



Energy Efficiency in Jordan

Introduction

- **Energy Sector Challenge**
 - ✓ Jordan's demand of energy has increased rapidly in the past years.
 - o Population growth(3.1%)
 - o increased per capita consumption
 - ✓ Increase in the cost of importing oil and gas resources

- Jordan needs to import almost all of its fuel needs (96%), steadily increasing the cost of consumed energy
- **Primary energy consumption** went up from less than **6.5 million Toe** in 2004 to more than **7.3 million Toe** in 2008 (+12%).
- **Electricity consumption** grew even faster and went up from **8.1 GWh** to **11.5 GWh** in the same time span (+42%).

Economic and Energy Statistics & Indicators for Jordan

Energy / Economic Statistics		Energy / Environmental Indicators	
Population (Million)	5.54	Energy Intensity/Population (toe / capita)	1.29
GDP (Billion in 2000 US\$)	12.15	Energy Intensity/GDP (toe per 2000 US\$)	0.59
GDP – PPP (Billion in 2000 US\$)	28.91	Energy Intensity/GDP – PPP (toe per 2000 US\$)	0.25
Energy Production (Mtoe)	0.29	Electric Consumption/Population (kWh / capita)	1,904
Imports (Mtoe)	6.91	CO ₂ per Population (ton CO ₂ / capita)	3.30
Net Production (Mtoe)	7.16	CO ₂ per GDP (Kg CO ₂ / 2000 US\$)	1.51
Electricity Consumption (Twh)	10.54	CO ₂ per GDP – PPP (Kg CO ₂ / 2000 US\$)	0.63
CO ₂ Emissions (million ton CO ₂)	18.30	CO ₂ per Production (ton CO ₂ / capita)	2.55

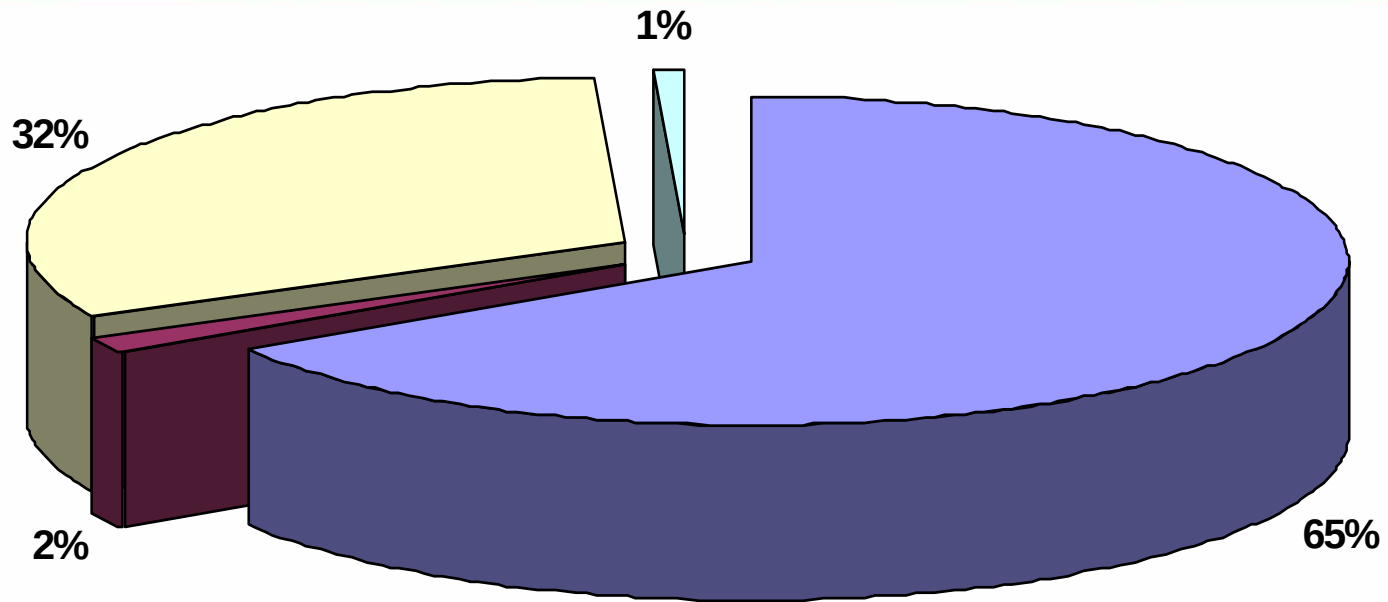
Comparisons of Energy Intensity Levels

Country	Bosnia	Yemen	Jordan	Cameroon	Egypt	Paraguay	Kuwait	Turkey	Tunisia	Brazil	Israel
Population (million)	3.93	21.73	5.54	18.18	74.17	6.02	2.6	72.97	10.13	189.32	7.05
GDP Bil. 2000 \$	6.83	11.88	12.15	12.53	127.85	8.34	54.78	261.20	25.45	765.13	133.65
Primary Supplytoe)	5.39	7.09	7.16	7.08	62.50	3.97	25.29	94.00	8.74	224.13	21.28
EI toe/000 2000\$)	0.79	0.60	0.59	0.57	0.49	0.48	0.46	0.36	0.34	0.29	0.16

More can be done to reduce energy consumption without

- reducing economic productivity, which is one of the key explicit directions of the National Energy Strategy.
- Energy Efficiency is certainly among the most cost-effective means to improve the Energy Intensity indicator

Primary Energy Consumption



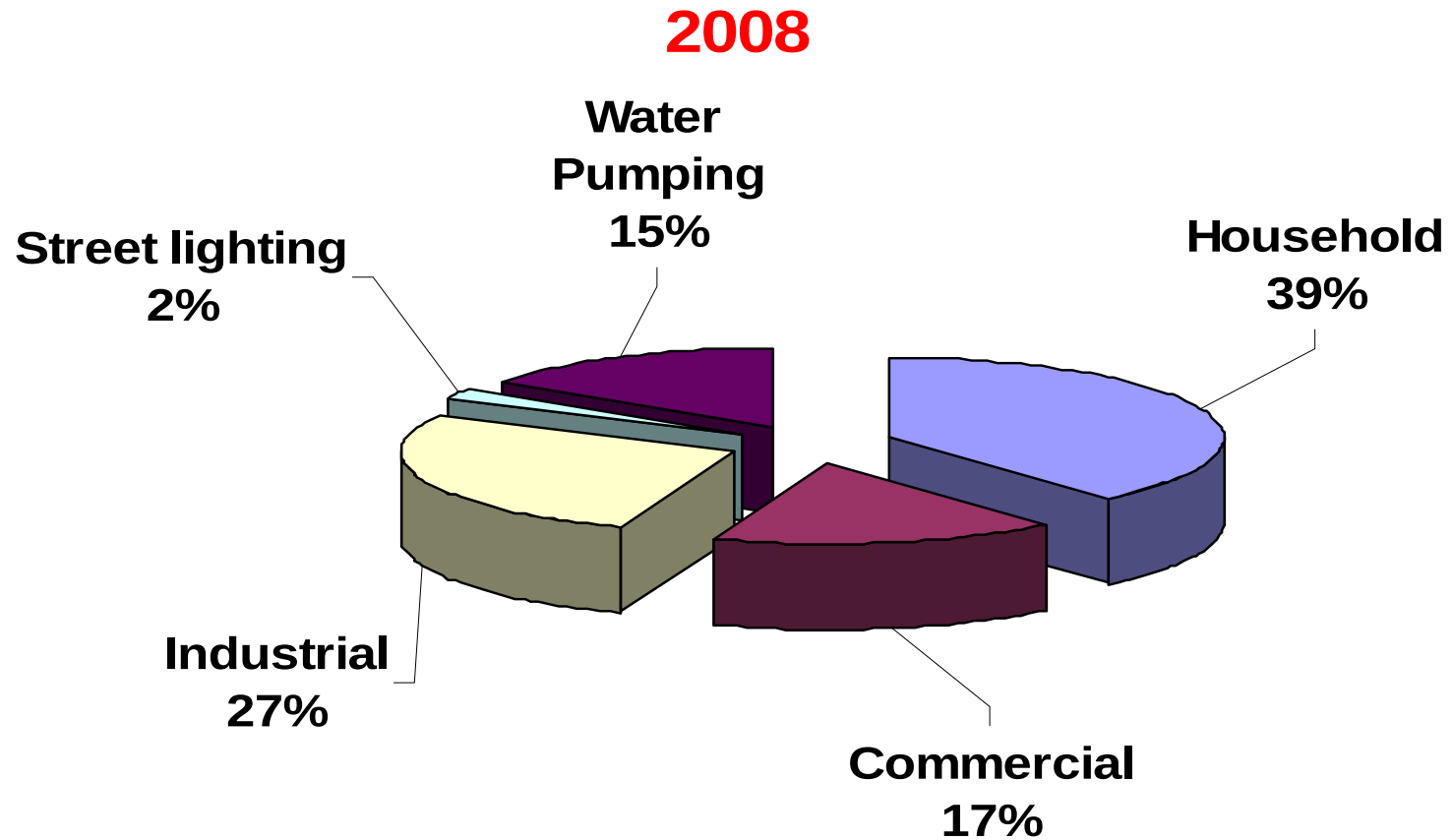
■ Oil & Oil Products

■ Renewable Energy

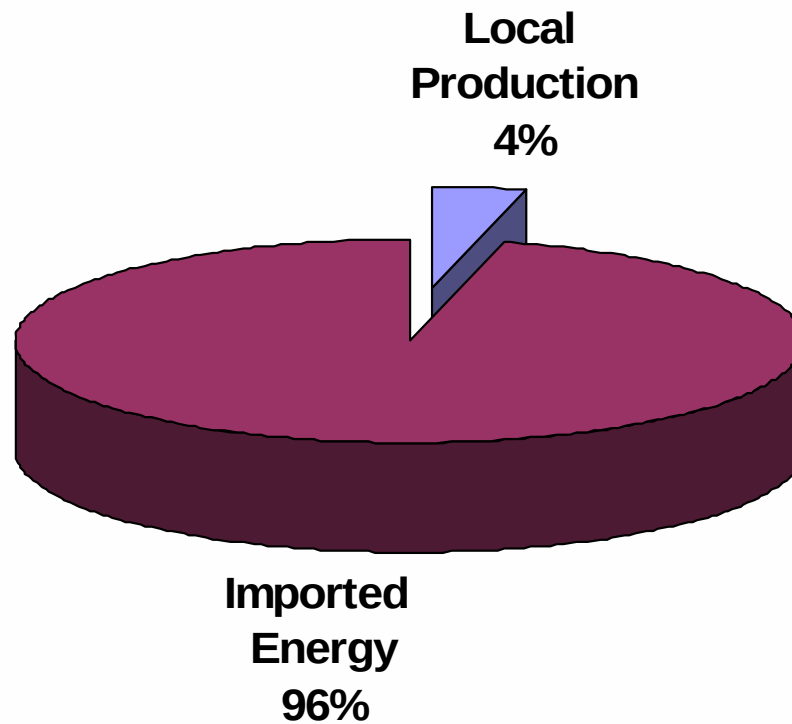
■ Natural Gas

■ Imported Electricity

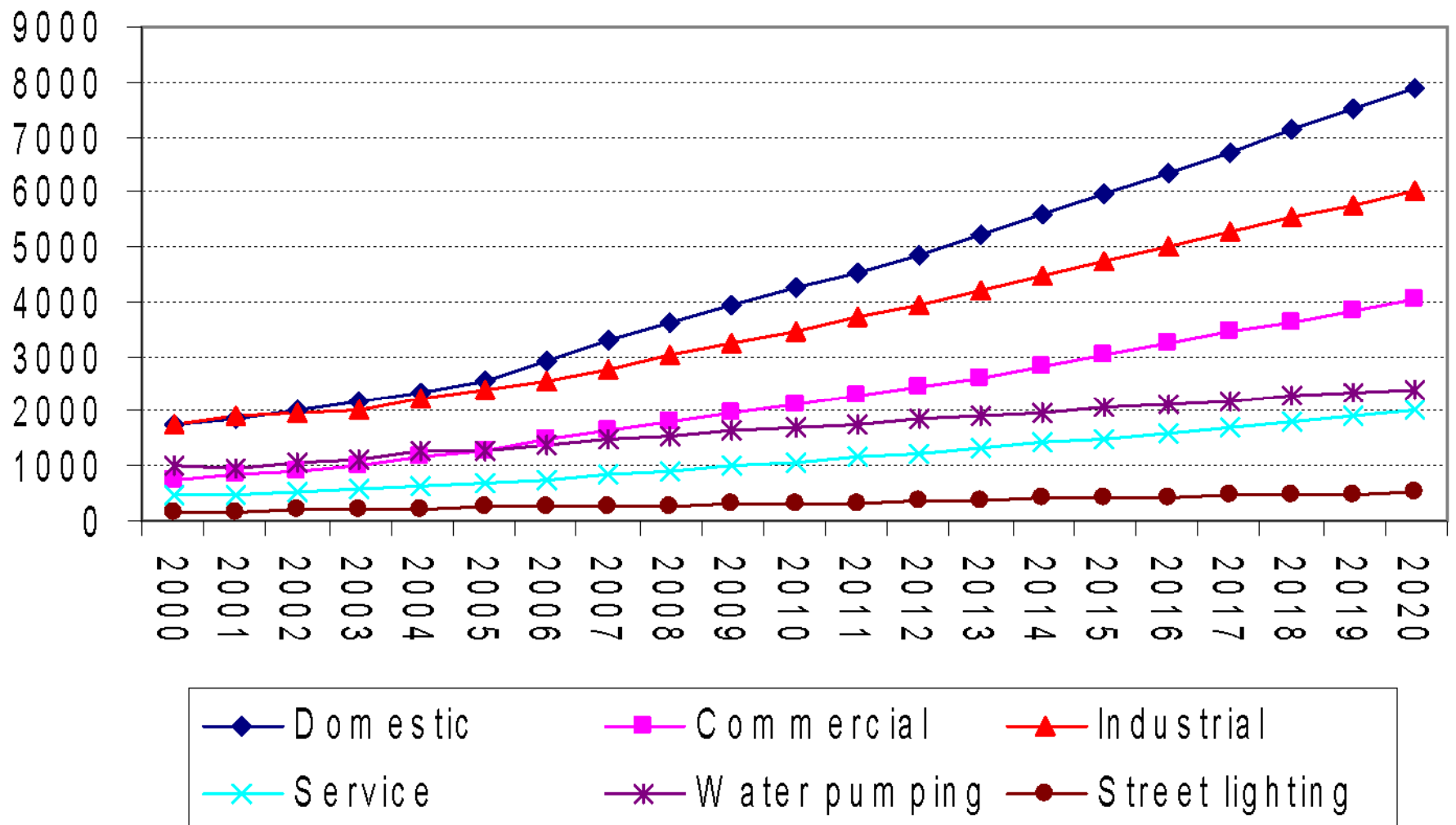
Electrical Energy Consumption



Share of Local Energy Production



Sectorial Electricity Consumption Forecast (GWh)



REVIEW OF THE EXISTING ENERGY POLICY

- ❑ In 2004, national energy strategy to address the challenges.
- ❑ Low oil prices compared to 2007/08.
- ❑ In 2007, the Strategy was updated.
- ❑ To face the sharp increase in expected future demand & limited quantity of gas supply from Egypt and the high cost of energy imports,
- ❑ Strategy called for diversification of the energy mix:
 - Renewable energy projects and energy efficiency programs.
 - Oil Shale as an alternative for power generation.
 - Nuclear power for electricity generation and water desalination.

Energy Efficiency Recommendations in the National Energy Strategy

1. Create an *Energy Efficiency Fund* to support the various *programs and* initiatives focused on reducing market demand and increasing renewable energy production.
2. Increase public awareness of energy efficiency
3. Provide financial incentives to energy-efficient and renewable technologies such as tax breaks and custom duties exemptions.
4. Establish an energy efficiency award program

Energy Efficiency Recommendations in the National Energy Strategy

- 5. Develop and enforce energy efficiency building codes such as thermal insulation,
- 6. Develop certification programs for residential buildings.
- 7. Promote the use of energy efficient lighting in all public buildings

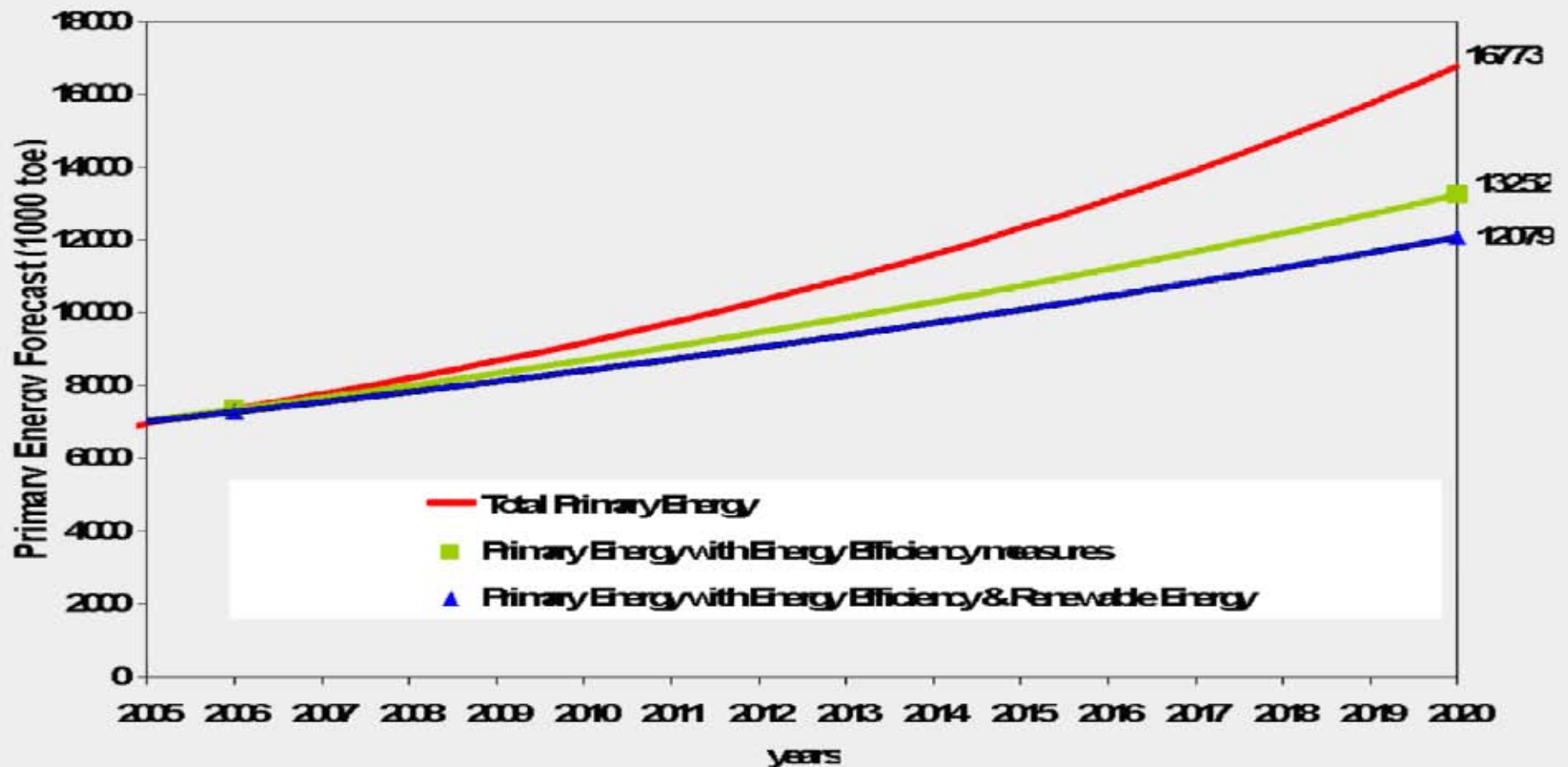
Energy Efficiency Recommendations in the National Energy Strategy

8. Implement energy efficiency programs in the transport sector such as:

- ✓ reducing custom duties on smaller engines and Hybrid cars that uses alternative fuels;
- ✓ shifting mass transit from fuel to electric light transit;
- ✓ upgrading the transport fleet;
- ✓ evaluating the use of Ethanol in vehicles and develop a pilot project
- ✓ developing a bio-diesel pilot

Primary Energy Demand Forecast & the Contribution of EE and RE in Energy Mix

Hypothetical Energy Use



Potential of Improving Energy Efficiency-case studies

Company Name	Total Cost Saving (JD)	Energy Consumption (JD/Year)	Saving %	Pay Back Period (Yr)	Investment Required (JD)
Arab Center for Heart and Special Surgery	67,989	313,832	22%	1.8	123,102
Radisson SAS Hotel (Amman)	35,168	243,811	14%	0.4	15,731
Radisson SAS Hotel (Aqaba)	68,275	199,996	35%	1.3	87,544
Le Meridian Hotel (Amman)	203,962	777,833	26%	1.3	382,387
Grand Hyatt Amman Hotel	112,954	578,514	20%	2.1	235,285
Movenpick Resort & Spa Dead Sea	76,821	665,625	12%	0.8	60,052
Movenpick Resort Aqaba	86,449	358,223	24%	1.9	164,819
Four Seasons Hotel (Amman)	120,307	648,569	19%	1.4	170,670
Jordan Kuwait Bank	17,854	103,505	17%	1.3	23,579
Industrial Development Bank	4,020	33,065	12%	2.9	11,711
TOTAL	793,806	3,917,828	20%	1.6	1,274,880

Potential Saving Based on 2008 consumption

Commercial Sector

Consumed around 666,738 toe

Potential energy saving is 20 %= 133,347

Transport Sector

Consumed around 1,767,000 toe

Potential energy saving is 20 %= 353,400

Industrial Sector

Consumed around 1,095,000 toe

Potential energy saving is 20 %= 219,000

Residential Sector

Consumed around 1,010,000 toe

Potential energy saving is 30 %= 303,000

Total 1,008,747 TOE

Jordan Paper & Cardboard Company

Zarqa-Jordan

Study performed in February 2001

Investigated Areas: Boiler & steam system, compressed air system, Pumping System, Vacuum System, motors & electrical systems and lighting.

Percentage of Energy/Cost saving 24 %.

Investments needed 110,000 JD.

Pay back Period Less than 1 year.

Utility	Energy cost Saving (JD/year)
(1) Peak Load Management: A-Diesel generator: 1000 kVA B-Stopping unnecessary machines. C-Managing Well Pump operation.	30702 512 2196
(2) Steam System	40372
(3) Electrical System	2270
(4) Lighting System	4317
(5) Vacuum System	48000
(6) Compressed Air System	9500
SUM	137,869

Le Meridian Hotel (Amman)

Date: 7/2004

Investigated Areas: Boiler & steam system, ventilation system, Pumping System, electrical systems lighting system and chilled water system and water treatment.

Percentage of Energy/Cost saving 26.3 %.

Investments needed 392,385JD. **Pay back Period** 1.9 years.

Utility	Energy cost Saving (JD/year)
1. Electrical System	150200
2. Ventilation system	6623
3. Steam System	4950
4. Lighting System	19179
5. Chilled Water System	15341
6. Water Treatment	4065
7. Solar Heating System	3858
Sum	204216

Case Study I

Excess air control (Tuning-Up Boiler)

Annual Diesel Consumption = 21,660 JD/yr
CO₂ in flue gases = 3.5 %
Excess air level = 350 %

Proposal: regular & proper tuning based on CO₂ & CO measurement is needed by using portable CO₂ analyzer

%CO₂ in flue gases = 12.5 %
Excess air level = 40 %
Saving in fuel = 30 %
Cost savings = 6500 JD/yr
Investment required = 150 JD
Payback period = 0.3 months

Case Study II

Blow down Heat Recovery

Boiler Capacity = 5 T/hr

Operating Pressure = 10 bar

Fuel used = F O

Boiler blow down = 500 kg

Feed water TDS = 300 ppm

TDS in Boiler = 3000 ppm

Max. allowable TDS= 3500 ppm

Proposal: Recovery of heat in blow down by preheating feed water passing through heating coil.

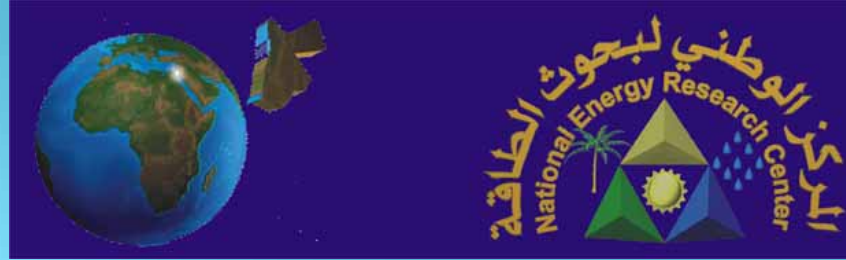
Rise in feed water temp.= 10-12 °C

Savings in Fuel Oil = 53T/yr

Cost savings = 11,925 JD

Investment required = 2,000 JD

Payback period = 2 Months



Case Study III

Operation of boilers based on performance

No. of boilers	= 2 (A&B)
No. of boilers in operation	= 1 (A or B)
Capacity of boilers	= 4 T/hr
Fuel used	= FO
Operating pressure	= 10.5 kg/Cm ²

Particulars	Boiler A	Boiler B
Fuel consumption	127 kg/hr	123 kg/hr
Operating hours	6700	500
Efficiency	79%	82%



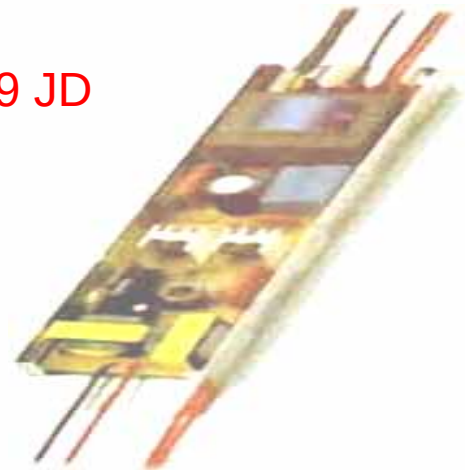
Proposal: Operating boiler B continuously & keeping boiler A as standby

Furnace oil saving	= 24.8 T/yr
Cost savings	=5580 JD
Investment	= Nil
Payback period	= Immediate

Case Study IV

(Electronic Ballast for Fluorescent Lamps)

- No. of Luminaries = 159 double tube fluorescent Lamp
- Operating Hours = 5800 hr/ year
- Total Existing Lighting Load = $159 \times 2 \times (36 + 12) = 16218$ watt
- System wattage for Double Fluorescent lamps with Electronic Ballast is 70 watt
- New lighting Load after replacement = $159 \times 70 = 11130$ watt
- Reduction in Lighting Load = $16218 - 11130 = 5088$ watt
- Annual electricity saving = $5088/1000 \times 5800 = 29510$ KWh
- Annual Cost Savings = $29510 \text{ KWh} \times 0.041 \text{ JD/KWh} = 1209 \text{ JD}$
- Cost of EB = 11 JD
- Investment Needed = $159 \times 11 = 1749$
- Simple payback = $1749/1150 = 1.44$ year



Current Energy Efficiency Activities in Jordan

- ❑ Jordan's energy efficiency strategy- 2004**
- ❑ Incentives for energy efficiency products in the new energy law**
- ❑ Energy service companies (ESCOs)**
- ❑ Commercial and industrial energy audits**
- ❑ Residential and street lighting efficiency program by afd**
- ❑ Equipment energy efficiency labels and standards**

Jordan Energy Efficiency Strategy

- ❑ In 2004, the Government of Jordan released the energy Efficiency Strategy which was approved by the Council of Ministers in September 2004
- ❑ Reducing energy consumption without negatively affecting production or the standard of living , in order to lower the imported oil bill on the national level and reducing the emission of harmful gasses to the environment

Jordan EE Strategy

General policies:

1. **Tariff policy:** gradually removing subsidies on petroleum products and electricity and applying a pricing structure based on actual cost.
2. **Legislations:**
 - Taxation policies
 - Technical standards
 - Thermal insulation
 - Building codes
 - Customs Duties
 - Traffic Congestion
3. **Awareness and Training**
4. **Financial Policies**

Measures

- 1- **Gradual elimination of subsidies**
- 2- Preparation and implementation of **Public Awareness Program** in the field of energy efficiency
- 3- Preparation of "**Energy Efficiency Code**"
- 4- Design and implementation of Energy Efficiency **Training Programs** for those who are involved in energy efficiency
- 5- Establishment of Energy Data Bank
- 6- Elimination or reduction of **Custom Duties & Sales Tax** on materials and equipment that contribute to energy saving including thermal insulation materials.
- 7- Provision of grants and soft loans for large and costly energy conservation projects.

Measures /cont.

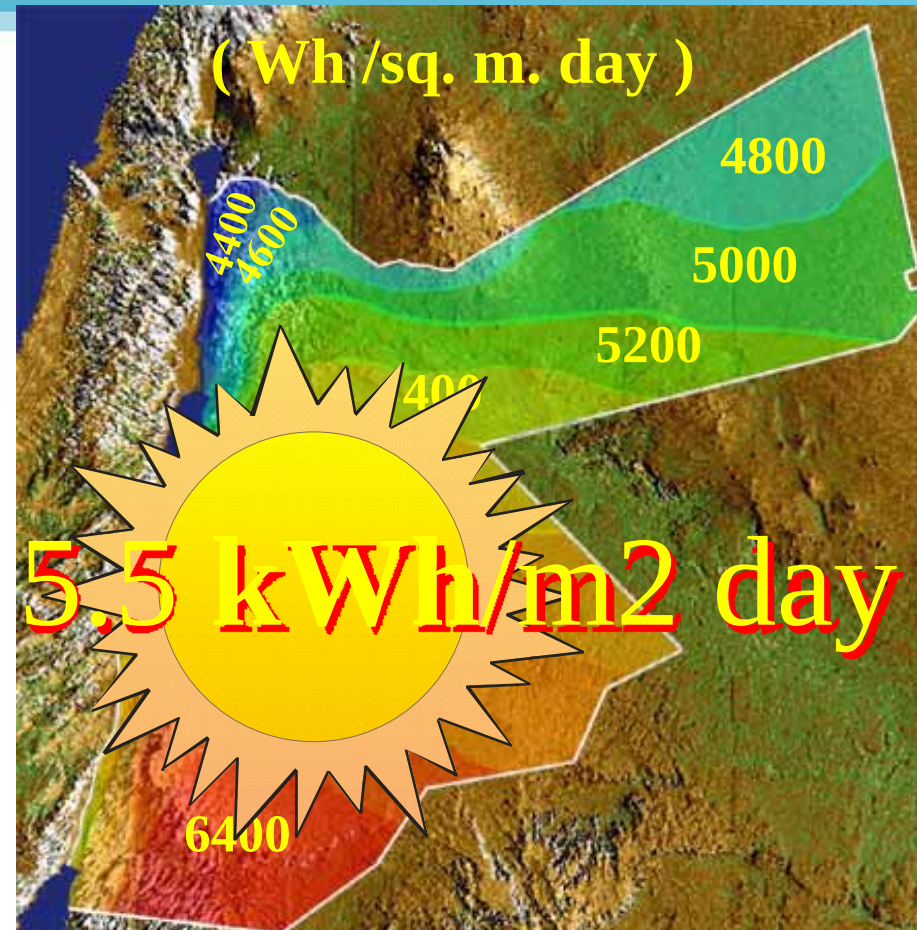
- 8- Oblige importers and manufacturers of energy consuming appliances to fix "**Energy Efficiency Label** " indicating the annual consumption of the equipment" on their product.
- 9- Enforcement of "Building Codes", in particular, parts related to energy efficiency
- 10- Application of thermal insulation & other energy efficiency measures in design and construction of public buildings
- 11- Oblige large industrial & commercial institutions to appoint "qualified energy engineer" and to carry out periodical energy audits.
- 12- Taking necessary measures to improve efficiency, including electrical load management, of production, transmission and distribution of electricity.

Measures /cont.

- 13- Implementation of energy efficiency **Demonstration Projects** like energy saving lamps, efficient street lighting and solar water heaters
- 14- Promotion of mass transportation systems
- 15- Encourage ownership and usage of small cars and discourage usage of old cars
- 16- Elimination of traffic jams through replacement of traffic lights by tunnels and bridges including implementation of green street traffic lights systems
- 17- Encourage and intensify construction of traffic signs that show directions to different places
- 18- Promotion and establishment of "Taxi stop" in several places, printing of maps that shows "bus lines" in different parts of the kingdom and make those maps available to the people

Solar Energy

- Jordan is blessed with an abundance of solar energy, where the annual daily average solar irradiance ranges between **5-7 kWh/m²**
- The total annual irradiance is **1600-2300 kWh/m²**



Wind Energy

Irbid and Ajloun
150- 200 MW

Jarash and North of Amman
150- 200 MW

Tafila and Karak
200- 250 MW

Fujaij
100 -150 MW

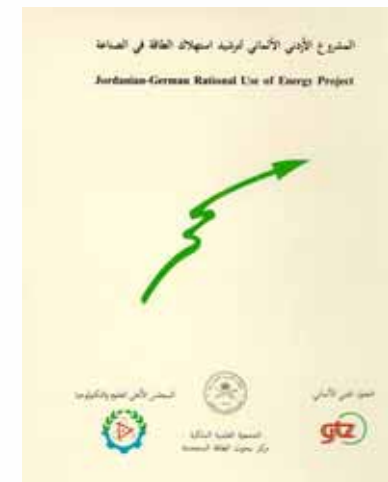
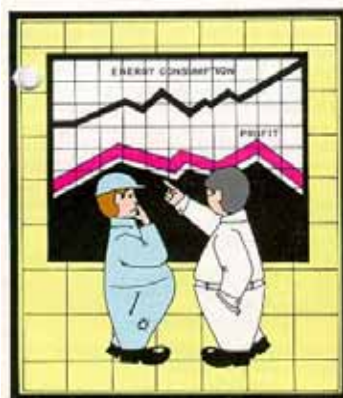
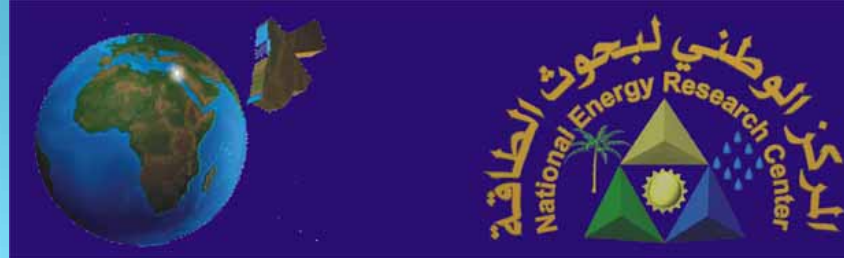
Wadi Mousa and Naqab
250-300 MW

North of Aqaba
150 MW

**Expected Wind Potential
at the promising sites
in Jordan**

**According to the Energy
Strategy 2007-2020,**

**The Target is 600 MW
Wind Energy by 2020.**



Free Question & Answer





دليل أجهزة ومعدات ترشيد استهلاك الطاقة
في المملكة الأردنية الهاشمية



2001



دليل أجهزة ومعدات ترشيد
استهلاك الطاقة والمياه
والطاقة المتجددة

حلول محلية لمشاكل بيئية عالمية

2002



دليل أجهزة ومعدات ترشيد استهلاك
الطاقة والمياه والطاقة المتجددة



حلول محلية لمشاكل بيئية عالمية

عمان ٢٠٠٤

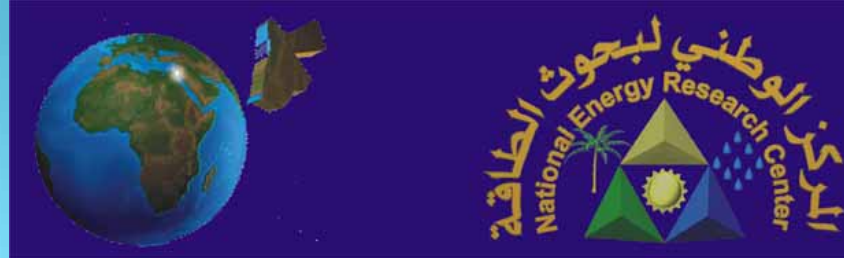


دليل أجهزة ومعدات ترشيد استهلاك
الطاقة والمياه والطاقة المتجددة



حلول محلية لمشاكل بيئية عالمية

عمان ٢٠٠٥



The First International Energy Conservation & Renewable Energy Exhibition

24 - 28/April/2002

Le Meridien Amman - Jordan





Under the Patronage of H. E. the Minister
of Energy and Mineral Resources

energy
energy 2 0 0 3

The 2nd International Energy Week

14 – 17 September 2003

Radisson SAS Hotel Amman - Jordan







1997



Boilers & Steam System
Training Course 9/8-13/8-
1997



Practical Energy Audit Training Course 10/5-14/5/1997



Managing Energy in Paper Industry Training Course 29/11-3/12/1997



1998



Energy Conservation in Industry
Training Program 28/9-30/9/1998



Managing Energy in Industry Training
Course 28/3-1/4/1998



Total Energy Management as Profit
Improvement Training Course 29/11-30/12/1998



1999



Electrical Energy Management Course 1/12-2/12/1999



2000



Energy Consultant Training & Qualification Course 28/5/2000 -1/6/2000



2001



Energy
Engineers Training Program 8-
12/4/2001



Energy & Water Conservation in
Commercial Buildings 21-23/10/2001



Energy

Engineers Training Program 13 –
17/1/2002

2003



Immediate measures and future challenges
Regional energy efficiency program 19-23/1/2003



Energy Conservation in Electrical
systems 17/7/2003-16



Energy Conservation in Mechanical
systems 6/8/2003-4



2004



Regional Energy Conservation Training 14/10-10



Cost reduction through energy conservation/technical & management equipment, 4-8/1/2004.



Energy Conservation in Buildings 4-8/7



2005



Energy Auditing
3-7/4/2005



Energy Conservation in Fans
& Pumps 8/2005/ 24- 21



Boilers & Steam Systems
21-24/11/2005



Energy Conservation and
its environmental Impact
6-8/3/2005



Energy Conservation
in Electrical Systems



2006



Energy Conservation in Industry 20/4/2006-16



Thank You

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