الجَمعيّة العِلميّة المَلكيّة
Royal Scientific Society

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AGENCE DE LA TRANSITION ÉCOLOGIQUE

meetMED
Mitigation Enabling Energy Transition in the MEDiterranean region
Together We Switch to Clean Energy

Welcome

GRASSMED TRAINING

26 - 28 Feb 2024

Green Building Situation in Jordan

Eng. Muhieddin Tawalbeh

Royal Scientific Society
A Brief Introduction

Founded in 1970 from the great heart and generous spirit of His Majesty the Late King Hussein and HRH Prince Hassan, the Royal Scientific Society (RSS) aims to be the knowledge leader for science and technology, locally and regionally.

Royal Scientific Society

A Brief Introduction

The Royal Scientific Society is the largest applied research institution, consultancy, and technical support service provider in Jordan, and is a regional leader in the fields of science and technology.

The National Energy Research Centre (NERC)

A Brief Introduction

الجَمعيّـة العِلميّـة المَلكيّـة
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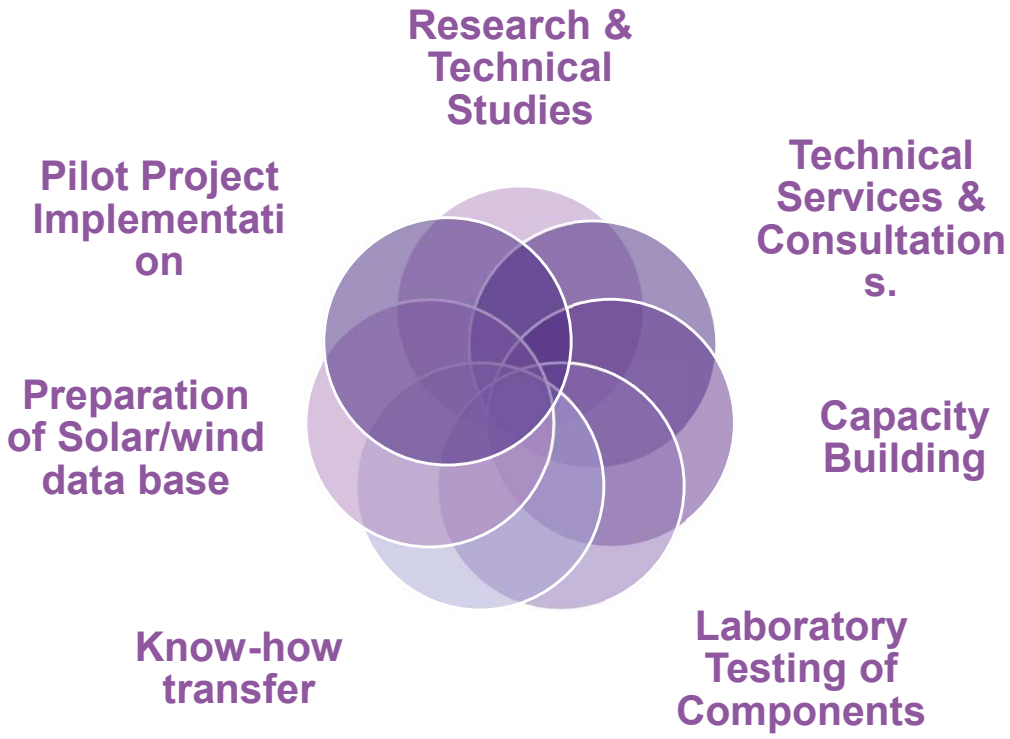
National Energy Research Center

NERC: Areas of specialization

- Photovoltaic
- Wind Energy
- Energy Efficiency
- Solar thermal Energy
- Geothermal
- Biogas



Laboratory Facilities at NERC

Energy efficiency labels for domestic appliances

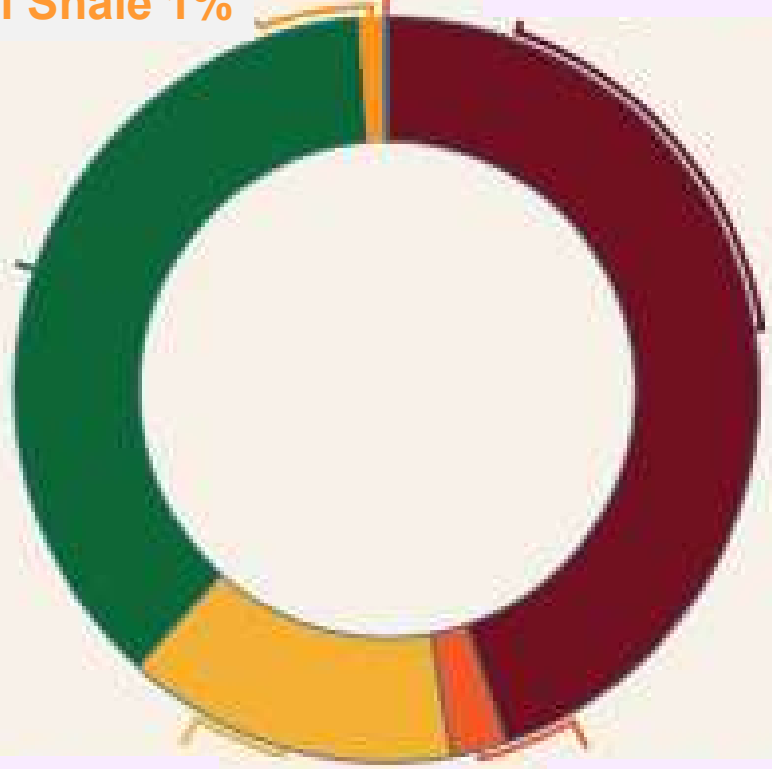
1. Lighting lab (Operational-accredited by Jordan Standards and Metrology Organization accredited (JSMO).
2. Air conditioner lab (Operational- accredited by JSMO.
3. Washing machine lab (Operational- accredited by JSMO)
4. Refrigerator lab (Operational- accredited by JSMO)
5. Solar water heater lab (Operational- accredited by JSMO)
6. Photovoltaic lab (Operational- accredited by JSMO)

Energy Status in Jordan

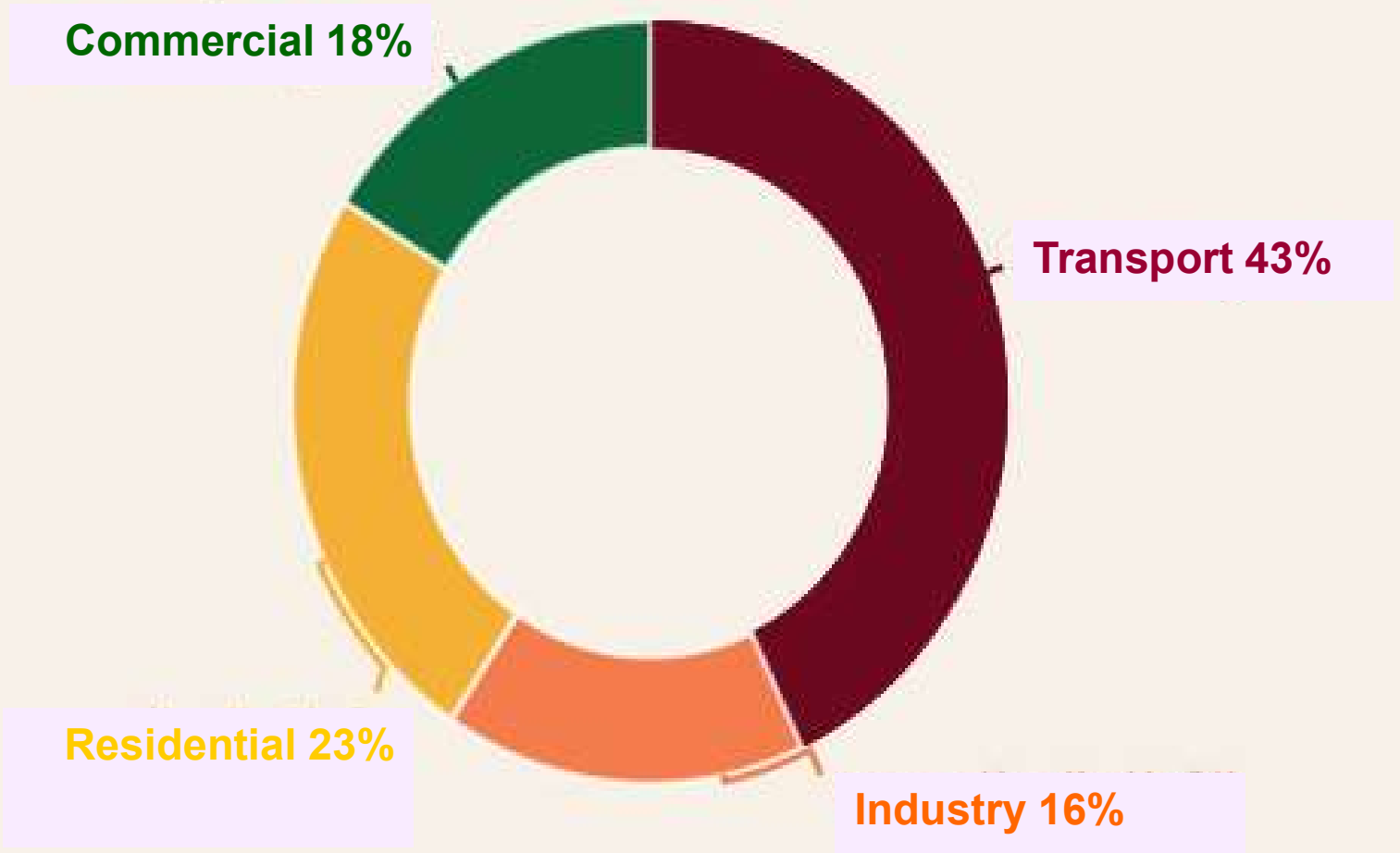
Energy Sector - Important Energy Figures - 2022

National Energy Production (Oil & RE) (Mtoe)	1.608 (17%)
Net Imports (Mtoe)	8.1997 (83%)
Total Primary Energy Consumption (Mtoe)	9.808
RE production (thermal & electricity) (Mtoe)	1.373 (15%)
Total Final Energy Consumption (Mtoe)	6.756
Total installed electricity capacity (MW)	6795
Electricity Consumption (GWh)	20,584
RE share in Electricity Consumption (%) in 2018	29%
CO2 emissions (MtCO2)	23.14

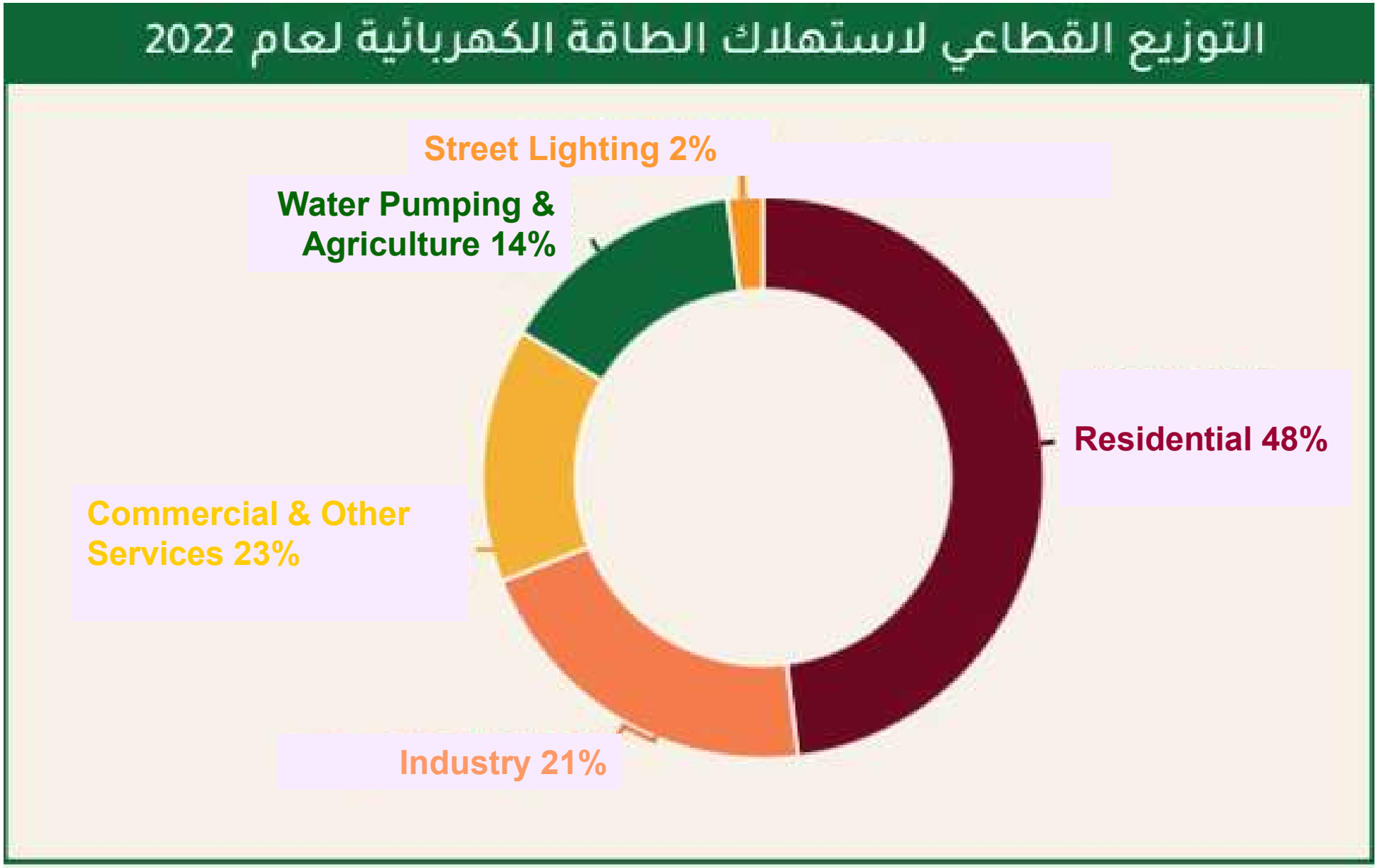
Jordan Energy Mix 2022

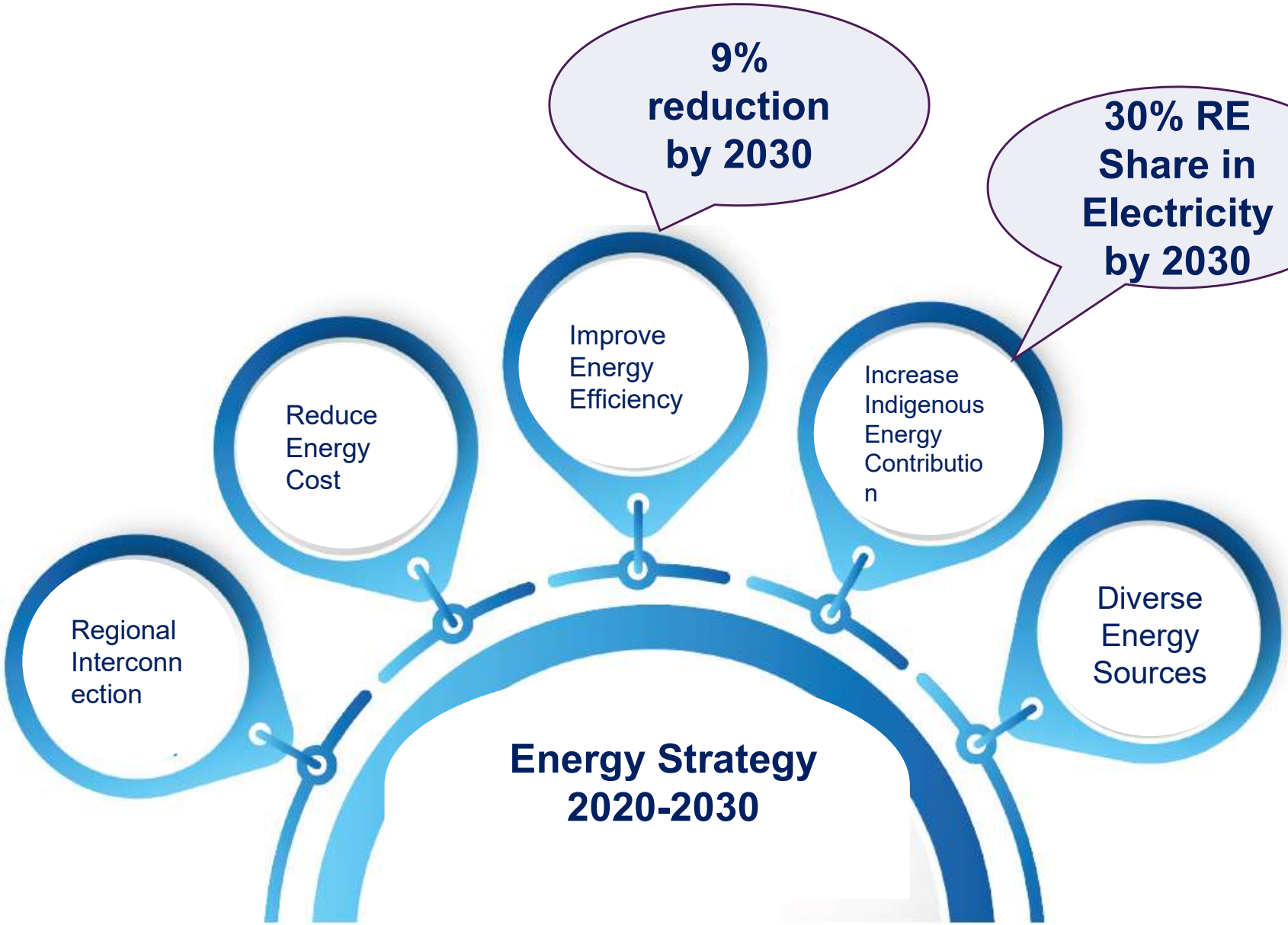


Final Energy Consumption 2022

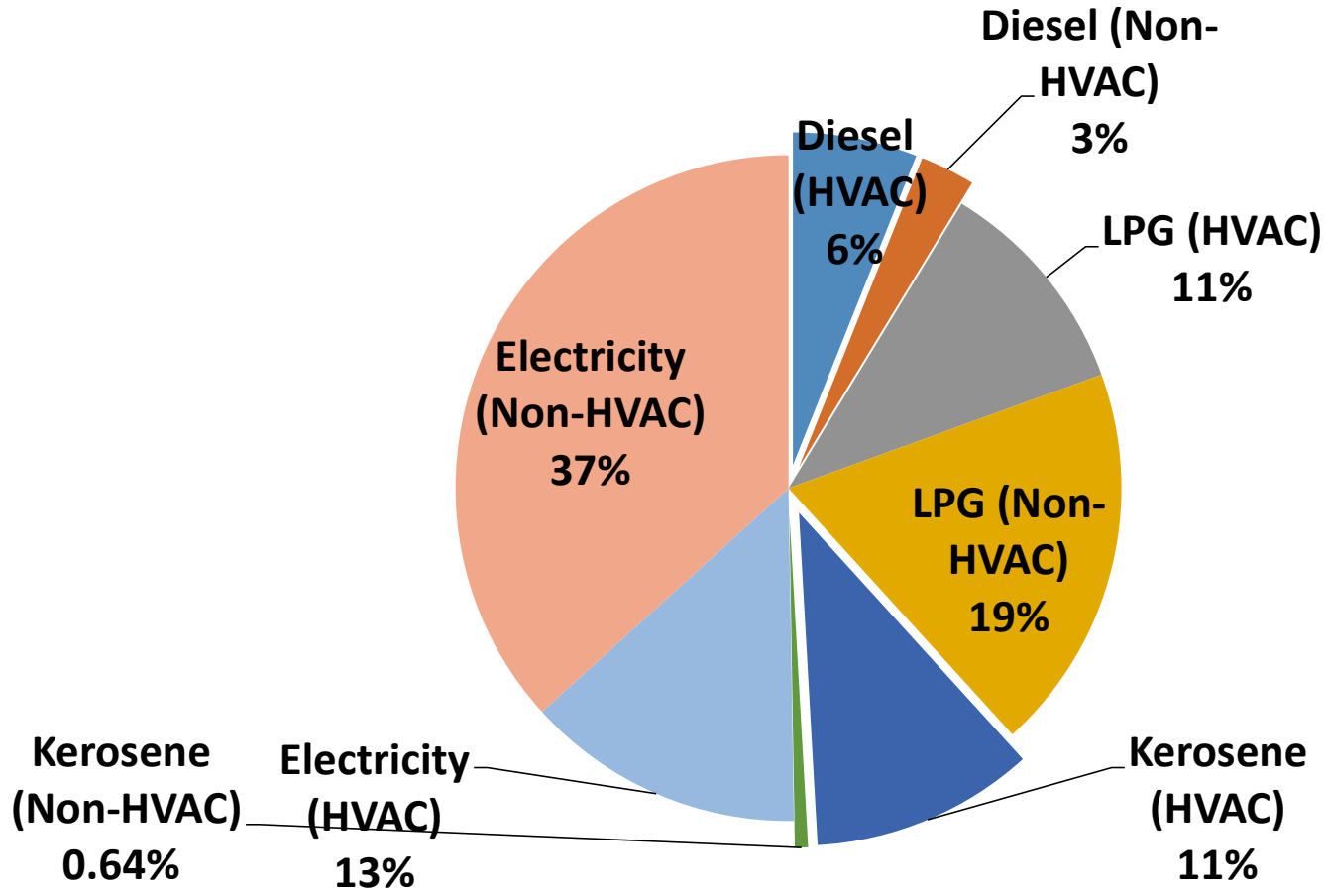


Buildings (Commercial, Public, and Residential) consume more than 60% of the total electricity consumed in Jordan



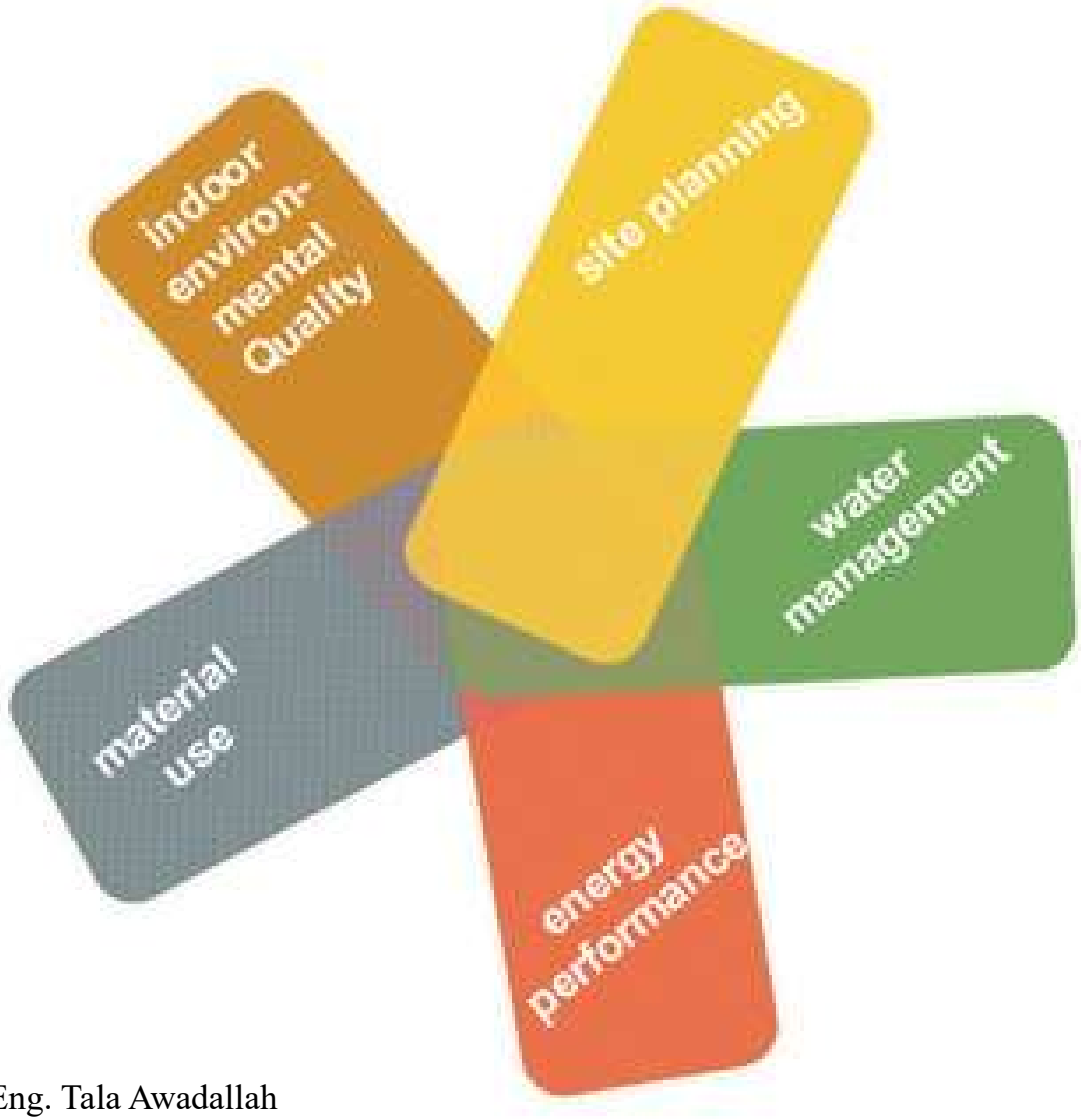

9% reduction by 2030
30% RE Share in Electricity by 2030
Improve Energy Efficiency
Reduce Energy Cost
Increase Indigenous Energy Contributio n
Regional Interconn ection
Diverse Energy Sources
Energy Strategy 2020-2030

Space Heating/cooling Share in the Energy Consumption for Residential Sector



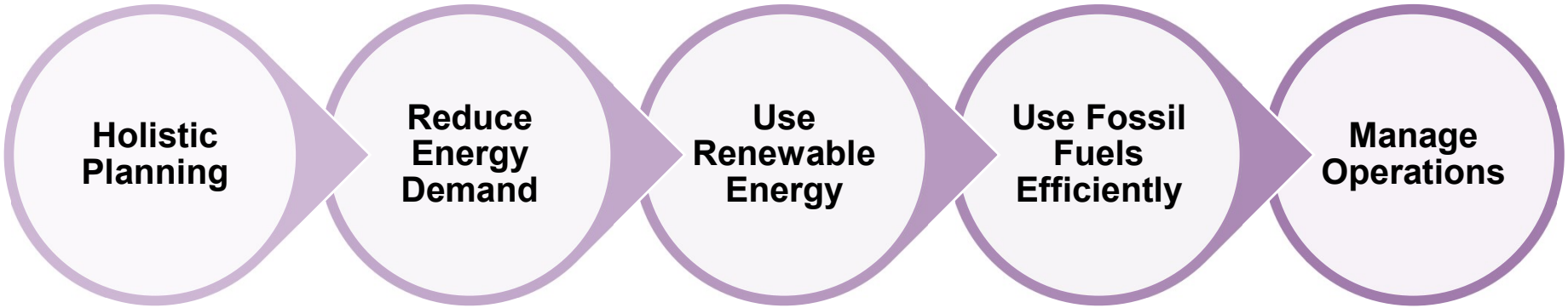
Energy Efficiency Status in Jordan

Basic Standards for Green Building



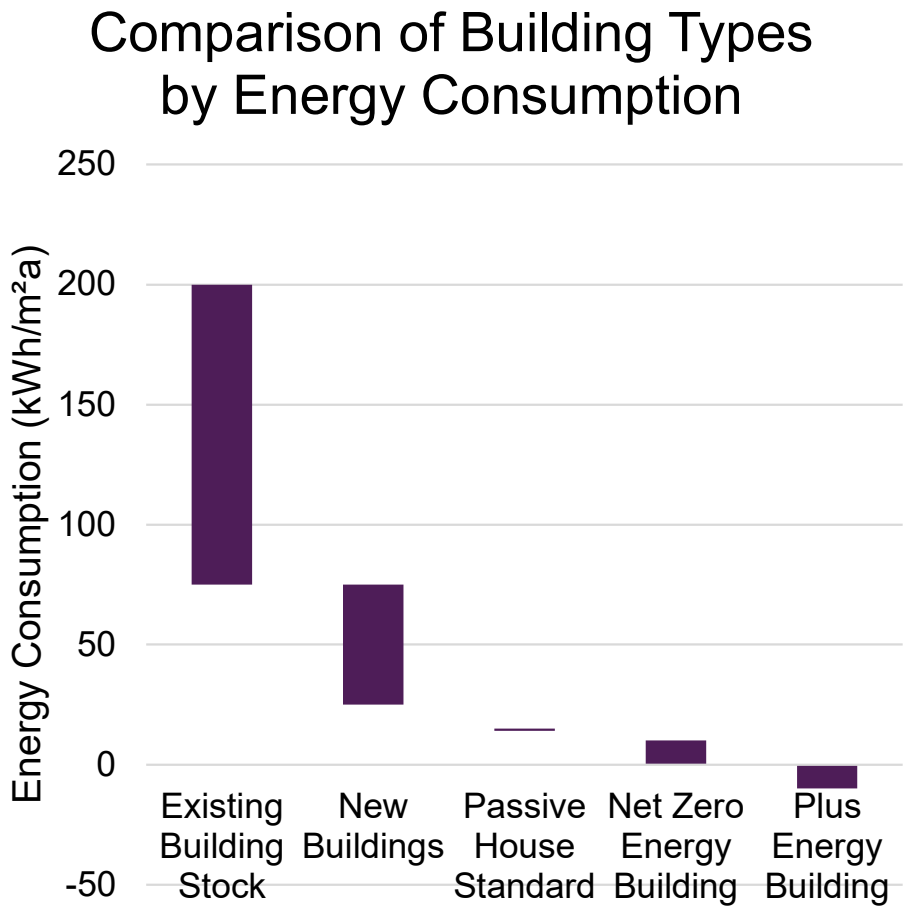
Source: Presentation- Eng. Tala Awadallah

Energy Efficient Buildings



Buildings energy levels

- Total amount of energy used by the building on an annual basis is equal to the amount of renewable energy created on-site
- Need to consider country-specific climate conditions, primary energy factors, ambition levels, calculation methodologies and building traditions
- Existing NZEB definitions can differ significantly (e.g. regarding the definition of energy, which can be either final or primary energy)



Financial mechanisms & windows

JREEEF

Financial Mechanisms

- Grants
- Interest Rate Subsidy
- Banks Loans Guarantees
- Cost sharing With International Donors

Others

Financial windows

- Central Bank of Jordan
- Commercial Banks
- Microfinance companies
- Local NGOS /CBOs

EBRD's first green financing facility to be launched in Jordan

European Bank for Reconstruction and Development

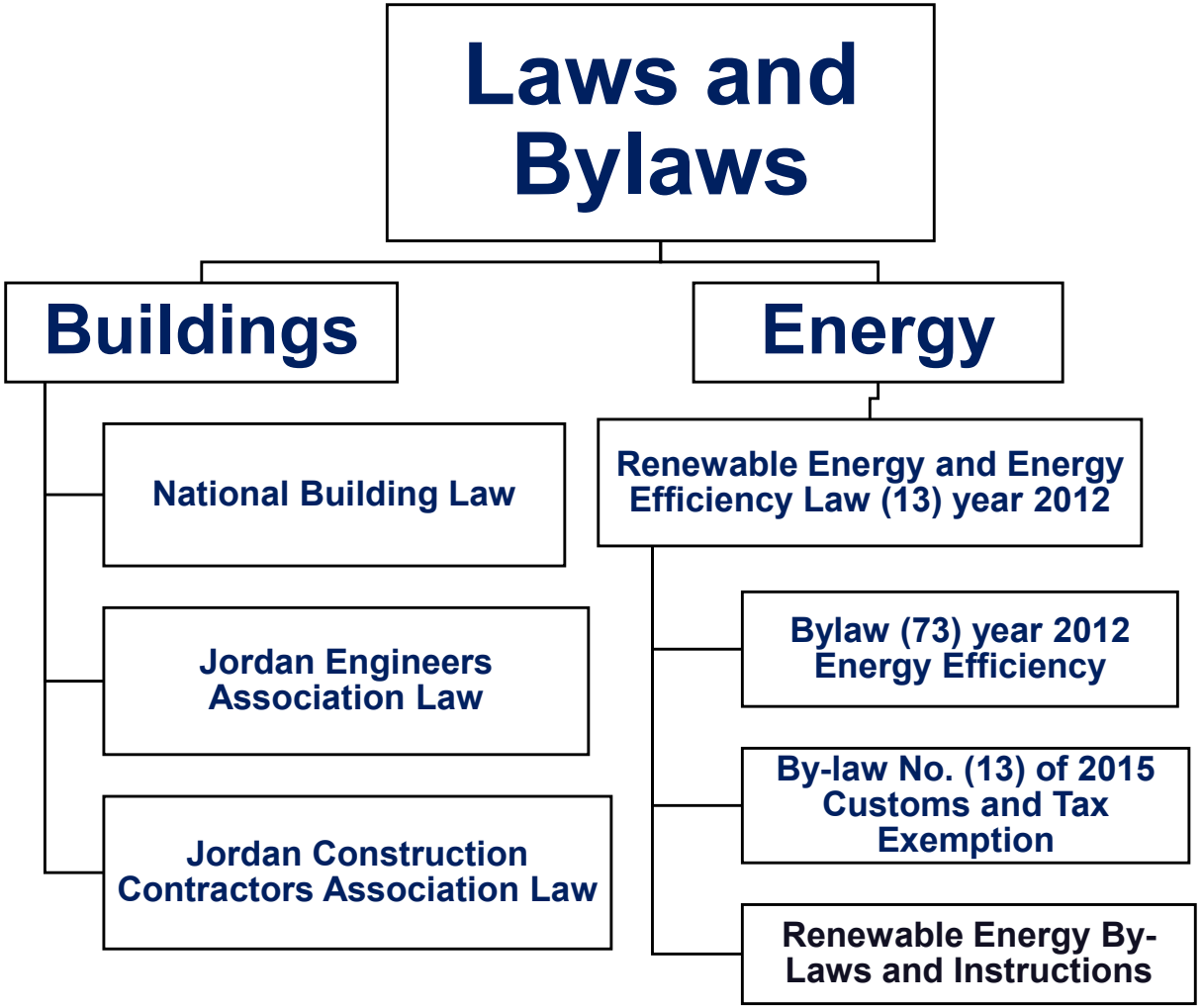
- The European Bank for Reconstruction and Development (EBRD) and the European Union (EU) in Jordan are promoting green investments in the private sector by introducing the first internationally supported comprehensive green economy programme in the country.
- The programme will support Jordan's transition to a green economy as the country adapts to an increase in demand for water and energy following a substantial growth in population, according to an EBRD statement.
- The programme combines commercial loans from the EBRD, concessional loans from the Green Climate Fund (GCF) and grant funding by the EU.
- GEFF supports businesses and homeowners with investments in green technologies to preserve natural resources, increase energy efficiency and reduce emissions through the introduction of state-of-the-art technologies and solutions, the statement said.
- The programme offers loans through local banks and microfinance institutions for on-lending to local corporates and SMEs.

https://www.jordantimes.com/news/local/ebrds-first-green-financing-facility-be-launched-jordan

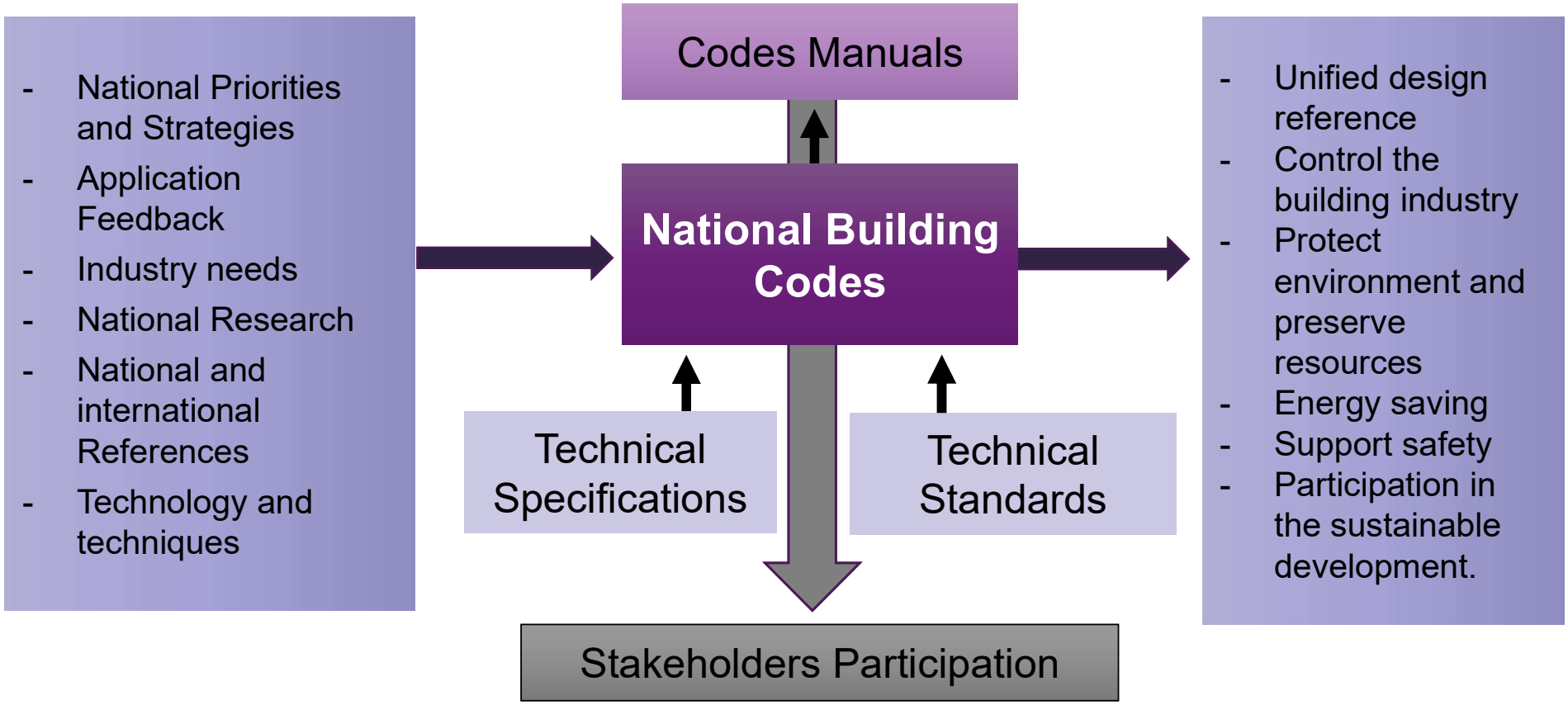
Building and Energy

Regulatory Framework, Codes, and Certification Scheme in Jordan

Regulatory Framework (Buildings and Energy)



ENERGY CODES DEVELOPMENT… CURRENT



ENERGY CODES ADOPTION… AMBITION

Code Development

- New references and feedback
- Stakeholders' engagement
- Checklists and Manuals

Building Design & Permitting

- Design Documents
- Baseline & Energy modeling
- Coordination Mechanism

Building Construction & Occupancy

- Enforcement Scheme
- Energy Audit
- Certification System

- National capacity building & awareness program
- Responsibility matrix
- National Fund & incentives system

- National requirements
- Updating time cycles
- National Database

Energy Codes and Manuals

Until March 2021

The following Codes and Manuals have been prepared to cover the technical requirements for energy in the construction sector in Jordan:

- Thermal Insulation Code and Manual
- Jordan Green Building Guide
- Natural Lighting Code
- Natural Ventilation Code
- Interior Illumination Code
- Energy Efficient Buildings Code and Manual
- Solar Energy Code and Manual
- Central Heating Code and manual
- Mechanical Ventilation and Air Conditioning Code and manual
- Code for Gas Piping in Buildings

Energy Efficient Buildings Code, and Manual

Under updating

The code aims to provide minimum requirements for energy efficiency in buildings excluding the low-rise residential buildings (two floors or less), in the design, construction, operation and maintenance phase of the building.

The draft contains seven sections dealing with the most important information the engineer needs to carry out the design, implementation and operation of buildings in accordance with the requirements of the minimum energy efficiency.

Some of the most important topics covered by the new draft are:

- HVAC equipment's minimum energy performance requirements.
- The minimum measures required for the building envelope to save energy, such as skin and roof minimum thermal insulation requirements, glazing, infiltration, and whole building simulation.

Energy Efficient Buildings Code, and Manual
The First Draft Content

Chapter One: General, Objective, Scope, Definitions.

Chapter Two: Building Envelop

Chapter Three: Mechanical ventilation, Heating and Air Conditioning Systems

Chapter Four: Water Heating Systems

Chapter Five: Electrical Power

Chapter Six: Artificial Lighting

Chapter Seven: Evaluating the energy efficiency of buildings

Solar Energy Code, and Manual

Under updating

The purpose of this code is to indicate the minimum requirements that must met in solar energy systems, whether they are solar photovoltaic systems or solar thermal systems, in order to ensure the protection of public health and safety and the public good.

The requirements and conditions in this draft are applied to the construction, installation, modification, restoration, relocation, replacement, addition, use, and maintenance of solar thermal systems and solar PV systems.

The draft includes topics such as:

- Utilization of solar thermal systems in swimming pools and hot tubs as well as thermal storage system.
- Lightning protection, and earthing design and installation.
- System monitoring.

Jordan's Thermal Insulation U Value for Walls

Mandatory Thermal Insulation Code Table(5-1, 5-2)	Mandatory Energy Saving Buildings Code Table(2-2, 2-3)	Mandatory Green Building Manual	Optional (1point) Green Building Manual	Optional (2 points) Green Building Manual
Solid walls = 0.57	Solid walls = 0.57	Solid walls = 0.57	Solid walls = 0.50-0.4	Solid walls = <0.4
All External walls =1.6	All External walls =1.6	All External walls =1.6	All External walls =1.45	All External walls =1.45

Solar Energy Code, and Manual

The First Draft Content

Part One: Photovoltaic Systems

- **Solar PV components**
- **Solar PV arrays and panel operational features**
- **System performance**
- **system electrical design**
- **Protection against lightning and overvoltage**
- **Inverter**
- **System requirements and connection to the electrical network**
- **Structural and mechanical requirements**
- **Monitoring system**
- **Installation process**

Part Two: Thermal Energy Systems

- **General Requirements: Equipment specifications, Circulating Pumps, Valves, Safety requirements, Disposal of liquid waste**
- **Piping Systems: Installation, Testing, Inspection, Dual Purpose Water Heating Systems, Expansion Tanks, Joints and Connections, System Control**
- **Solar Collectors**
- **Solar thermal systems**
- **Storage Systems**


برنامج الطاقة المتجددة وكفاءة الطاقة
المشروع ممول من الإتحاد الأوروبي
إلزامية تطبيق كودات البناء المتعلقة
بكفاءة الطاقة والطاقة المتجددة في المباني
كودة العزل الحراري
كودة المباني الموفرة للطاقة
كودة الطاقة الشمسية
كودة التدفئة المركزية
كودة التهوية الميكانيكية وتكييف الهواء
كودة التهوية الطبيعية والاصول الصحية
كودة الانارة الطبيعة
١ مرحلة التصميم وإصدار رخصة الإنشاءات
المكتب الهندسي
نقابة المهندسين الأردنيين
الدفاع المدني
نقابة مقاولي الإنشاءات
الجهات المانحة للتراخيص
تصميم وفقاً للكودات
تدقيق فني وتصديق المخططات
رخصة الإنشاءات
٢ مرحلة التنفيذ
نظام اجراءات الرقابة والتفتيش على أعمال الإعمار: رقم (٥٢) لسنة ٢٠٢٠
نقابة المهندسين الأردنيين
جهة الإشراف
نقابة المهندسين الأردنيين
الجهات المانحة للتراخيص
جهة الإشراف
نقابة مقاولي الإنشاءات
(مقاول مرخص ومصنف)
مصادقة
شهادة المطابقة
زيارات
متابعة الإشراف
بإشراف هندسي
بناء مطابق للكودات
٣ مرحلة الإشغال
الجهات المانحة للتراخيص
مزودي الخدمات
المالك / المستخدم
إذن الإشغال
توصيل الخدمات
بناء كفؤ موفر للطاقة
استغلال الطاقة الشمسية
تدفئة وتبريد كفؤة
إنارة طبيعية
عزل حراري لجميع الأسطح والجدران
تهوية طبيعية
إنارة موفرة للطاقة
تطبيق كودات البناء الوطني الأردني إلزامي بموجب القانون
ضمان جودة البناء وراحة المستخدمين
تقليل تكاليف الصيانة الدورية
ترشيد نفقات التشغيل
بالتعاون مع

Voluntary Certification Scheme for Energy Efficient Buildings in Jordan

BUILD_ME Building Typology
considering the prepared typology as a baseline

Building Energy Performance Tool
(BEP) tool as a calculation method considering local market information

Systems of national institutions

Requirements local banks

Adaptability to national context
Considering country needs and managerial infrastructures

Establishment of a national energy classification scheme

Ensure implementation and ownership of the scheme beyond BUILD_ME

Voluntary Certification Scheme for Energy Efficient Buildings in Jordan

Ownership & management

Scheme concept & design options

- Target market
- Rating score
- Deriving energy performance
- Updates and validity of assessment
- Database and certificate
- Engage with stakeholders and present the concept

Operational framework

- Certification and labelling process
- Verification, monitoring, surveillance and enforcement (including penalties)

Testing & roll out

- Phased implementation
- Capacity building program

Evaluation & update of the scheme

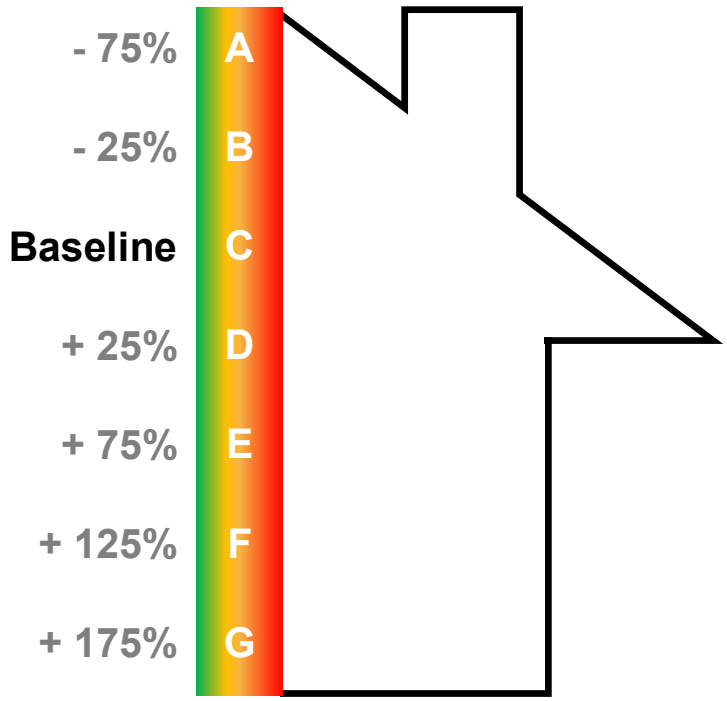
- Regulatory impact assessment (ex-ante evaluation)
- Plan and mechanism for evaluating the effectiveness of the scheme (ex post evaluation)

Voluntary Certification Scheme for Energy Efficient Buildings in Jordan

Classification scores for BUILD_ME building types

Class	Term	Score
A	Nearly zero energy building	<0.25
B	High performance building	0.25 - 0.75
C	Average new construction	0.76 - 1.25
D	Stock, better quality	1.26 - 1.75
E	Stock, medium quality	1.76 - 2.25
F	Stock, poor quality	2.26 - 2.75
G	Stock, urgent renovation demand	>2.75

Application of the classification score to baseline level



Energy Efficient Buildings In Jordan

Jordanian first solar house-1981 at RSS

- Study the possibilities of solar heating and cooling in buildings,
- Both passive and active design criteria were considered.
- The house faces the south, with large windows insulated walls.
- These collectors are manufactured in Jordan and have a total area of 40 m2.

KONN – Modular Housing

HVAC Systems & Appliances

Heating / Cooling
1/1.5 TonSplit unit A/C unit for each room, cooling/ heating (4 COP)
Coefficient of Performance = 3.52 W/W

Lighting
LED (natural light) integrated energy-saving lighting fixtures

Appliances
A++ Energy saving appliances for the living room and kitchen
(TV, Washing Machine, Refrigerator, Dishwasher, Microwave)

Renewable Energy

Solar Collector
Combined flat plate solar collector with hot water cylinder with integrated Instantaneous electrical water heater

Photovoltaic
Super high power poly perc Modules
Max. Power capacity = 2.0 KW

Izzat Marji HQ

LEED Certified Building in Amman with primary energy demand of 45 kWh/(m2*a)

(HCST)

The Higher Council for Science and Technology

A green building that uses renewable energy technologies to generate electricity from solar energy, geothermal energy for (water) heating and cooling, and LED lighting technology.

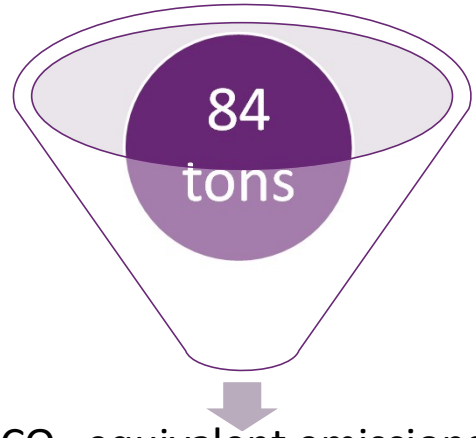
Implemented Projects

Relative to Green Buildings

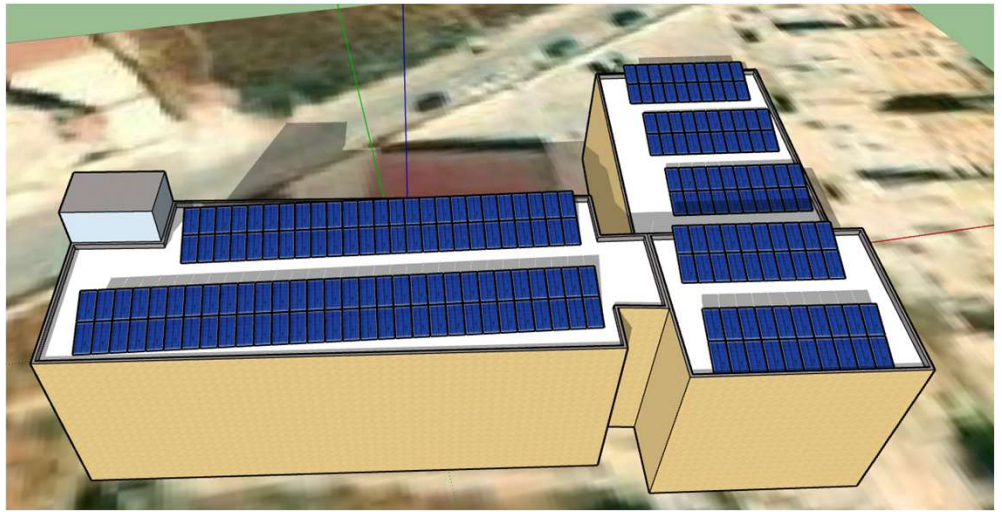
ENI CBC Med SOLE Project

High Energy efficiency for the public stock Buildings in Mediterranean

- **Selected Renewable Energy Systems**
  1. Solar Domestic water heating System
  2. PV System (84 kWp)
- **Selected Energy Efficiency Measures**
  1. Replacing Lighting Units
  2. Thermal insulation external walls and roofs, double glaze with PVC frame
  3. heating and cooling systems (AC split units)



CO_2-equivalent emissions reduction per year



Iskan Faiha' primary mixed School. (Public School)

MINARET

The MENA Region Initiative as a Model of the NEXUS Approach to Renewable Energy Technologies.

The overall goal of the project is to “Strengthen regional cooperation within the MENA region through implementing the NEXUS approach (energy/water/food) integrated with renewable energy technologies at the municipality level, to mitigate climate change impacts and combat poverty”.

ENI CBC Med BEEP project

(BIM for Energy Efficiency in the Public sector)

- BEEP project aims at strengthening the use of Building Information Modeling (BIM) to enhance energy efficiency in buildings.
- The testing of this emerging technology on built heritage will be performed to demonstrate its scalability to the entire building stock.
- The project will provide public administrations with a powerful method for the energy rehabilitation of public buildings to be supported with private funds through the Energy Performance Contracting.

BEEP

ENI CBCMED
Cooperating across borders in the Mediterranean

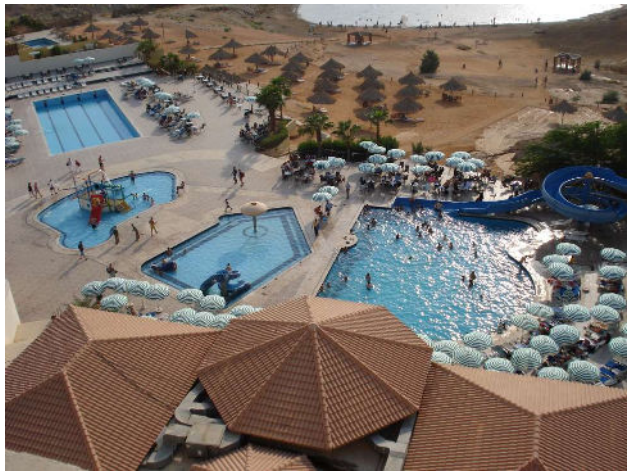
Project funded by the EUROPEAN UNION

REGIONE AUTÒNOMA DE SARDIGNA
REGIONE AUTONOMA DELLA SARDEGNA

REACt Project :

Renewable Energy Air-Conditioning Systems for Mediterranean Countries

The project aims to set-up innovative pilot RES-based (heat and air conditioning), to be used in specific environments:



- Summer performance (March – September): 57.8 MWh
- Winter performance (October – February): 13.5 MWh

BUILD_ME: IKI Project Accelerating 0-emission building sector

Towards a Low-Carbon Building Sector in the MENA Region

1. Increase use of efficient or renewable energy-based heating and air conditioning systems in new multi-family residential buildings and commercial buildings.
2. Build on project knowledge of the first phase prepare the ground for future collaboration to implement recommendations.
3. Draw from insights from a broad range of stakeholders: owners-occupants, financial institutions, municipalities, ministries and project developers.
4. Facilitate and increase the access to financing and funding opportunities for energy efficient building projects in the building sector.
5. Support the reform and transitions of the political frameworks towards improving energy efficiency in the building sector.

(AREE)-EU/MED - ENEC Project

Aqaba Residents Energy Efficiency pilot Project

Aqaba Residents Energy Efficiency pilot project.

Energy saving.

Grey water.

PV system

Local insulating materials

Results and potential for dissemination

- The 420 m² house is almost finished and will save over 70% of electricity, with incremental cost of about 38%, compared to a conventional house. The pay-back period for this investment is 8.6 years. The energy savings correspond to a yearly reduction of CO2 emissions of 21 tons, e.g. 315 tons over the minimum lifetime of the house. If photovoltaic panels will be added, the savings may amount to 93%

Opportunities & Challenges

- Access to EE technologies
- Availability of incentives and local initiatives
- Availability of testing and certification facilities and labs
- Availability of skilled ESCO and skilled engineers
- High potential solar energy
- Continuous development of NEEAPs

- Unaffordability of certain technologies
- Lack of sufficient public awareness on the benefits of energy efficiency and conservation
- Insufficient local manufacturers
- Lack of building codes enforcements
- Lack of grid technical capacity for absorbing generated renewable energy

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Royal Scientific Society

PO Box 1438, Amman 11941, Jordan
T (+962) 6 534 4701 | F (+962) 6 534 4806 | www.rss.jo