Increasing Efficiency

Developing the Capacity of ESCWA Member Countries to Address the Water and Energy Nexus for Achieving the SDGs: Regional Policy Tool Kit

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Economic and Social Commission for Western Asia

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Water and energy efficiency across sectors: From production, its use as a commodity and beyond

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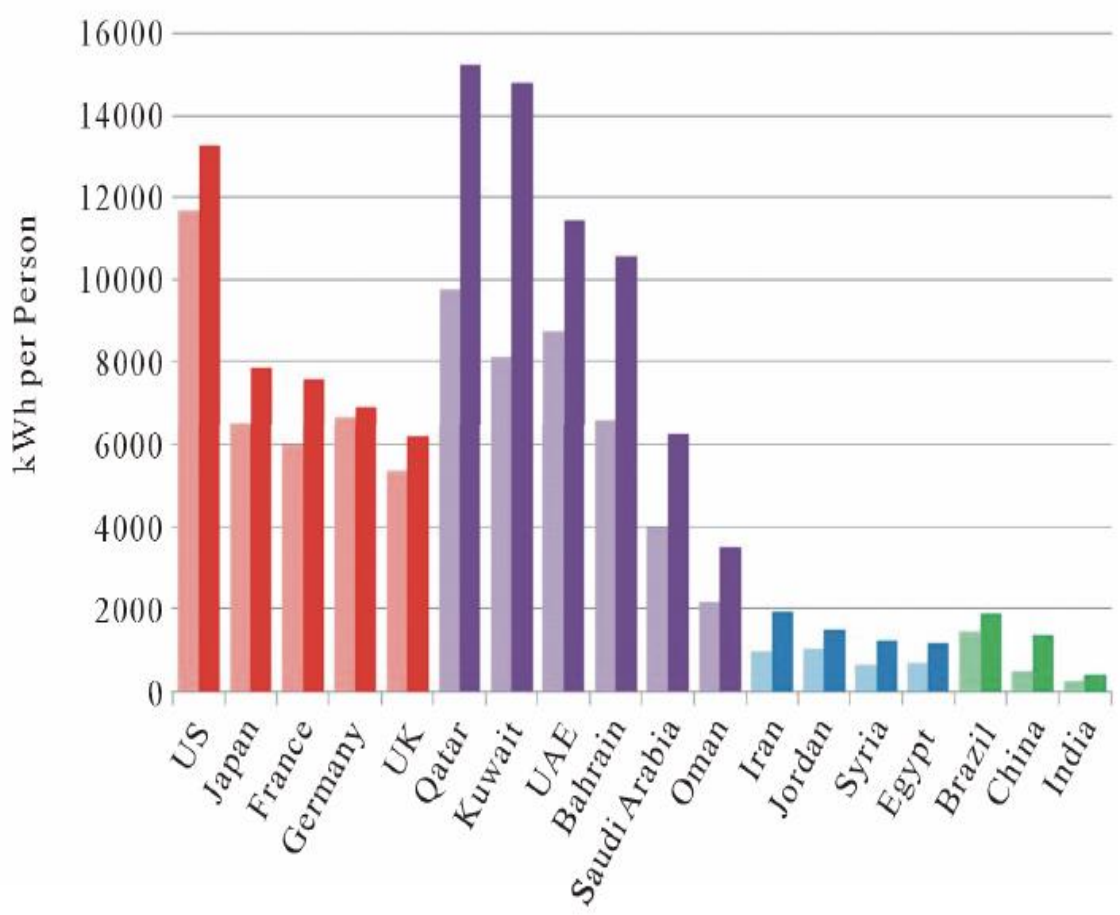
Water and Energy Efficiency across sectors

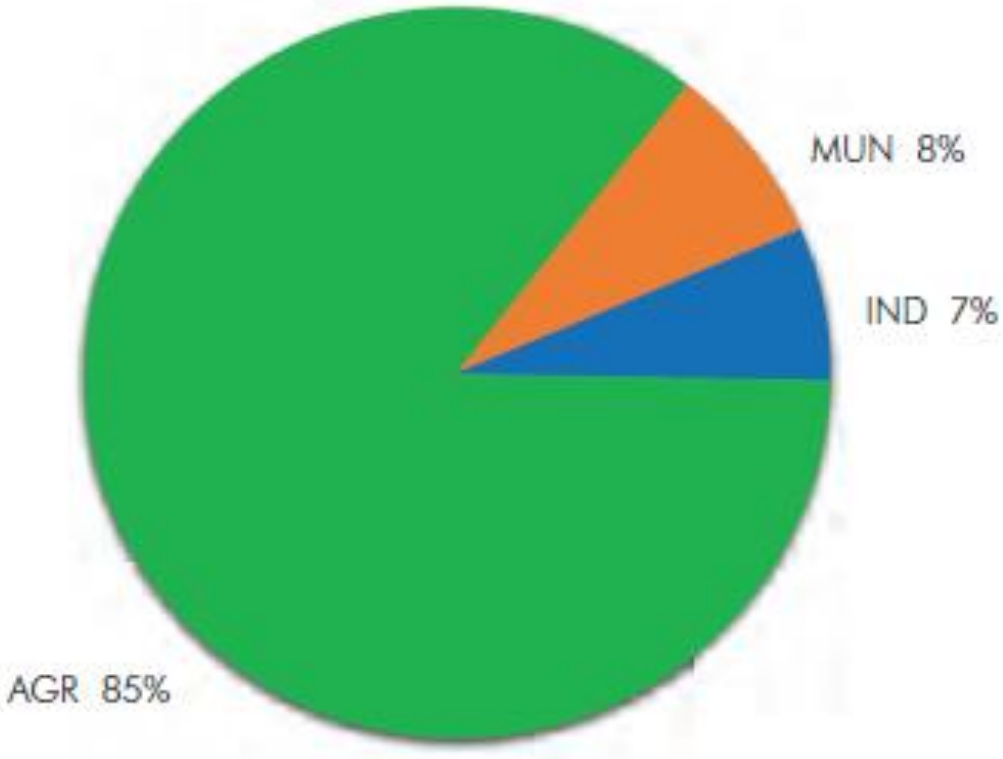
Energy Consumption Patterns

(Arab region and developed countries)



Source: Darwhish and Mohtar, 2013

Water Use by Sector in the Arab World



Source: AFED, 2016

Efficiency, Productivity and Nexus Productivity

Energy Efficiency

- Reducing the energy used or needed to provide certain products and/or services.
- Issues lie in this definition that make it hard to quantify progress

Water Efficiency

- Reducing water use for a certain product or service.
- Water's value governs definition of services, access, historical rights and allocation

Efficiency, Productivity and Nexus Productivity (continued)

Limitations of the term “efficiency”

- Limited to measuring economic and resources losses.
- Does not reflect the natural linkage between water and energy.

More inclusive and integrated view of efficiency is needed.

Productivity in the water-energy nexus

This is an integrating concept that evaluates the **total value** of resources, products and services.

Should integrate policy making with: industry/urban/agriculture policy and planning

Applies to manufacturing/private and utility sectors.

Productivity analysis in the energy and water production sector can look at:

1. Decentralized vs. centralized generation
2. Overall productivity of the supply chain

Productivity in the water-energy nexus (cont.)

Productivity addresses total value proposition to the user and broader economy by better applying resources not just efficiency.

However, it lacks the concept of human **access**.

Main reasons to look at broader/more integrated approach

1. Resource conservation
2. Reduce production and operating costs
3. Sustain fuel supply
4. Improve product quality
5. Protect the environment
6. Improve safety and productivity

Resource productivity

The productivity concept lacks a clear delineation of responsibilities of providing products and services and safe access to primary resources.

Question remains as to how to keep a balance between:

1. Efficacy and productivity
2. Environmental impact, and
3. Equity and access

Scale of Efficiency

The Alliance Commission on National Energy Efficiency Policy study recommends 3 areas of attention to double US Energy productivity by 2030

1. Investment in energy productivity throughout economy in cost-effective energy savings opportunities
2. Modernization of policies and infrastructure to improve energy productivity in order to reach national efficiency targets
3. Development of human capital through educating public, business leaders and policy makers on energy productivity pathways

Primary Resource Efficiency Framework

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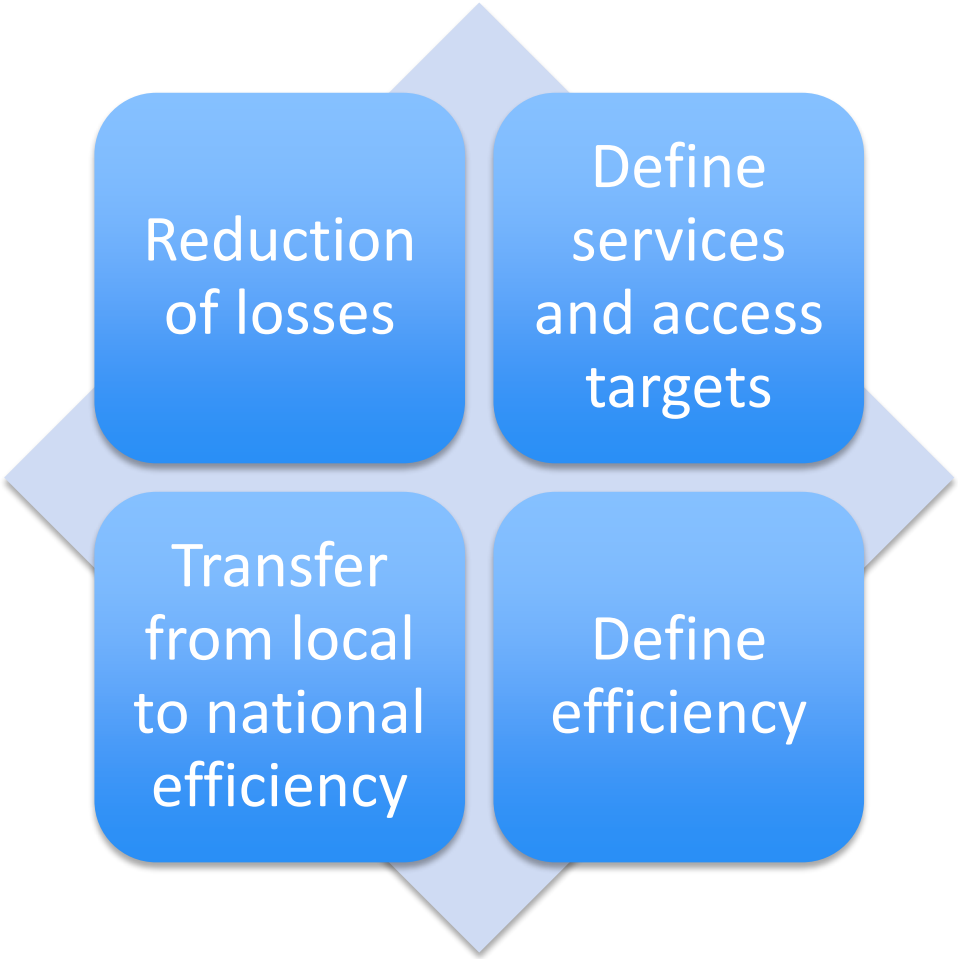
Primary resource efficiency framework



Primary resource efficiency framework: *Reduction of losses*

1. Continue effort to reduce losses in resources while providing critical services/products to stakeholders
2. Increasing resources efficiencies requires following investments
   - High efficiency and adaptable technologies
   - Production, storage and delivery infrastructure
   - Development of local know how human capacity
   - Public awareness on value of conservation
   - Public policy on pricing and incentives to conserve resources

Primary resource efficiency framework: *Define services and access targets*

1. Define services/products that delineate roles and responsibilities of public and private sector

2. This ensures access and equity of services as access to these primary resources must be looked at as a human right issue.

Primary resource efficiency framework: *Transfer from Local to Natinal Efficiency*

1. Create a multiscale framework
   Allows for transfer and translation of local scale efficiency in water and energy into national resources efficiency

2. Resources sustainability and implementation of SDGs must be assessed at the regional and national scale

Primary resource efficiency framework: *Define Efficiency*

Define it first in order to track progress!

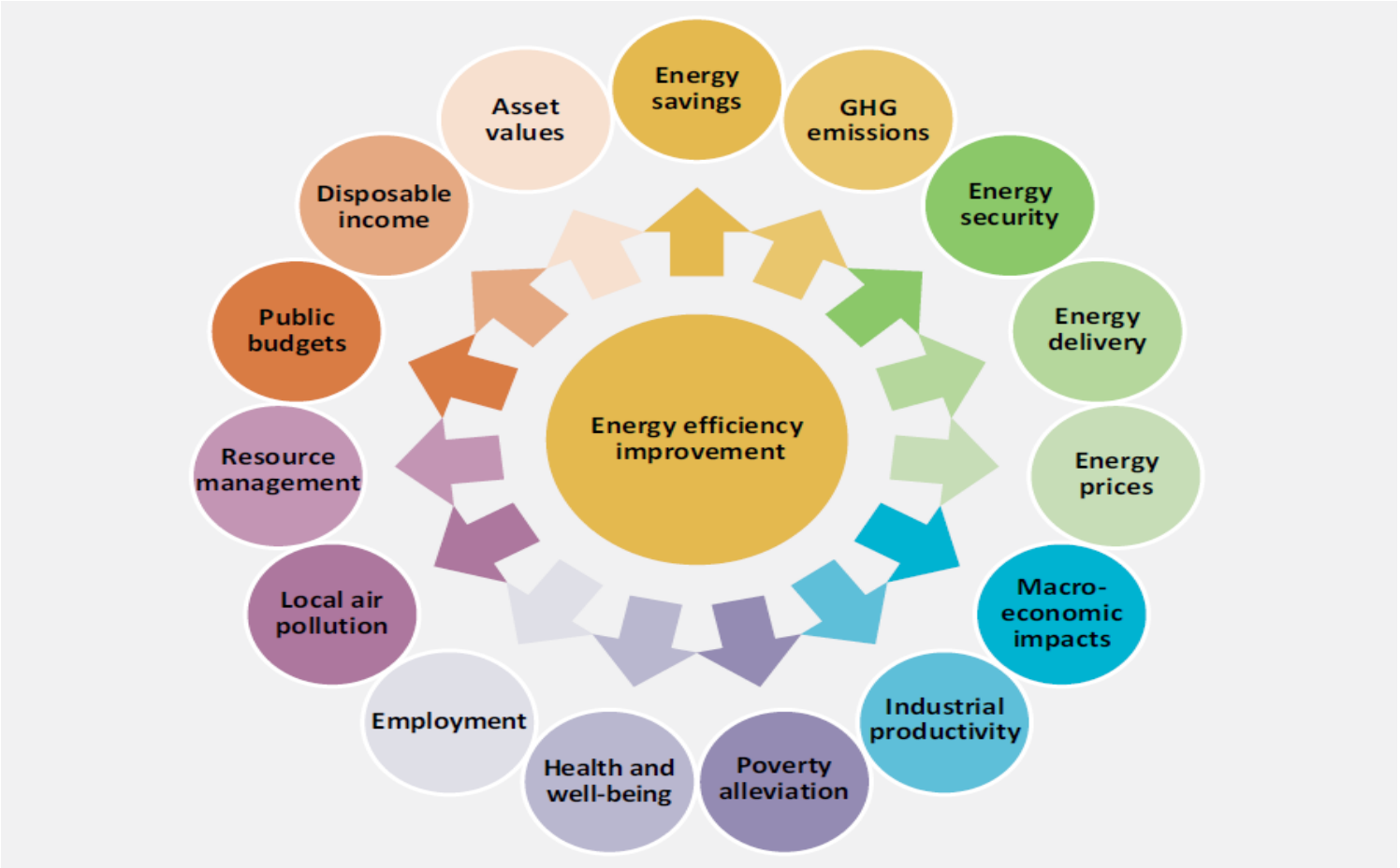
1. Economic efficiency
   Water, energy, and land footprints and economic resources used for services and products provided

2. Social efficiency
   Access infrastructure related to the services
   Prices, equity and affordability of the services

3. Environmental efficiency
   Resources long-term sustainability
   Air, soil, and water pollution from the production and utilization of the resource

4. Many others detentions!

Benefits of integrated energy efficiency improvement



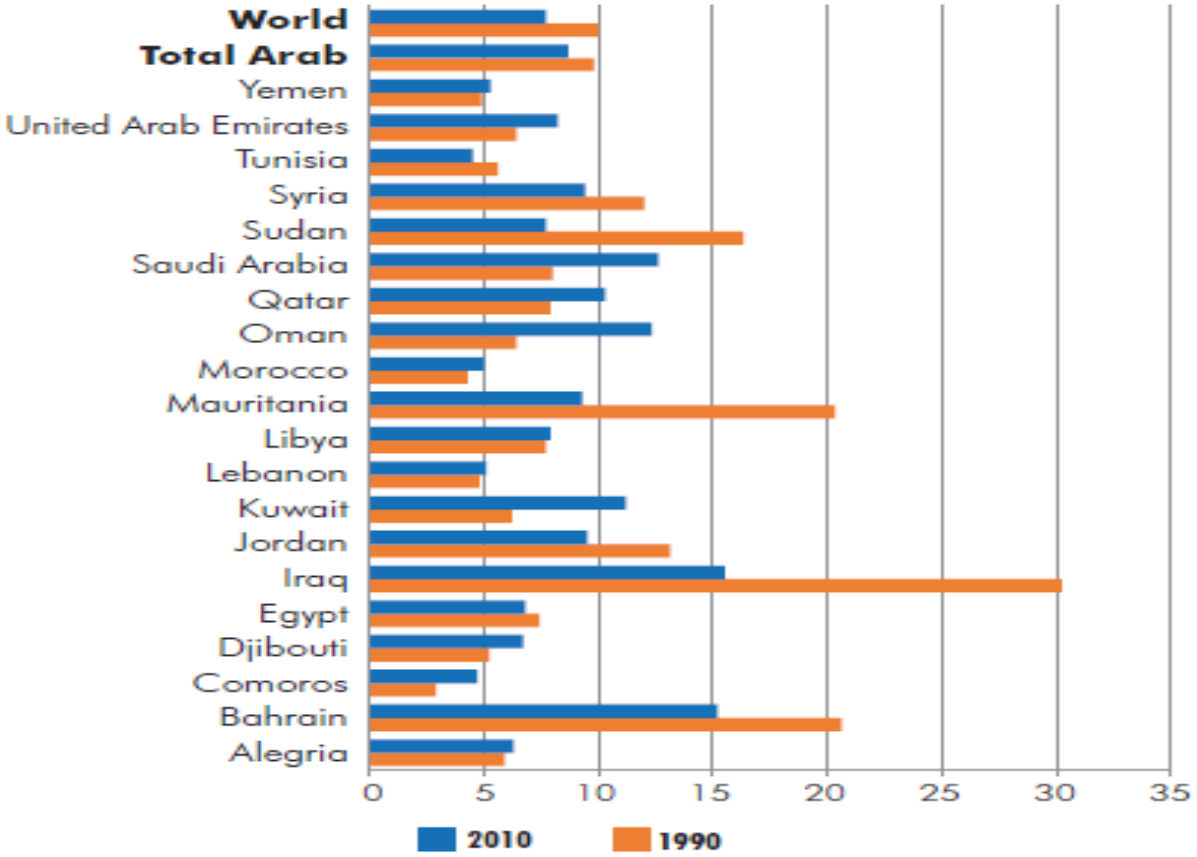
Energy Intensity

Energy intensity measures energy productivity of a country.
Defined as the ratio between primary energy consumption and the country's GDP

Ratio is adjusted to account for differences in cost of living in various countries

Measure of how much energy is needed to produce a unit of economic value
The lower the value, the better the infrastructure

Energy Intensity (MJ/$ 2005 PPP)



Source: AFED, 2015

Efficiency in the water industry: Desalination facts

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Efficiency in the water industry: Desalination case study

Entire GCC is under water deficit.
Desalination is an option that will be widespread in other MENA countries!

Excessive energy consumption drains fuel resources at a higher rate than production rates

Membrane technologies

Can save 75% of the energy and cut water production cost by 2/3 compared to thermal technologies

Total energy footprint is more than 5 times less than thermal technologies

Emissions are proportionally less as well

However, there are many reasons for not moving into membrane technology

Water and Energy Relation in Desalinated Water Production

Desalting water by MSF and Multi effect-Thermal Vapor Compression (MED-TVC) have almost the same energy requirements

MSF and MED-TVC should be replaced by SWRO, which could save up to 75% of the fuel energy used and reduce DW cost

Switching to RO Systems will add capital cost and predesigned site specific pretreatment technology

Treated wastewater should be considered as a non-conventional resource of water

Water and Energy Relation in Desalinated Water Production (continued)

Reduce costs by using relatively cheap natural gas fuel instead of oil.

Desalted water quality and cost is high, so its use should be limited to cooking and drinking

TWW should be used for applications that do not need high quality water

It is imperative to reduce per capita water use

Energy requirements and CO2 Emissions of Various Desalination Technologies

Technology	Mech. Equivalent to thermal energy input, kWh/m^3	Pumping energy input, kWh/m^3	Consumed fuel in, MJ/m^3	Consumed fuel in CPDP, kg/m^3	CO2 in kg/m^3 D	Cost $ /m^3
MSF (Boiler operated)	27	4	344	7.5	27.48	3
MSF in CPDP	16	4	200	4.36	15.98	-
TVC-MED	18	2	200	4.36	15.98	-
SWRO	NA	5	50	1.09	3.99	1

Production efficiency and consumer behavior: A case study about food waste and loss and its implication on water and energy.

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Food Waste Case Study

Food waste is a concern to food, water and energy security

This case study highlights food waste in three eco-zones of the ESCWA countries and its implications on water and energy waste

Food Waste Case Study: *Estimated waste percentages*

Estimated waste percentages for each commodity group in each step of the food supply chain (FSC) for MENA countries						
-	Agricultural production	Postharvest handling and storage	Processing and packaging	Distribution	Consumption	Total waste and loss
Cereals	6%	8%	5%	4%	12%	31%
Roots and tubers	6%	10%	12%	4%	6%	33%
Oilseeds and pulses	15%	6%	8%	2%	2%	29%
Fruits and vegetables	17%	10%	20%	15%	12%	55%
Meat	6.60%	0.20%	5%	5%	8%	23%
Fish and seafood	6.60%	5%	9%	10%	4%	30%
Milk	3.50%	6%	2%	8%	2%	20%

Estimated waste percentages for each commodity group in each step of the FSC for MENA countries (FAO, 2011)

Food Waste Solution Implemented; A Scenario of food waste reduction by 20%

Reducing food waste by only 20% can save:

3% of the total water used nationally for agriculture (case in Lebanon)

2% of the total national electricity generated (in the case of Morocco).

Reducing food loss and waste

Following activities are proposed solutions for the ESCWA region:

1. Consumer education campaigns
2. Waste tracking and analysis
3. Standardized date labeling
4. Produce specification (imperfect produce)
5. Packaging adjustment
6. Secondary resellers
7. Spoilage prevention packaging
8. Improved inventory management
9. Manufacturing line optimization
10. Cold chain management

Integrated Water-Energy Efficiency Programs

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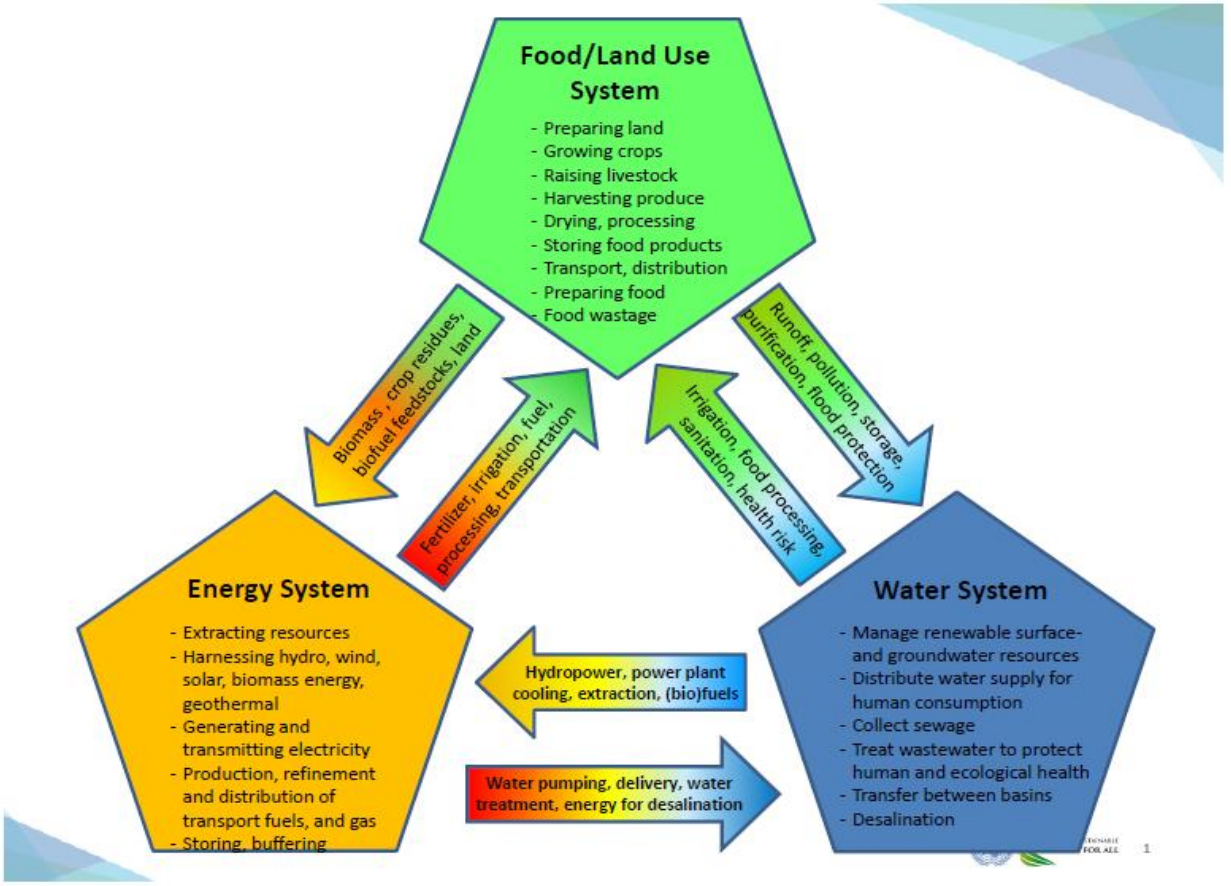
Water-Energy-Food nexus and efficiency



Source: SE4all, 2016

Water, Energy and Food as a Nexus for Efficiency in the SDGs

SDG 6.4: “By 2030, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity”,

SDG 7.a: “By 2030, enhance international cooperation to facilitate access to clean energy research and technology, including renewable energy, energy efficiency and advanced and cleaner fossil-fuel technology, and promote investment in energy infrastructure and clean energy technology.”

UN-DESA 2015.

Water, Energy and Food as a Nexus for Efficiency in the SDGs (continued)

SDG number 12, and specifically target 12.3: “By 2030, halve per capita global food waste at the retail and consumer levels and reduce food losses along production and supply chains, including post-harvest losses

UN-DESA 2015.

Integrated Water Resources Management, efficiency and the Nexus: So what's new?

IWRM is based on the view that segmented sectorial planning and decision making is likely to lead to unsustainable development pathways and inefficiencies.

Nexus and IWRM both see the need to promote greater coordination between inter-linked resource producing and consuming sectors.

Integrated Water Resources Management, efficiency and the Nexus: So what's new?

Key difference:

IWRM starts with the water resource

Nexus looks at all three elements as an interrelated system.

Therefore, the nexus offers a transdisciplinary participatory platform approach, while the IWRM is still a single sector approach to resources efficiency.

Incentives for investing in water-energy efficiency

1. Resource conservation and reducing cost of commodity production for public and private sectors

2. Sustain fuel supply in the oil and gas producing countries and reduce import of oil and gas in countries where no fossil fuel resources are available

3. Reducing cost and increasing profit will enhance product quality and consumer satisfaction

4. Reducing water and energy use for the same services will protect the environment, conserve natural resources and improve safety and productivity of the operations

Key Messages

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Title of Section

KEY MESSAGES

1. There is a gap in resource efficiency and resource productivity and their definitions
2. New vision of efficiency was proposed that integrates issues of scale, human right and access to these primary resources
3. Water-energy-food nexus thinking offers real opportunities for synergies to improve resource efficiency

KEY MESSAGES (continued)

4. Removal of subsidies is imminent to move towards more efficient and sustainable consumption and production patterns
5. Framework presented must be adapted to each nation and regions based on inherent values
6. The role of adaptable technology adoption and technology transfer is critical

Thank you

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