.2 Subsidies

Governments can help in closing financial gaps, catalyze private investment and accelerate the energy efficiency of market transformation through financial and non-financial interventions. Given that the majority

[32] http://ec.europa.eu/dgs/jrc/downloads/jrc_ar_2012.pdf

of EE technologies are commercially competitive, public financing may be an option for incentivizing private financing rather than substituting it.

There is a wide range of finance mechanisms, including grants and subsidies used by public funds, to support energy efficiency. Grant programmes (investment grants or interest rate subsidies) are often provided by governments to support the upfront cost of energy efficiency projects (e.g. investment in upgrading production lines in this case) that may require too high an investment and long amortization periods. Subsidies on investments increase the financial rate of return on investments (ROI), increasing investors' demand for them. In addition, investment subsidies improve cash flow and thereby increase investors' access to debt finance.

Government of Jordan working on establishing Renewable Energy and Energy Efficiency Fund

The Jordan's Renewable Energy and Energy Efficiency Fund (JREEF) will be a key energy policy instrument that will contribute to the development of renewable energy and energy efficiency in Jordan. The fund is conceived considering the diversity of renewable energy resources in the country and the potential for energy savings, reflecting the country's pattern of energy consumption. Proposed JREEF windows will provide support at each stage of development, from the demand for renewable energy and energy efficiency through public awareness and training, to the early stage of project preparation, and access to credit and equity financing. The Government is committed to providing credible and substantial financial resourses to the Fund in addition to donor resources that will be dedicated to it.

The JREEF will be established after the implementation of the new Renewable Energy and Energy Efficiency Law, which has been approved by his Majesty King Abdullah of Jordan. Its functions will be determined on the basis of the specific regulations covering the powers, authorities, functions, structure and administration of the law.

Currently, the country's available national funds or funding tools include the Jordan Upgrading and Modernization Programme (JUMP), which is affiliated to the Ministry of Trade and Industry. This entity includes various activities within its funding pool, and energy efficiency is one of these. The fund is coordinated with Amman Chamber of Industry to provide assistance to Small and Medium Enterprises (SMEs). This assistance includes providing grants for energy audits conducted by local consultants. Furthermore, the funding entity provides limited grants for the implementation of energy efficiency measures.

The Higher Council for Science and Technology (HCST) provides small grants to conduct energy audits and implement energy efficiency measures through the Industrial Scientific Research Fund and the National Fund for the Support of Enterprises. However, not all the funds available or allocated by the HCST are dedicated to the achievement of energy efficiency. ESCOs can play a major role in funding and implementing energy efficiency measures. Unfortunately, they are few in number and do not have adequate budgets to play this role. Consequently, they have to request loans from local banks, which are usually not familiar with this kind of funding.

However, external sources of funding are available and contribute significantly to achieving energy efficiency in Jordan. These sources provide funds by implementing energy efficiency programmes, conducting applied research and pilot projects, building capacity, raising awareness and addressing other relevant policy issues.

A €35 million assistance package was allocated by the EU in 2011 for Jordan to provide critical support to energy efficiency and renewable energy. This assistance will provide the required support to roll-out the 2007-2020 energy strategy, which aims to achieve the ambitious goals of 10% energy production from renewable energies and 20% energy savings by 2020.[33] The table below provides a list of donor agencies that are providing funding to the energy and environment sector in Jordon (2009 onwards).

Table 14: Donor agencies active in energy and environment related funding.

Sectors	Institutions and Countries								
	EC	France	Greece	Netherlands	Sweden	EIB	WB	USA	Canada
Energy	■					■	■		
Environment		■	■	■	■	■		■	■

EC: European Commission
EIB: European Investment Bank

[33] http://europa.eu/rapid/press-release_IP-11-967_en.htm

WB: World Bank

 *= Indicates funding in the sector*

7.2.3 Lending programmes

Revolving funds
Revolving funds are intended to channel liquidity into markets that witness constraints in terms of access to financing and the amount of financing available. Revolving funds inject special purpose public finance into commercial finance systems. Revolving funds are self-sustaining financial schemes, which usually require a one-time initial investment. In the area of energy efficiency, a revolving fund could combine public sector grants and an adequate financing structure to fund energy efficiency, provide loan guarantees to cover default risks related to investments made to fund energy efficiency and provide adequate private sector loans. The advantage of revolving funds is that they are less dependent on external investors. If operated effectively, revolving funds can contribute to the establishment of a permanent financing structure for investments in energy efficiency initiatives — separate from political influence. The typical disadvantages encountered while using revolving funds in achieving energy efficiency include the fact that they require substantial upfront investment and may be cumbersome and expensive to administer. The latter complexity is, however, also inherent in subsidy schemes. Some of the donor agencies active in Jordan have suggested that revolving funds are not the best option to support EE programmes due to lack of expertise / technical knowledge among government agencies and private firms, as well as low awareness of the importance of such programmes among Jordanian customers.

Soft loans
Soft loans provide long-term financial coverage to help bridge pre-commercialization financing gaps in EE projects by providing direct subsidies on interest payments, risk premiums (e.g. an IFI or a state can guarantee a certain quantum of loans) or by means of capital gains for a revolving fund.

Credit lines and guarantee schemes for energy efficiency initiatives
Credit lines and guarantee schemes for EE are available in a number of countries. In some, these credit lines and guarantee schemes have been established with the support of public banks. For example, KfW in Germany, KredEx in Estonia, BPME and Ademe (the Fogime Guarantee Scheme) in France, the Bank for Environmental Protection in Poland, and Fidi Toscana and Finpeimonte in Toscana and Piedmont in Italy provide guarantees and/or on-lending to commercial financial institutions (CFIs). In Spain, the IDEA , a state-owned business entity that reports to the country's Ministry of Industry, Tourism and Trade, has a credit line for EE and acts as a financier to businesses. The Ministry of Economy and Foreign Trade in Luxembourg offers the status of EE partner to CFIs that provide a low interest rate for EE projects. In other countries, such as Bulgaria, Slovakia and Romania, credit lines and guarantee schemes have typically been established by International Financial institutions (IFIs) such as EBRD and the World Bank, targeting energy efficiency projects implemented by enterprises, local authorities and individuals. The IFC has also been active in the region with the CEEF programme, covering Hungary, the Czech Republic, Slovakia, Latvia and Lithuania. IFIs were very active during the "accession" period in these countries, often combining credit lines or guarantee schemes with advisory services to help build project pipelines. However, as with the case of subsidies, donor programmes need a degree of coordination to avoid the "crowding" effect and direct competition between programmes, as was the case in Bulgaria, where EBRD and the World Bank established facilities that targeted a similar group of borrowers. Some countries have established supportive frameworks to encourage banks to offer preferential loans for EE on their own initiative. The Netherlands is the leader in this respect with its Green Funds. These funds enable CFIs to offer preferential loans. Under the Livret de Développment Durable (LDD) scheme in France, banks must use a portion of the funds made available to them to offer preferential loans for residential energy conservation projects.

7.2.4 Carbon / Climate finance

Energy efficiency and clean technology require intensive initial capital investment. Although governments and organizations are willing to invest in greener technologies, the high investments required can be a barrier. To address this barrier, climate finance can be an option. Climate finance includes resources provided to projects that aim to reduce (or that are expected to reduce) greenhouse gas emissions (*World*

Bank, 2012). Financial risks and opportunities impact corporate balance sheets, and market-based instruments such as carbon finance are capable of transferring environmental risk and achieving environmental objectives. The most effective and globally accepted carbon financing mechanisms include:

- Cap and trade (e.g. the EU Emissions Trading Scheme, EU-ETS)
- Baseline and credit (e.g. the Clean Development Mechanism)
- National/regional schemes

7.3 Mapping financing schemes against stakeholders (manufacturers & suppliers/importers)

During initial discussions with stakeholders, it was observed that while some financing options may suit local manufacturers, others are more applicable for suppliers or importers. The table below depicts the appropriateness of each financing option with respect to each stakeholder group.

Table 15: Mapping financing schemes against stakeholders (manufacturers, suppliers or importers)

Financing mechanism	Benefits for manufacturers	Benefits for Importers/suppliers
Tax incentive	Import duty rebate on components required to manufacture EE appliances; VAT rebate on sale of EE appliances	Import duty rebate on import of EE appliances.[34] VAT rebate on sale of EE appliances.
Subsidies	Grant and subsidy programme to minimize the impact of investing in new product lines	-
Lending programmes	Revolving or soft loans to purchase new manufacturing equipment and upgrade facilities	-
Climate finance	Technology transfer attached to climate financing; reducing sale price of EE appliances through opening up additional carbon revenues	Reducing sale price of EE appliances through climate finance

The experiences of different countries in promoting standards and labelling by using fiscal incentives are provided in Annex V.

[34] However, any reduction in the customs duty of ready-to-use appliances may be contested by local manufacturers.

8. Conclusions

The Jordanian appliance industry comprises local manufacturers and importers which import appliances from other economies, including Korea, Japan and the US. The imported products constitute a major part (around 80%) of the annual appliances sold in the Jordanian market. This implies that the introduction of the S&L programme may not have a significant impact on the appliance market as a whole, since importers can readily supply compliant appliances to the market. However, local manufacturing, although limited, will be impacted, since manufacturers would need to transition from manufacturing energy-inefficient to energy-efficient appliances. The study has highlighted the following:

1. Local manufacturers will need to upgrade their facilities to produce energy-efficient appliances.
2. Changes will have to be made in the supply chain for components required to manufacture appliances that are compliant with the S&L scheme.
3. Employees will need to be trained, including production personnel and after-sales personnel.

For suppliers/importers of multinational brands, the operational impact will be lower than for local manufacturers. Suppliers/importers have a range of response options in the event their products fail the MEPS level. Importers can request their overseas manufacturers to improve designs, substitute more efficient models from their product range, or – if the importers are not tied to specific brands – they can even change suppliers. However, suppliers with a large number of non-compliant models will need to make additional effort to acquire or make compliant models.

Changes in local manufacturing will have a financial impact on manufacturers. Investment is required to upgrade manufacturing facilities, procure energy efficient (costlier) components and provide capacity building to the supply chain. This study indicates that the investment required is not significant for local manufacturers and can be achieved.

Additionally, for S&L implementation in Jordan, the Government may have to ensure the availability of well-equipped test laboratories within the country. This has to be achieved in a manner that makes testing of appliances economically viable for local appliance manufacturers. Currently, Jordan does not have well-equipped test laboratories and, if MEPS are applied, local manufacturers will not be able to test appliances and equipment within the country.

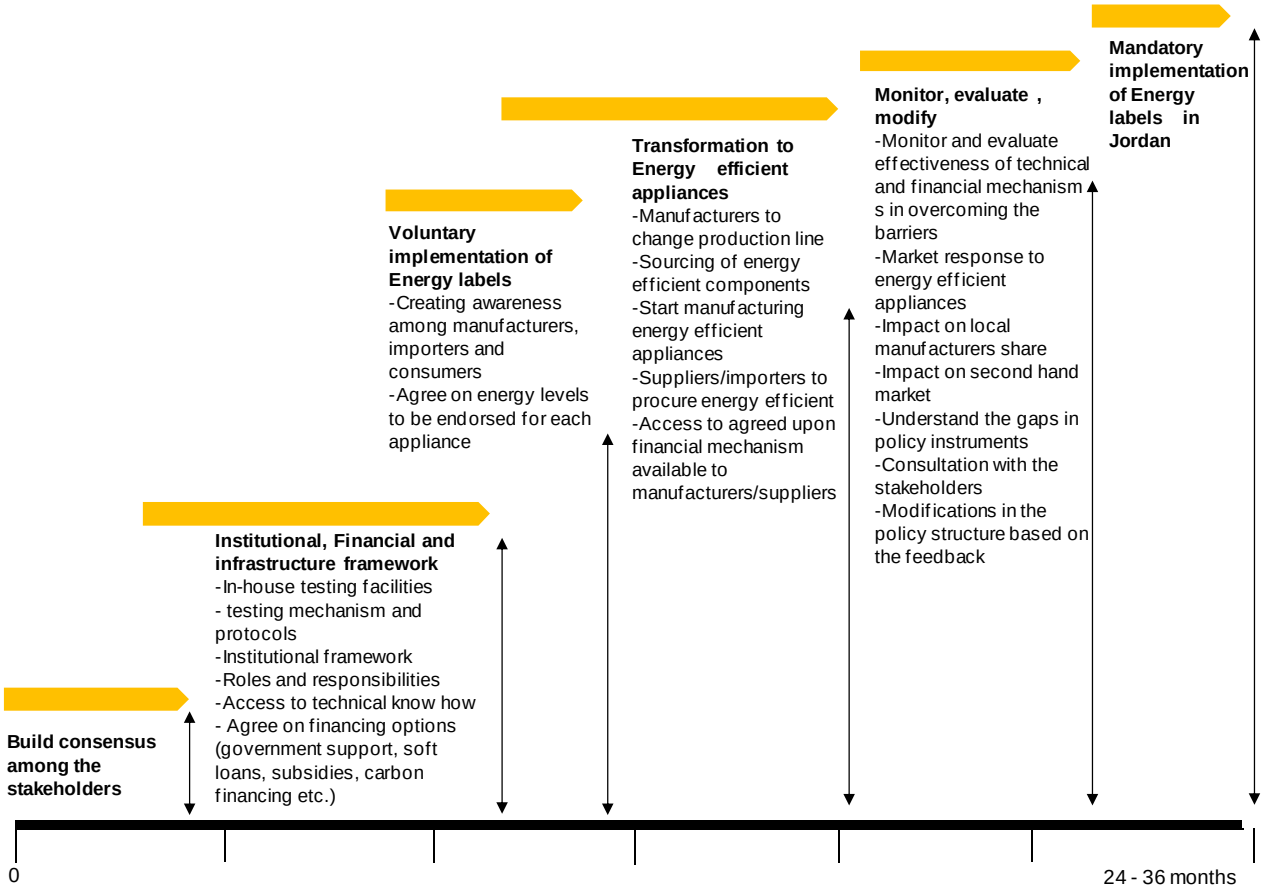
In countries such as Jordan, where the price of electricity is subsidized by the state and primary fuels are imported, the impact of introducing an S&L programme is expected to be significant. The marginal abatement cost curve indicates that the S&L programme in Jordan will become self-sustaining over a period of time, provided local suppliers and manufacturers are allowed an adequate transition period to comply with the new regulations. However, the implementation of the S&L programme can be fast-tracked through a programmatic approach supported by the Jordanian Government, development agencies and donors.

The implementation of the S&L programme is expected to generate significant economic benefits for Jordan:

a. The saving of electricity (subsidized), resulting in financial savings for the Government.
b. Savings in primary fuel (mainly imported), resulting in improved energy security for the country and a positive impact on foreign exchange reserves.
c. Significantly reduced GHG emissions and active contribution to global climate change initiatives.
d. The promotion of energy-efficient appliances in the market, leading to a technology upgrade in local manufacturing and potentially resulting in opportunities for local manufacturers to export their energy-efficient products to other markets.

An indicative action plan to address the challenges faced by local manufacturers and suppliers, to help them smoothly implement S&L regulations for the four electrical appliances mentioned, is depicted below.

Figure 24: Tentative roadmap for market transformation to energy-efficient appliances to address operational and financial challenges faced by local manufacturers/suppliers



This is based on the experiences of other countries that have already implemented these regulations. However, the timeline mentioned is indicative and can vary from two to three years, as mentioned earlier in the report.

Annexes:

Annex I:

Stakeholder workshop

The stakeholder workshop was organized by UNDP, NERC and Ernst & Young on 24 September 2012 at Jordan Enterprise Development Corporation (JEDCO), Amman, Jordan. The workshop was consultative in nature and witnessed the participation of a range of stakeholders including manufacturers, suppliers, importers, Government officials, test lab personnel and the project team members. The schedule of the workshop was as follows:

Table 16: Schedule of the workshop

Time	Activity	Name/Organization
10:00	Welcome note	Muhieddin Tawalbeh — NERC
10:10	Overview of energy efficiency S&L project	Mohammad Maaytah — UNDP
10:20	Overview of Technical Market Analysis assignment	Fadi AlShihabi — Ernst & Young
11:15	Round table discussion	All stakeholders
12:00	Closing of workshop	

Figure 25: Stakeholders' consultation workshop

Major input captured during the workshop:

- **Ernst & Young's team encouraged the stakeholders (including manufactures, suppliers and importers) to share their views on the implementation of the S&L programme in Jordan.**
- **Dr. Iyad Abu Haltam (Chairman, Eastern Amman Investors Industrial Association)** suggested that the report include a section on the time period manufacturers may require to comply with S&L

guidelines. He claimed that many manufacturers will not be able to implement S&L regulations by 2014, since the transition time provided under this regulation in its current form may not be adequate for them.

- **Response from Ernst & Young team**: While appreciating the apprehension shared by Mr. Iyad, the team suggested that UNDP, NERC and manufacturers should work together to identify and implement action to overcome these barriers. This will expedite the process of implementing the S&L programme in Jordan.
- **Mr. Ali Tamimi, Operations Manager, Haider Murad & Sons Investment Group:** Mr. Ali Tamimi shared the point of view of the traders on the additional cost of importing high-grade appliances and consumers' limited awareness of highly efficient appliances. According to Mohammad Yaser Mahani, Assistant General Manager of the Murad & Mahani Investment Group, such appliances are not attractive to the majority of consumers in the country due to their high cost. They are ready to pay premium prices for well-known brands, based on the country of origin of these appliances and their water consumption, and the amount of energy they consume is not a prime concern for them. He suggested an assessment of the possibility of the Government providing incentives for such appliances.
- **Eng. Fadia Abdulghani** from JSMO shared with the forum various actions or plans the organisation had been working on for the last two years. One of its activities included an intensive workshop in May 2012. The workshop aimed to develop energy efficiency standards in Jordan. JSMO has shared the draft with its stakeholders for their comments. Once the regulations are accepted in Jordan, they will be shared with the EU.
- **Eng. Hasib Salameh,** Director, Industrial Development, Jordan Chamber of Industry, shared his views on how the new regulations (that Eng.fadia had spoken about) could affect manufacturers. His submission was that the Government should review its Import Tax mechanism to promote manufacturing of energy-efficient appliances in the country. He indicated that the Chamber is supporting this regulation, but feels that adequate transition time is needed for consumers.

Annex II:

Case study: Assessment of Egypt's domestic manufacturing capacity

Before launching an EE appliance labelling scheme in Egypt, the team conducted a survey on domestic manufacturers to obtain detailed information on local product models, and their quantities and specifications. The team also assessed local manufacturers' capabilities regarding the proposed standards, export opportunities in the country, applied tests and the capability of testing facilities. In parallel, it reviewed international energy efficiency standards and programmes, from which it gained significant information.

- It was discovered that the energy consumption levels (in KWh) of locally-produced refrigerators were nearly double those of models produced in other countries. The annual electricity consumption per litre of the adjusted volume of internationally-produced refrigerators, compared with Egyptian models, amounted to around 2.69, 2.13 and 2.84 kWh for manual defrost, automatic defrost and no-frost refrigerators, respectively
- The energy consumption levels of locally-produced washing machines were found to be fairly competitive with those produced internationally. The horizontal-axis (front-loading) features of locally-produced washers were among the positive factors taken into account in gauging their market competitiveness. Furthermore, washing machines manufactured in Egypt were found to be superior to those produced internationally, especially in their new configuration, which is characterized by a jet pump system. This system accounts for a reduction of around 20% in the energy consumption levels of domestically-produced washing machines, compared with the traditional automatic models. The electricity consumption of the local machines for a 1kg load of clothes was 0.2 KWh for the jet-type and 0.24 KWh for the traditional automatic washing machines.
- The team discovered that two main types of ACs are sold in the local market – window units and split-configuration units. The energy consumption levels of local ACs were found to be close to internationally-produced models. This promoted the export-related ambitions of private-sector manufacturers to obtain the international export licence required to export their products to other markets.

The Ernst & Young team conducted this assessment in Egypt to gauge the technological gap between existing Egyptian products and those that were to be manufactured under the proposed EE standards.

Annex III:

Energy performance level of appliances available in Jordan

Table 17: Energy efficiency class of appliances currently sold in Jordan

Product	Imported / Local brands	Comments
ACs	Imported	During the assessment, the team observed that imported ACs are categorized under the energy efficiency classes C to A.
	Local	The energy efficiency class of local brands sold in Jordan range between classes E to D.
Washing machines	Imported	Imported brand washing machines are categorized under the classes A to A+++.
	Local	Local brands are categorized under the classes D to A.
Refrigerators	Imported	Imported brands are classified in energy efficiency brackets A to A+.
	Local	Local brands are categorized in the energy efficiency classes D to C.
Freezers	Imported	Imported brand freezers are classified in the brackets B to A+.
	Local	Local brands are categorized in the energy efficiency classes D.

Table 18: Appliances: Set 1 (imported brand products)

Product (ACs/freezers/refrigerators/ washing machines)	Size (TR/KG/liter)	Energy efficiency class based on EU labels (A+, A, B, C, etc)
ACs	1 tonne	Cooling D Heating C
ACs	1.5 tonnes	Cooling C Heating D
ACs	2.25 tonnes	Cooling B Heating C
ACs — Plasma	1 tonne	Cooling C Heating C
ACs — Plasma	1.5 tonnes	Cooling C Heating D
ACs — Plasma	2.25 tonnes	Cooling B Heating C
ACs — Inverter	1 tonne	Cooling A Heating A
ACs — Inverter	1.5 tonnes	Cooling A Heating A
ACs — Inverter	2.25 tonnes	Cooling A Heating C
Washing machines	5 kg	A
Washing machines	7 kg	A+
Washing machines	8 kg	A+
Washing machines	9 kg	A
Refrigerators	300-500 litres	A & A+
Refrigerators	510-700 litres	A & A+
Freezers	100-300 litres	A & A+

Table 19: Appliances: Set 2 (imported brand products)

Product (ACs/freezers/refrigerators/washing machines)	Model	Size (TR/KG/ liter)	Energy efficiency class based on EU label (A+, A, B, C, etc)
ACs	3 models	1, 1.5, 2	C
ACs	3 models	1, 1.5, 2	A
ACs	3 models	1, 1.5, 2	D/E
Washing machines	10		A-A+++
Washing machines	10		A-A+++
Refrigerators	25		A
Freezers	15 models		A

Table 20: Appliances: Set 3 (imported brand products)

Products (ACs/freezers/refrigerators/washing machines)	Model	Size (TR/KG/ liter)	Energy efficiency class based on EU label (A+, A, B, C, etc.)
ACs	6 models	1, 1.5, 2	A/C
Washing machines	11 models		A
Refrigerators	20 models		A
Freezers	8 models		B

Table 21: Appliances: Set 4 (domestic brands)

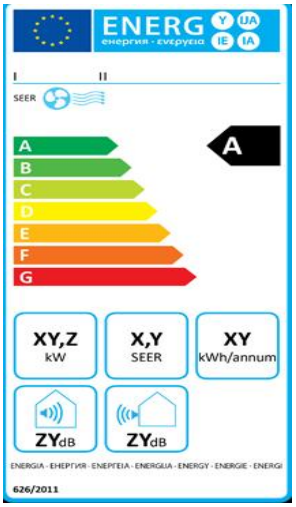
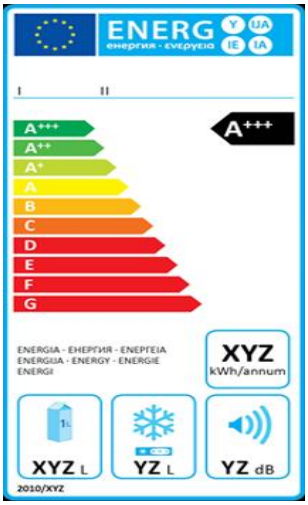
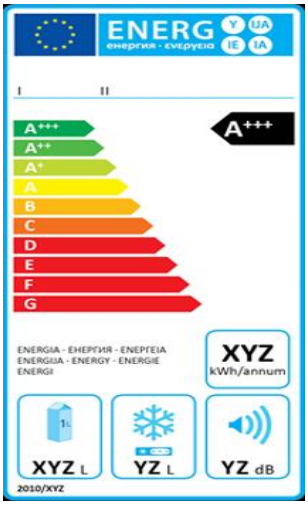
Products (ACs/freezer/refrigerators/washing machines)	Model	Size (TR/KG/ liter)	Energy efficiency class based on EU label (A+, A, B, C, etc.)
ACs	1 model	1.5 TR	D
Washing machines	1 model	7KG	D
Refrigerators	1 model	300L	D
Freezers	1 model	280L	D

Table 22: Appliances: Set 5 (domestic brands)

Products (ACs/freezers/refrigerators/washing machines)	Model	Size (TR/KG/ Liter)	Energy efficiency class based on EU label (A+, A, B, C, etc.)
ACs	NA	NA	E
Washing machines	NA	NA	A
Refrigerators	NA	NA	C
Freezers	NA	NA	NA

EU energy label

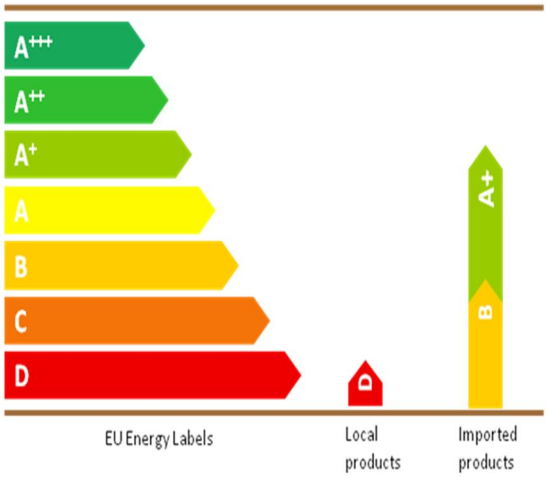
The basic elements of the label consist of 7 energy classes from A to G, where A is the most efficient and G is the least efficient. However, there is a provision for 3 additional classes, A+, A++, and A+++, which can be added to the current A-G classification scale. The classes available for appliances such as AC, refrigerators, freezers and washing machines are provided below:

Appliance type	Energy efficiency class available
Air conditioners	 7 classes
Refrigerators	  7 classes 10 classes
Freezers	  7 classes 10 classes

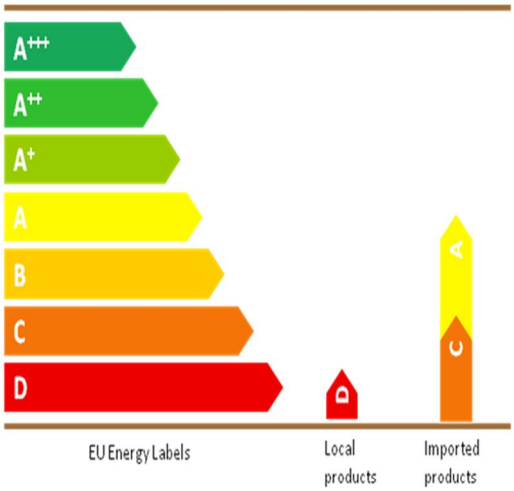
Washing machines	

Energy performance levels of electrical appliances in Jordan

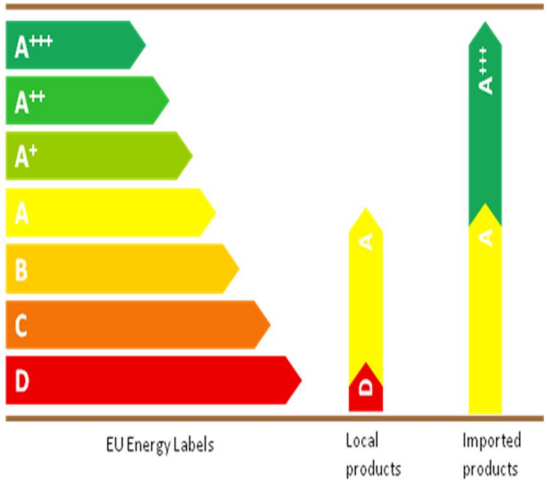
Freezers



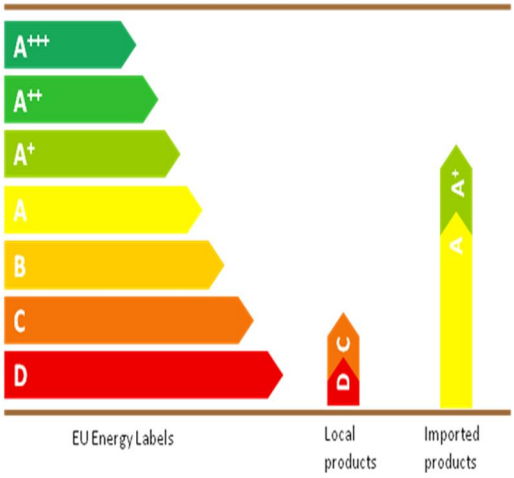
Air Conditioners



Washing Machines



Refrigerators



Annex IV:

Fiscal incentives promoting S&L — experiences of different countries

Fiscal Incentives promoting S&L	Beneficiary	Country
Appliance tax credit for manufacturers: ► US federal government-run programme, giving tax credit to manufacturers of energy efficient home appliances (washers, refrigerators and dishwashers) ► Source: American Recovery and Reinvestment Act (ARRA) through Energy Manufacturing Tax Credit (MTC) ► Credits available for models produced in 2008, 2009 and 2010	Manufacturers	USA
Energy efficient New Homes Tax Credit for home-builders, US ► Home builders eligible for a US$2,000 tax credit for a new energy efficient home that achieves 50% energy savings in heating and cooling over the 2004 International Energy Conservation Code (IECC) and supplements ► US$1,000 tax credit to new homes achieving 30% energy savings for heating and cooling over the 2004 IECC and supplements (at least one-third the savings from building envelope improvements) or a home that meets ENERGY STAR requirements	Developers of residential buildings	USA
DOE-sponsored R&D programme in the USA Number of programmes in the building sector through the Energy Policy Act of 2005, the Energy Independence and Security Act of 2007, and ARRA 2009. Total budget of $140 million (FY09, not including ARRA funding) focus on energy efficiency gains in: ► Building envelope ► Building equipment ► Analysis and design tools ► Solid state lighting, etc.	R&D institutes	USA
Super-Efficient Equipment and Appliance Deployment (SEAD), USA This programme was launched in Washington in July 2010. Its objective is to promote & raise efficiency level by super-efficient appliance through procurement, R&D, strengthening the foundation of efficiency programmes, etc.	R&D institutes	USA
Austin Home Performance with ENERGY STAR Loan ► Utility – Austin Energy, service area: the city of Austin, Texas and parts of Williamson and Travis counties, Texas ► Source of loan capital: loans financed via Austin Energy partner, Velocity Credit Union (VCU). Austin Energy (AE) buys down the interest rate on these loans to between 0 and 6 percent, depending on the improvements made, the loan term, and the customer's credit profile ► Source of fund: Austin Energy buys down the interest rate on VCU loans with money from AE's operating budget and the American Reinvestment and Recovery Act (ARRA) ► Approximately 1800 projects sanctioned with $12.5 million in loans disbursed during 2006- 2011	Consumers	USA
Sustainable Development Tax Credit (SDTC) for purchase of EE equipment ► Offer to taxpayers, the ability to recover a part of the investment in the form of an income tax deduction, in accordance with the type of energy efficient equipment bought ► Tax credit range of 13%, 22%, 36% and 45% in 2011 — applies to a wide range of energy efficient equipment	Consumers	France
Eco-point scheme ► Green home appliances: consumers obtain "eco-points" by purchasing "green" home appliances for products to be designated as "exchangeable." ► Products should have a 4-star or more efficiency .	Consumers	Japan

Fiscal Incentives promoting S&L	Beneficiary	Country
► Points granted can be exchanged for gift certificates, prepaid cards, regional specialties and energy-efficient/ environment-friendly products; they can also be donated to any of the 181 environmental organizations selected from public entries. ► In May–December 2009, around 85.93 billion points were issued to individual consumers and 79.27 billion points were used to order gifts or make donations.		

Annex V:

Household energy consumption data

Appliances	Percentage of HHs owning appliances (source: NERC survey 2012)	Total no. of households	Average Annual Consumption per unit (kWh)*	Annual consumption (GWh)
AC	48%	1,063,353	3,181	3,382.5
Washing Machines	100%	1,063,353	236	251.0
Refrigerators	100%	1,063,353	329	349.8
Freezers	34%	1,063,353	386	410.5
Total annual consumption [GWh]				4,393.8

* Source: Project document on energy efficiency standards and labelling, Jordan – UNDP (2010)

Electricity Demand [GWh]			14,647
% share of household electricity consumption			41%
Total household consumption [GWh]			6005
% share of the above 4 appliances			73%

Annex VI:

Department of Statistics and other data.

According to the DOS, Jordan's population was 5,848,440 in 2008; with an average household size of 5.5, the estimated number of households was 1,063,353. In 2012, Jordan's total population was estimated at 6,499,119 and the number of households increased by 118,305. It is assumed that these households purchased new appliances.

A consumer survey was conducted by NERC Jordan in 2012 to gauge the penetration of these appliances in Jordanian households; the survey was conducted in the Amman, Zarqa, Irbid, Karak and Aqaba governorates and is assumed to represent the whole of Jordan. The results of the survey along with DOS 2008 data are shown in the table below:

Table 23: Percentage of households owning the four appliances in Jordan in 2012

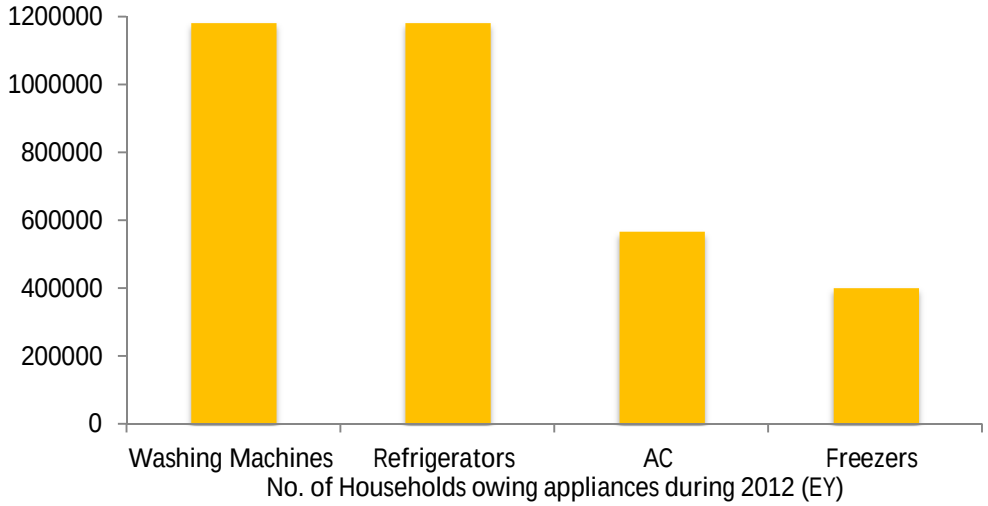
Appliances	Percentage of HHs owning appliances (source: NERC survey 2012)	Percentage of HHs owning appliances (source: Department of Statistics – ff 2008)
AC	48%	NA
Washing Machines	100%	97.3
Refrigerators[35]	100%	97.2
Freezers	34%	NA

Calculation of the number of households owning appliances

- The NERC market survey report 2012 indicates that 48% of households have ACs.
- The NERC market survey report 2012 indicates that 100% of households have washing machines. (However, the DOS indicates that 97.3% of households owned washing machines in 2008.)
- The NERC market survey report 2012 reveals that 100% of households own refrigerators. (However, the DOS indicates that 97.2% of households owned refrigerators in 2008.)
- The NERC market survey report 2012 shows that 34% of households in the country have freezers.

Details of the households owning the four appliances considered in the study are provided in Annex XI.
The sources for the data above were used to estimate the number of households in Jordan owning the four appliances.

Figure 26: Households owning appliances in 2012



[35] Note : Freezers; freezing units (not included in the Refrigerators)

The information provided above includes details of appliance-ownership numbers and the total number of appliance sales in Jordan in 2012. The method of estimation is given below:

1. Total number of appliances sold = new appliances purchased + purchase due to replacement of existing old appliances.
2. Estimation of new appliances[36] purchased:
   a. To calculate the number of appliances sold in 2012, the percentage of households owning appliances in 2012 (obtained from the calculation explained in the previous section) were multiplied by the total number of households (estimated) in 2012.
   b. Therefore, the total number of households owning appliances in 2008 using figures provided by the DOS was estimated.
   c. The estimated numbers of households owning appliances in 2012 and those owning appliances in 2008 were used to estimate sales of new appliances during the period 2008–2012, which has been annualized.
3. Estimation of purchased appliances due to replacement:
   a. Since each appliance has a specific lifetime, they need to be replaced by purchasing new models. This accounts for appliances purchased to replace existing models.
4. Finally, total sales figures in the country in 2012 were obtained by adding new purchases made by new households and the replacement of existing appliances by new ones.
   The table below provides a snapshot of total sales in Jordan during 2012. The detailed estimation can be seen in Annex XI.

Table 24: Estimated sales of the four appliances during 2012, (Gathered through secondary research)

Appliances	Replacement purchases during FY 2012	New purchases during 2012	Sales during 2011–12
Washing machines	**68,976**	**36,754**	**105,730**
Refrigerators	**68,905**	**37,020**	**105,925**

Secondary information (with reasonable authenticity) was available on sales of washing machines and refrigerators.

[36] New appliances here means first-time buyer of appliances.

Annex VII:
Basic appliance assumptions.

Refrigerators

Refrigerator type: refrigerator + freezer compartment

Size: 300 litres

Rating	Consumption (kWh/year)
A+++	128
A++	192
A+	258
A	322
B	439
C	556
D	644

Freezers

Size: 300 litres

Rating	Consumption (kWh/year)
A+++	105
A++	157
A+	209
A	262
B	357
C	453
D	524

Washing Machines

Capacity: 6.5 kg

Rating	Consumption (kWh/year)
A+++	283
A++	326
A+	366
A	427
B	473
C	540
D	611

ACs

Size: 1.5 tonnes (18,000 BTU)

Use: 4 hours/day for four months (cooling mode)

Rating	Consumption (kWh/hour)
A	1.65
B	1.76
C	1.88
E	2.03
E	2.20
F	2.39
G	2.63

Annex VIII:

Primary information collected from manufacturers and suppliers in Jordan.

Table 25: Information collected through primary research

	Supplier 1						Supplier 2					
Year	FY 2010-11			FY 2011-12			FY 2010-11			FY 2011-12		
Appliance	Units sold	%Market share	Total Market	Units Sold	%Market share	Total Market	Units sold	%Market share	Total Market	Units Sold	%Market share	Total Market
Air Conditioner	5,343	10%	53,430	5,434	11.50%	47,252	2,000	3%	66,667	2,500	4%	62,500
Refrigerators	8,712	13.30%	65,504	8,932	14%	63,800	6,000	7%	85,714	6,000	7%	85,714
Freezers	3,048	18%	16,933	3,250	18.50%	17,568	2,000	7%	28,571	2,000	7%	28,571
Washing Machine	21,583	36%	59,953	28,250	42%	67,262	8,000	9%	88,889	8,000	9%	88,889

	Supplier 3						Local Manufacturer 1					
Year	FY 2010-11			FY 2011-12			FY 2010-11			FY 2011-12		
Appliance	Units sold	%Market share	Total Market	Units Sold	%Market share	Total Market	Units sold	%Market share	Total Market	Units Sold	%Market share	Total Market
Air Conditioner	2,150	3%	71,667	2,050	3%	68,333	3,010	5%	60,200	2,630	5%	52,600
Refrigerators	14,200	18%	78,889	14,750	20%	73,750	5,540	3%	184,667	6,080	4%	152,000
Freezers	1,220	6%	20,333	1,050	6%	17,500	500	3%	16,667	330	2%	16,500
Washing Machine	4,200	12%	35,000	4,600	12%	38,333	6,040	6%	100,667	5,730	6%	95,500

Annex IX:

Table 26: Capital investment estimation for ACs

Description	Value	Units	Comments	
Total sales volume	57,671	units		
Percentage of market share of local manufacturers	20%	%		
Market share of local manufacturers	11534	units		
Incremental costs	90.24	US$/unit		
Fixed costs (percentage of incremental costs)	15%	%		
Incremental fixed cost per unit	13.536	US$		
Payback period for fixed cost	4	years		
Default rate of return	17.7%	%		
	Year 1	**Year 2**	**Year 3**	**Year 4**
Cash flow (US$)	156,127	156,127	156,127	156,127
Total Investment (million US$)	**0.422**			

Table 27: Capital investment estimation for washing machines

Description	Value	Units	Comments	
Total sales volume	98,267	units		
Percentage of market share of local manufacturers	20%	%		
Market share of local manufacturers	19653	units		
Incremental costs	45.12	USD/unit		
Fixed costs (percentage of incremental costs)	10%	%		
Incremental fixed cost per unit	4.512	US$		
Payback period for fixed cost	4	years		
Default rate of return	17.7%	%		
	Year 1	**Year 2**	**Year 3**	**Year 4**
Cash flow (US$)	88,676	88,676	88,676	88,676
Total Investment (million US$)	**0.240**			

Table 28: Capital investment estimation for refrigerators

Description	Value	Units	Comments
Total sales volume	133,627	units	
Percentage of market share of local manufacturers	20%	%	
Market share of local manufacturers	26725	units	
Incremental costs	56.4	US$/unit	
Fixed costs (percentage of incremental costs)	15%	%	
Incremental fixed cost per unit	8.46	US$	
Payback period for fixed cost	4	years	

Description	Value	Units	Comments	
Default rate of return	17.7%	%		
	Year 1	**Year 2**	**Year 3**	**Year 4**
Cash flow (US$)	226,097	226,097	226,097	226,097
Total investment (million US$)	**0.612**			

Table 29: Capital investment estimation for freezers

Description	Value	Units	Comments	
Total sales volume	25,747	units		
Percentage of market share of local manufacturers	20%	%		
Market share of local manufacturers	5149	units		
Incremental costs	62.04	US$/unit		
Fixed costs (percentage of incremental costs)	15%	%		
Incremental fixed cost per unit	9.306	US$		
Pay-back period of fixed cost	4	years		
Default rate of return	17.7%	%		
	Year 1	**Year 2**	**Year 3**	**Year 4**
Cash flow (US$)	47,920	47,920	47,920	47,920
Total investment (million US$)	**0.130**			

Annex X:

Area	Time period	Source	Average household size	House units connected to electricity network	Households owning refrigerators	House-holds owning washing machines	Population	Households	Households owning refrigerators	Households owning washing machines
			Person	Percent	Percent	Percent	Number	Number	Number	Number
Ajloun	2008	DOS_Statistical Year Book, 2009	6.2	100	95.6	97.5	134,475	21,690	20,735	21,147
Amman	2008		5.2	100	97.9	98.4	2,264,657	435,511	426,365	428,543
Aqaba	2008		5.7	99.4	97.4	96.1	127,433	22,357	21,775	21,485
Balqa	2008		5.6	100	96.3	93.1	391,787	69,962	67,373	65,135
Irbid	2008		5.9	100	97.3	98.2	1,040,983	176,438	171,674	173,262
Jarash	2008		5.4	100	93.9	90.7	175,453	32,491	30,509	29,470
Karak	2008		5.8	99.7	97.3	96.2	228,070	39,322	38,261	37,828
Maan	2008		6.1	99.6	94.9	95.4	111,199	18,229	17,300	17,391
Madaba	2008		5.6	98.7	96.1	96.7	146,211	26,109	25,091	25,248
Mafraq	2008		6.4	99.7	95.4	95.8	0	0	0	0
Tafiela	2008		5.8	100	98.2	97.9	81,859	14,114	13,860	13,817
Zarqa	2008		5.4	99.7	97.3	97.6	871,398	161,370	157,013	157,497
Jordan	**2008**		**5.5**	**99.9**	**97.2**	**97.3**	**5,848,440**	**1,063,353**	**1,033,579**	**1,034,642**
Jordan	**2012**	Estimated	**5.5**	**99.9**	**97.2**	**97.3**	**6,499,119**	**1,181,658**	**1,148,572**	**1,149,753**

Major urban centres

Appliance	Percentage of households owning appliance in 2012	Number of HH owning appliance during 2012 (estimation)	Number of households owning appliance according to DOS 2008 estimate	New purchases during 2008–2012	Replacement purchases during FY 2012	New purchases during 2012	Sales during 2011–12
Washing machines	100.00%	1,181,658	1,034,642	147,016	68,976	36,754	**105,730**
Refrigerators	100.00%	1,181,658	1,033,579	148,079	68,905	37,020	**105,925**

Annex XI:

Refrigerators

Country	Estimated cost escalation due to EE S&L (percentage of cost escalation/EE)	Programme reference / assumptions	Document reference used for estimation
EU	0.65	EC, 2008	Business Case for Energy Efficiency in Support of Climate Change Mitigation, Economic and Societal Benefits in India – LNBL
China	0.79	Retail Price Analysis Price.ea3w.com, 2011	Business Case for Energy Efficiency in Support of Climate Change Mitigation, Economic and Societal Benefits in India
India	-	BEE Star label	Business Case for Energy Efficiency in Support of Climate Change Mitigation, Economic and Societal Benefits in India – LNBL
South Africa	0.98	Eastern Europe Proxy (GfK, 2004)	Business Case for Energy Efficiency in Support of Climate Change Mitigation, Economic and Societal Benefits in India – LNBL
Brazil	1.70	Jannuzzi, 2002	Business Case for Energy Efficiency in Support of Climate Change Mitigation, Economic and Societal Benefits in India – LNBL
Mexico	0.12	US proxy	Business Case for Energy Efficiency in Support of Climate Change Mitigation, Economic and Societal Benefits in India – LNBL

Freezers

Country	Estimated cost escalation due to EE S&L (percentage of cost escalation/EE)	Programme reference / assumptions	Document reference used for estimation
EU	0.05	EC, 2010a	Business Case for Energy Efficiency in Support of Climate Change Mitigation, Economic and Societal Benefits in India – LNBL

Room AC – window

Country	Estimated cost escalation due to EE S&L (percentage of cost escalation/EE)	Programme reference / assumptions	Document reference used for estimation
India	1.58	Tathagat and Anand, 2011	Business Case for Energy Efficiency in Support of Climate Change Mitigation, Economic and Societal Benefits in India – LNBL
Mexico	1.47	US proxy	Business Case for Energy Efficiency in Support of Climate Change Mitigation, Economic and Societal Benefits in India – LNBL

Room AC – reversible split

Country	Estimated cost escalation due to EE S&L (percentage of cost escalation/EE)	Programme reference / assumptions	Document reference used for estimation
China	1.67	Study by N Shah *et al.*, 2012	Business Case for Energy Efficiency in Support of Climate Change Mitigation, Economic and Societal Benefits in India – LNBL
EU	1.97		Business Case for Energy Efficiency in Support of Climate Change Mitigation, Economic and Societal Benefits in India – LNBL
Mexico	3.26		Business Case for Energy Efficiency in Support of Climate Change Mitigation, Economic and Societal Benefits in India – LNBL
Russia	0.52		Business Case for Energy Efficiency in Support of Climate Change Mitigation, Economic and Societal Benefits in India – LNBL

Room AC – cooling only split

Country	Estimated cost escalation due to EE S&L (percentage of cost escalation/EE)	Programme reference / assumptions	Document reference used for estimation
Brazil	1.74	Jannuzzi, 2002	Business Case for Energy Efficiency in Support of Climate Change Mitigation, Economic and Societal Benefits in India – LNBL
India	1.62	BEE Star Rating	Business Case for Energy Efficiency in Support of Climate Change Mitigation, Economic and Societal Benefits in India – LNBL
Indonesia	1.17	India proxy	Business Case for Energy Efficiency in Support of Climate Change Mitigation, Economic and Societal Benefits in India – LNBL
Mexico	1.97	US proxy	Business Case for Energy Efficiency in Support of Climate Change Mitigation, Economic and Societal Benefits in India – LNBL

Washing machines

Country	Estimated cost escalation due to EE S&L (percentage of cost escalation/EE)	Programme reference / assumptions	Document reference used for estimation
China	0.69	Retail Price Analysis Price.ea3w.com, 2011	Business Case for Energy Efficiency in Support of Climate Change Mitigation, Economic and Societal Benefits in India – LNBL