

## **Using the UN Sustainable Development Goals to Achieve Integrated Approaches to Water Scarcity, Agriculture and Energy for West Asia and North Africa**

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### ***Abstract:***

Achieving poverty eradication and development in West Asia and North Africa depends upon the sustainable use of natural resources and especially water as enter the post-2015 era and begin implementation of the United Nations Sustainable Development Goals (SDGs). The long term sustainability of water resources - threatened by climate, population and development - can be lower priority for countries faced by more immediate challenges of poverty and low productivity. Responding to water scarcity and drought depends upon integrated policy and planning and across multiple sectors, especially water, agriculture and energy.

National implementation of the SDGs in West Asia and North Africa supports integrated approaches to water scarcity, agriculture and energy. The paper explores the SDGs and the interconnections between water scarcity, agriculture and energy for the region. The paper draws on the UN Open Working Group on Sustainable Development Goals' Outcome Document; prior academic research on financial approaches, public private partnerships and community based and owned projects; and the United Nations Department of Economic and Social Affairs' (UN DESA) expertise and water scarcity projects. It also considers UN DESA pilot projects and strategic initiatives for knowledge transfer, capacity development and the integration of national agencies and programs.

Links between water scarcity, agriculture and energy are pressing in West Asia and North Africa due to greater drought and water scarcity at a time of growing populations, increasing social and economic needs, and climate impacts. Global frameworks and tools are explored including public private partnerships, finance and investment; the role of community-based energy and water projects for agriculture; and integrated policy making and water planning for implementing the SDGs for West Asia and North Africa. Finally, the paper closes with brief conclusions and recommendations.

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## **I. Introduction**

The paper explores the interconnections between water scarcity, agriculture and energy for developed and developing countries in West Asia and North Africa and the strategic role of United Nations Department of Economic and Social Affairs (UN DESA) in supporting the transfer of knowledge, strategic planning and the integration of national agencies and programs in these countries. The paper draws on prior academic research, UN DESA expertise and pilot projects, and the process for developing these goals by the UN Open Working Group on Sustainable Development Goals. Links between water scarcity, agriculture and energy are important due to pressing social and economic needs and climate impacts. Particular issues are top-down and bottom-up approaches for implementing the Sustainable Development Goals (SDGs) including public private partnerships, the role of public and private finance and investment, and community based and owned energy and water projects for the rural agricultural sector in West Asia and North Africa.

The July 19, 2014 Outcome Document of the Open Working Group on Sustainable Development Goals consists of an introductory preamble and seventeen goals. The goals in this consensus document are an extension and elaboration on the Rio+20 process originally established to improve resiliency and achieve economic growth and equity. These goals are closely interlinked and contain numerous connections between water, agriculture, energy and climate. Achieving poverty eradication and sustained progress in development in West Asia and North Africa depends upon the use of natural resources especially water as enter the post-2015 era. West Asia and North Africa are exposed to an arid and highly variable climate.

Current water demands in West Asia and North Africa are unsustainable and leading to rapid depletion of groundwater resources and increased food exports. The longer term sustainability of water resources - threatened by climate shifts, population growth and development needs - can be a lower priority for countries with more immediate challenges of poverty and economy. In particular, it requires the integration of policy, planning and implementation across sectors – especially water, agriculture, and energy. Addressing water scarcity, agriculture, and energy together and applying an integrated approach to planning can lead to sustainable economies by increasing efficiency, exploiting and building synergies, and improving governance across sectors.

National implementation of goals and targets under the SDGs requires sectoral integration. The interconnections and interdependencies between water, agriculture, and energy have led to the development of UN pilot assessments to identify gaps and exploit synergies, these pilots and tools being highlighted for Mauritius and Qatar. It is also apparent in a UN DESA water scarcity project for five countries in West Asia, and the Jordan case study, both discussed in this paper. Governance frameworks such as public and private partnerships and community based and owned projects, and modelling and tools for climate-land-energy-water-development also support an integrated approach to resource planning, and are discussed in this paper.

## **II. Sustainable Development Goals and Their Relevance for Water Scarcity, Agriculture and Energy in West Asia and North Africa**

### ***Introduction of the Outcome Document***

On July 19, 2014, the UN Open Working Group on Sustainable Development Goals (OWG SDGs) issued an Outcome Document. This consensus Outcome Document on the SDGs will be considered by the UN General Assembly in the fall of 2014. The introduction to the Outcome Document is discussed first, followed by a discussion of relevant goals and targets for water scarcity, agriculture and energy in West Asia and North Africa.

The introduction to the Outcome Document refers to objectives and requirements for sustainable development including sustainable patterns of consumption, and the production, protection and management of the natural resource base.

3. Poverty eradication, changing unsustainable and promoting sustainable patterns of consumption and production and protecting and managing the natural resource base of economic and social development are the overarching objectives of and essential requirements for sustainable development.

The SDGs take place within and affirm the existing international framework, and may support the implementation of these international agreements (clause 6). Climate change is a truly crosscutting issue across the Outcome Document, being recognized in the introduction (clause 8), and subsequently within the goals and targets.

The primary role of developing countries and their national policies and strategies is recognized:

12. Each country has primary responsibility for its own economic and social development and the role of national policies, domestic resources and development strategies cannot be overemphasized. Developing countries need additional resources for sustainable development. There is a need for significant mobilization of resources from a variety of sources and the effective use of financing, in order to promote sustainable development. ... Good governance and the rule of law at the national and international levels are essential for sustained, inclusive and equitable economic growth, sustainable development and the eradication of poverty and hunger.

The role of partnerships, the private sector and civil society are discussed in clause 14 of the introduction of the Outcome Document.

14. The implementation of sustainable development goals will depend on a global partnership for sustainable development with the active engagement of governments, as well as civil society, the private sector, and the United Nations system. A robust mechanism of implementation review will be essential for the

success of the SDGs. The General Assembly, the ECOSOC system and the High Level Political Forum will play a key role in this regard.

The SDGs are implemented with targets and indicators. The targets are described in the consensus document, with the indicators still to be negotiated. As clause 18 in the introduction indicates, the targets are designed to be flexible, with national targets and taking into account national circumstances.

18. Sustainable Development Goals are accompanied by targets and will be further elaborated through indicators focused on measurable outcomes. They are action oriented, global in nature and universally applicable. They take into account different national realities, capacities and levels of development and respect national policies and priorities. ... Targets are defined as aspirational global targets, with each government setting its own national targets guided by the global level of ambition but taking into account national circumstances. The goals and targets integrate economic, social and environmental aspects and recognize their interlinkages in achieving sustainable development in all its dimensions.

Some discussion of possible indicators has already occurred, but was of necessity tentative in the absence of defined goals and targets (SDSN 2014). More discussion of indicators will now occur.

Relevant SDGs in the Outcome Document for the examination of the water scarcity, agriculture, and energy in West Asia and North Africa include:

- Goal 2. End hunger, achieve food security and improved nutrition, and promote sustainable agriculture,
- Goal 6. Ensure availability and sustainable management of water and sanitation for all,
- Goal 7. Ensure access to affordable, reliable, sustainable, and modern energy for all,
- Goal 12. Ensure sustainable consumption and production patterns,
- Goal 13. Take urgent action to combat climate change and its impacts,
- Goal 15. Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss, and
- Goal 17. Strengthen the means of implementation and revitalize the global partnership for sustainable development.

### ***Goal 6: Water***

Given the prevalence of water scarcity and drought across West Asia and North Africa, goal 6 for water is the very pertinent. Goal 6 states:

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

6.5 by 2030 implement integrated water resources management at all levels, including through transboundary cooperation as appropriate

6.6 by 2020 protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes

6.a by 2030, expand international cooperation and capacity-building support to developing countries in water and sanitation related activities and programmes, including water harvesting, desalination, water efficiency, wastewater treatment, recycling and reuse technologies

6.b support and strengthen the participation of local communities for improving water and sanitation management

The above language refer to the role of efficiencies, technologies and capacity building and technology in addressing water scarcity, sanitation, treatment, re-use and recycling. Integrated water resource management, including transboundary cooperation, is highlighted. Water ecosystems are defined broadly in target 6.6 to include rivers, lakes, mountains and aquifers, reflecting the complexity of the global hydrological system as well as the aquifer based water supply in parts of West Asia and North Africa.

Supporting UN DESA initiatives and pilots for water scarcity in the region, target 6.a refers to the role of international cooperation, capacity building, activities, program and technologies. Target 6.b refers to supporting and strengthening local community participation, thus incorporating community based and owned projects for water (including agriculture and energy) within the goal's ambit.

## ***Goal 2: Food Security and Sustainable Agriculture***

Goal 2 includes provisions for agriculture and sustainability. Target 2.3 focuses on increasing agricultural productivity, particularly at the local level and small scale, while target 2.4 addresses linkages between climate and water scarcity. Both these targets are relevant for West Asia and North Africa, stating:

2.3 by 2030 double the agricultural productivity and the incomes of small-scale food producers, particularly women, indigenous peoples, family farmers, pastoralists and fishers, including through secure and equal access to land, other productive resources and inputs, knowledge, financial services, markets, and opportunities for value addition and non-farm employment

2.4 by 2030 ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters, and that progressively improve land and soil quality.

## ***Goal 7: Energy***

Goal 7 for energy includes provides a framework for international cooperation, technologies, and infrastructure, with a focus on developing countries:

7.1 by 2030 ensure universal access to affordable, reliable, and modern energy services

7.2 increase substantially the share of renewable energy in the global energy mix by 2030

7.3 double the global rate of improvement in energy efficiency by 2030

7.a by 2030 enhance international cooperation to facilitate access to clean energy research and technologies, including renewable energy, energy efficiency, and advanced and cleaner fossil fuel technologies, and promote investment in energy infrastructure and clean energy technologies

7.b by 2030 expand infrastructure and upgrade technology for supplying modern and sustainable energy services for all in developing countries, particularly LDCs and SIDS

## ***Goal 13: Climate***

Climate goal 13 refers to strengthening resilience and adaptive capacity to climate related hazards and natural disasters in all countries, including the water scarcity and drought that routinely afflicts much of West Asia and North Africa. Targets 13.1 to 13.3 state:

13.1 strengthen resilience and adaptive capacity to climate related hazards and natural disasters in all countries

13.2 integrate climate change measures into national policies, strategies, and planning

13.3 improve education, awareness raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction, and early warning

## ***Goal 12: Sustainable Consumption and Production***

Goal 12 for sustainable consumption and production integrates water, agriculture and energy. However, due to the more general nature of goal 12, this goal sets a framework and context for sustainable consumption and production across all sectors and resources; while the targets for the goals for water, agriculture and energy provide specific examples of how sustainable consumption and production may occur for these sectors and resources.

Targets 12.8 and 12.a-c state:

12.8 by 2030 ensure that people everywhere have the relevant information and awareness for sustainable development and lifestyles in harmony with nature

12.a support developing countries to strengthen their scientific and technological capacities to move towards more sustainable patterns of consumption and production

12.b develop and implement tools to monitor sustainable development impacts for sustainable tourism which creates jobs, promotes local culture and products

12.c rationalize inefficient fossil fuel subsidies that encourage wasteful consumption by removing market distortions, in accordance with national circumstances, including by restructuring taxation and phasing out those harmful subsidies, where they exist, to reflect their environmental impacts, taking fully into account the specific needs and conditions of developing countries and minimizing the possible adverse impacts on their development in a manner that protects the poor and the affected communities

### ***Goal 15: Biodiversity and Ecosystems***

Goal 15 for terrestrial biodiversity and ecosystems is relevant, although it is important to recollect that biodiversity, ecosystems and water are also referred to target 6.6 of the water goal. Targets 15.1, 15.3 and 15.9 state:

15.1 by 2020 ensure conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services, in particular forests, wetlands, mountains and drylands, in line with obligations under international agreements

15.3 by 2020, combat desertification, and restore degraded land and soil, including land affected by desertification, drought and floods, and strive to achieve a land-degradation neutral world

15.9 by 2020, integrate ecosystems and biodiversity values into national and local planning, development processes and poverty reduction strategies, and accounts

The reference in the terrestrial targets to drylands, desertification and droughts - including the conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services - is important for West Asia and North Africa, as is the focus on national and local planning, development process, and poverty reduction.



## ***Goal 17: Implementation of Sustainable Development Goals Through Technology, Capacity Development and Partnerships***

Goal 17 focuses on the implementation of the SDGs. Key targets under this goal would apply to and support UN DESA initiatives and pilots for water scarcity, agriculture and energy in West Asia and North Africa. Targets under this goal include:

17.6 enhance North-South, South-South and triangular regional and international cooperation on and access to science, technology and innovation, and enhance knowledge sharing on mutually agreed terms, including through improved coordination among existing mechanisms, particularly at UN level, and through a global technology facilitation mechanism when agreed

17.9 enhance international support for implementing effective and targeted capacity building in developing countries to support national plans to implement all sustainable development goals, including through North-South, South-South, and triangular cooperation

17.16 enhance the global partnership for sustainable development complemented by multi-stakeholder partnerships that mobilize and share knowledge, expertise, technologies and financial resources to support the achievement of sustainable development goals in all countries, particularly developing countries

17.17 encourage and promote effective public, public-private, and civil society partnerships, building on the experience and resourcing strategies of partnerships

The breadth of the above targets is wide. International cooperation and access to science, technology, knowledge and innovation is stressed in these targets, including at the UN level and through future global facilitative mechanisms. The role of international support for capacity building in developing countries for national planning to implement the SDGs is highlighted.

The breadth of partnerships and financial resources described in these targets include multi-stakeholder, public, public-private, and civil society partnerships and public and private finance. All these matters are discussed immediately below under section about the governance framework and tools for West Asia and North Africa.

### **III. Governance Framework and Tools for West Asia and North Africa**

#### **Financial Approaches for Implementing the Sustainable Development Goals**

Achieving sustainable development requires structural and technological changes, and significant investment in sectors such as water, agriculture, energy and related infrastructure. Sustainable development financing for these changes and sectors can come from domestic and external sources, including public and private finance.

Public and private finance can be complementary, though each have unique objectives and attributes. Different aspects of these financial approaches are discussed below, drawing upon existing research on financial approaches to support implementation of the SDGs (Muir 2014).

Obstacles remain for mobilising international finance to meet sustainability goals. Public policies and sources of revenues are critical to address market failures and raise resources for financing long-term investments in infrastructure, high risk investments such as innovation and new technologies, and global public goods.

In this context, there are challenges for advancing dialogue and setting of stakeholder priorities: clarifying global goals and commitments, assessing investment requirement and financing needs, and considering financial flows and practical options for sustainable development. These challenges are embodied in the two key tracks and reports of the Rio+20 follow-up processes: the Open Working Group on Sustainable Development Goals (Outcome Document 2014) and the Intergovernmental Committee of Experts on Sustainable Development Financing (IGCE SDF, 2014).

Ideally, inter-governmental processes could provide clear information on how to address the three challenges. However, there is a need for a more integrated approach, in particular linking of practical solutions with goals and financing needs. For example, a simplified initial framework to support financing the SDGs could be stakeholder reports on information from their sectors, resulting in short sectoral assessments that combine qualitative and quantitative elements.

This information framework could begin to provide the decision and policy makers with initial data and information for answering questions such as:

- What are the global and national goals and targets for a particular sector?
- What are the financing needs for the goals and targets?
- How to mobilize international public finance and private finance at scales needed?
- What are the different instruments and financing options for a sector on a profit and non-profit basis, and do they include non-financial incentives such as the provision of goods and services and improving regulatory frameworks?
- How to ensure most efficient and effective use of scarce public and private financial resources to achieve sustainable development objectives?

Key stakeholders for implementing the financial approaches and instruments include governments, the private sector, civil society including non-governmental organisations (NGOs), development aid and climate finance, and innovative sources of finance.

The components of these financial instruments or options can be characterized as follows:

- Financial approach: the financial facilities or mechanisms, such as public private partnership led by the public or private sector or civil society, including philanthropic organisations and NGOs through which public and private funds may flow;
- Business model: the core aspects of a business that describes the rationale of how an organization creates, delivers, and captures value in economic, social, environmental contexts; and
- Financing instruments: the types of financial products or policy tools via which finance is delivered.

These characterisations can be used to clarify the complex institutional roles and mechanisms of international finance.

Clear and comprehensive maps of financial approaches, instruments and options could also be a tool that enables decision and policy makers to recognize the respective instruments and opportunities for public and private finance, and to ensure that regulatory instruments and public finance can be strategically used to encourage and leverage private finance.

Common instruments of public and private finance include global funds, grants and guarantees for blended loans from development finance institutions, structured grants (for viability-gap funding and project preparation), specific forms of contracts (such as pilots in advanced market commitments and development impact bonds), risk-based instruments (first-loss funding, guarantees and political risk insurance), concessional loan and finance, and equity participation.

Along with the private sector, the expanding role of civil society can also be considered, including the roles of philanthropic foundations, NGOs, public charities and individual charity initiatives (i.e., donations and crowdsourcing).

Public private partnerships can mobilise additional finance. Public private partnerships (PPP) includes a broad range of public private engagements, and will be important in the delivery of the sustainable development goals, including the development of sectoral capacity to deliver those goals at the regional, national and local scale.

A traditional model of PPP involves a contract between the public sector and a private enterprise in which the enterprise provides a public service or project and assumes financial, technical or operational risks.

Another model is the public private community partnership (PPCP), where government and private enterprises work together for social welfare, eliminating the focus on profit.

Public social private partnership (PSPP) includes government, private enterprises, and social enterprises and social economic organizations, with the partnership implementing social aims.

Global public private partnership (GPPP) foster cooperation between the public and private sectors facilitated by an international intergovernmental organisation like the United Nations.

Specialized sectoral partnerships have also potential to achieve specific goals and targets under the SDGs. For example, a health services PPP could be designed to deliver on one or more targets pertaining to water and health, such as sanitation or water treatment. A health services PPP could be a long-term contract where government engages private enterprises to innovate and deliver health services over a contract term. In this case, the private enterprise is paid for delivering health services and assumes financial, technical and operational risks; and is incentivized to reduce costs by sharing the benefits of health cost reductions with government.

For the purpose of financing the SDGs, the following financial approaches will be useful:

- Public finance from governments and international organizations;
- Blended public and private finance;
- Private finance for international and national programmes; and
- Non-financial contributions in all the other categories, such as improvement of regulatory frameworks, in-kind contributions including the provision of expert and technical advice and services, tangible and intangible goods, and data and data analytics.

The above public and private financial approaches can also be pursued on a profit and non-profit basis, broadening the range of approaches and instruments. These financial approaches could also be designed to meet cross cutting issues across sustainable development such as: climate adaptation and mitigation; the energy, water and food security nexus; maternal and child health; and education and economic development.

Once the post-2015 development agenda and all SDG targets and indicators are agreed, future global sustainable development reports and other reporting and communications mechanisms and tool can include financial input.

Ongoing financial input would support efforts to expand global knowledge of the financial challenges, available financing approaches, and public and private financial instruments and options. This ongoing financial reporting and communications would also assist in scaling up and mainstreaming the financing of the post-2015 sustainable development agenda and goals.

## **Community Based and Owned Approaches to Water, Agriculture and Energy in West Asia and North Africa that Support Sustainable Development Goals**

Community based and owned projects can alleviate water scarcity and address agriculture and energy. The overall objective of these projects for West Asia and North Africa is to address water scarcity and energy demands for domestic water use and irrigation. In so doing, they facilitate small scale off-grid rural electrification, and increase agriculture productivity and economic growth.

These community based and owned projects could satisfy energy demands associated with water use, improve irrigation and agricultural processing, enable smarter practices by providing mechanical energy and electricity; and allow leapfrogging through innovative design.

This community based and owned approach to projects has been considered for Asia and Africa (Sovacool, 2012). Research projects have developed community based and owned micro-hydro projects in rural Tanzania (Sovacool/Muir, 2014), with these approaches that is discussed here and adapted for West Asia and North Africa. This approach to community based and owned projects can be scaled up and down, with flexibility as to project design and energy and water technologies. For example, renewable energy sources and technologies such as bio-mass, hydro including micro and run of river, solar, and wind can be substituted interchangeably. Furthermore, renewable energy can be combined with desalination, thus addressing both the energy and water goals.

Community based and owned projects are organized around the following structure and process: 1) the design and construction of renewable units in rural agriculture areas, implemented in tandem with partners in the government and community based organizations; 2) followed by detailed community level analysis of agricultural productivity impacts and corresponding community development funds, through the use of household surveys; and 3) socioeconomic analysis supporting replication of the project and other related business opportunities.

The most important output of these projects is the construction and operation of small-scale renewable energy projects, and the use of electricity for agriculture and water purposes. Depending on community needs, electricity can be provided for:

- Agro-processing (husking, grinding, expelling) of grains and other food crops,
- Water purification, pumping, irrigation for agricultural crops, livestock and domestic uses,
- Lighting for farms, small-scale commercial enterprises, and for nighttime training classes and educational sessions,
- Cooling of drugs and vaccines,
- Mobile phone charging including monitoring crop and livestock prices, and
- Household electrification for lighting and cooking.

A secondary aspect of community based and owned projects is the improved socio-economic status of the communities, which can be verified through direct field measurements, household surveys, focus groups and interviews. A final aspect is the replication and the development of new products, business models and mechanisms for clean energy projects in rural agricultural communities. This last aspect can result in the production of reports for local partners, government ministries, industry and other stakeholders.

This model for community based and owned projects follows the UNDP's Renewable Energy Development Project model of devolving control over each renewable energy installation to Renewable Energy Functional Groups (REFG), with equal representation of men and women. Project partners can work with the REFG and other stakeholders to design a Community Development Fund (CDF).

The CDF is designed to be financed through revenue from electricity sales and managed by community members. It supports system maintenance and community-led projects designed to enhance agricultural productivity, accelerate economic growth, reduce poverty, and promote education, health and gender empowerment.

Depending on community priorities, the community funds could be used to pay for training for more efficient agricultural processing and improved productivity, expansion of household electrification, and establishment of cooperatives and micro-lending programs. Implementation impacts on agricultural productivity are assessed through farm surveys to estimate impacts on crop yields and inputs, as well as through semi-structured interviews at the farm and community level. Emphasis is placed on quantifying changes in agricultural production and village-level economic activity, including analysis of improvements in production of agricultural products (i.e., increases in yields due to irrigation) and changes in the value of agricultural production (i.e., improvements in agro-processing).

These multiple aspects make community based and owned projects adaptive, innovative and resilient including a focus on leapfrogging, efficiency, and agriculture; the use of renewable energy technologies that demonstrate innovation in cost, storage and demand factors; the emphasis on gender empowerment and linkages with family health and education; the devolution of implementation and management to the community; and the design and implementation of the community mobilization fund.

Research throughout Asia and Sub-Saharan Africa has shown how these types of community projects improve community income levels, equalized gender roles, enhanced access to education, health and information services, and reduced migration patterns. They generate income and employment in direct and indirect ways. Moreover, it provides means for electricity information and communication technologies to become accessible to villagers (Sovacool, 2012).

A primary goal of community based and owned projects is to increase agricultural productivity in rural offgrid agricultural communities by bringing electrification from renewable sources. Additional community benefits will occur due to an integrated, whole-community approach including: better educational opportunities, improved gender roles, higher incomes, better public health, enhanced social resilience, improved climate change adaptation, and reduced greenhouse gas emissions.

When implemented properly, community based and owned projects can provide avenues for income generation such as agricultural processing, shops, carpenters, and tailors, as well as long-term effects through schooling and information, as well as changed rural-urban migratory patterns. Power supply independent of the national grid, furthermore, can energize attached irrigation systems, and enable improved education and training in efficient water usage. More access through information and income generation can improve community health and reduce the indoor pollution caused by wood fires.

The whole-community strategy uses functional community groups that devolve decision-making authority to men and women. Furthermore, community funding supports training, maintenance, and provides ongoing capital to make the projects self-sustaining. By selecting strong communities, this ensures that using the electricity improves agricultural efficiency and the local economy, and serves as models for subsequent replication.

Community based and owned projects support agricultural-based economic growth by improving the efficiency of both supply and demand aspects of farming. On the supply side, they enable more efficient irrigation, water pumping, water purification, and agricultural processing. On the demand side, they improve resilience and community education by enabling electronic telecommunications, lighting for productive and educational uses, and cooling for drugs and vaccines. To the extent that households use the electricity for cooking, they can displace the collection of woody biomass and charcoal, which contribute to deforestation and community health issues. Electricity can also be used to pump and purify contaminated water.

Community based and owned projects for water, agriculture and energy are National Adaptation Programmes of Actions (or NAPAs). Besides displacing traditional fuels and kerosene for lighting, electrification improves community assets and bolsters social resilience, thereby enhancing the adaptive capacity and resilience of communities.

Community based and owned projects are Nationally Appropriate Mitigation Actions (or NAMAs), resulting in low carbon power generation and low carbon business development in rural agriculture. The projects result in low carbon electricity, and the displacement of future hydrocarbon use in rural agriculture and for local household uses. Typically, the calculation of the mitigated carbon is based on the displacement of electricity from diesel generators. The actual carbon reduction can be tabulated once the projects are underway.

## **Beyond Silos to Integrated Policy Making Under the Sustainable Development Goals**

One of the key recommendations from the UN High Level Political Forum is to focus on transitioning from silo-based policymaking to integrated policymaking (HLPF 2014). This is critical to fostering fit-for-purpose governance which effectively addresses development challenges at all levels. The application of integrated modeling and planning approaches have also increasingly been used at the national level.

At the national level, integrated modeling and planning approaches to climate, land, energy and water (also known as CLEW) and other nexus approaches support integrated decision-making between different sectors by allowing all sectors to use the same data and benchmarks, highlighting the interdependencies and illuminating existing synergies and trade-offs.

To achieve integrated policymaking for sustainable development, governments must: foster greater institutional coordination in the form of a national strategic planning agency or process with a multi-stakeholder platform, designate each sector's lead government agency, delineate chains of decision-making authority, and support the appropriate institutional linkages to enable leadership.

Increasing horizontal coordination allows the analysis of submissions by different agencies in decision making processes. It incorporates systems of accountability, balances various interests, facilitates compromise, and mitigates conflicts in policymaking. Capacity gaps can remain for data collection, analysis, monitoring and evaluation, as well as availability of data and modeling platforms for all stakeholders. Knowledge sharing and awareness-raising on the value of integrated planning contributes to developing and enhancing capacity across government, stakeholders and civil society.

The interconnections and interdependencies between water, energy and agriculture have widely been recognized in the United Nations and have led to the development of pilot assessments and subsequent tools to identify gaps and exploit synergies. This is highlighted in two pilot cases in Mauritius and Qatar. An integrated modeling and planning approach for assessing climate land energy water development (CLEWD) was utilized in both places. Figure 1 illustrates the CLEWD model and tool.

CLEWD modeling in Mauritius exposed how a national biofuel policy that made sense from a best practice energy and land planning perspective could be jeopardized by climate impacts. The use of modeling and analysis tools focusing on links determined that changes in precipitation would require increased water withdrawals, which in turn would lead to high energy demand to maintain the pumps to feed bio-fuel crop. The increased electricity for desalination and pumping would be met with coal-fired power generation, which would negate the carbon reductions originally sought. Higher coal imports also have a negative impact on energy security. Therefore, the benefits of the biofuel ethanol policy aimed to reduce energy import costs and emissions were vulnerable to climate change and, over the long term, the policy was high risk (UN 2014).



Qatar is a nation with strong growth and advancement, and governed by a national visions and goals. Agriculture is limited by infertile soils, water scarcity, poor water quality and management and unsuitable climatic conditions, which all contribute to low crop yield. A study identified water, energy, and agricultural and economic strategies to achieve food self-sufficiency. Multiple scenarios demonstrated that increasing the self-sufficiency of food products by 10% would increase land requirement by 153% and water requirements by 82%. As a result the study, scientific discussion and policy narrative changed from self-sufficiency to identifying a mix of local production and international trade (UN 2014).

### **Integrated Water Planning to Address Water Scarcity and Drought in West Asia and North Africa**

Access to adequate supplies of water is a universal component and indicator of human well-being and development and plays a fundamental role in helping to resolve problems associated with poverty, disadvantage and exclusion (Potter 2010). It is also a fundamental aspect of national development, and economic and social equity and stability. Growing demands stress water resources. This is especially true for North Africa and West Asia as the majority of the region suffers from water scarcity, drought, and rapid population growth. For example, approximately 80 per cent of the population in this region is affected by drought.

Drought management is an integral aspect of water and resource management. Droughts are complex events generally associated with reduced and highly variable precipitation. Drought impact in African and Asian regions according to the United Nations Development Program results in decreased crop yields and a decline in food security, shortages in potable water, declining health, economic losses, a decrease in livestock, famine, migration and displacement, a decrease in water available for business and industry (hydropower), increases in community and national level conflicts and crimes (including violence against women in the household), fires, and forced sale of land and household assets (UN DESA/ESCWA 2013).

A major drought gripped West Asia and North Africa region in 1999 affected nearly 40 million people, including 37 million in Iran and another 3 million shared across Morocco, Jordan, Pakistan and Syria. By 2000, nearly 50 million people were affected as drought expanded from Morocco to Tajikistan. The drought continued unabated through 2001 before beginning to lessen in most areas by 2002 (UN DESA/ESCWA 2013).

Climate impacts has affected the water balance for the Mediterranean basin, influencing extreme events such as floods and droughts through shifts in timing and amount of precipitation (IPCC, 2013). Many areas affected by drought are arid to semi-arid, under substantial ecological pressure, and low resource availability. Drought has already become an increasingly frequent and major threat to human security in the West Asia and North Africa, and exacerbated by climate change (UN DESA/ESCWA 2013).

To ensure water resource security, there is a great need to develop and implement water scarcity and drought management plans in water-scarce countries most susceptible to drought in order to increase societal and environmental resiliency and to enhance drought response and recovery capabilities. The wide reaching impacts of water scarcity and drought underscore the need to incorporate stakeholders from multiple sectors, both in government and the private sector.

Secure water resources play an integral role in industry, energy production, agriculture, and are an indicator of human well-being and health. Stakeholders must be involved in every step of policy and project development to ensure efficient resource management and policy and project integration. These linkages exist in other areas and on different local, national and regional scales, such as energy input for agriculture, agriculture for biofuel production, or energy for seawater desalination. The linkages require integrated approaches to identify solutions to cross-sectorial trade-offs and to build on synergies.

This is highlighted by the UN DESA pilot project, Strengthening National Capacities to Manage Water Scarcity and Drought in West Asia and North Africa. The project's main objective is to strengthen the capacities of national planners, policy makers and stakeholders in water-scarce and in transition settings countries in West Asia and North Africa, and to enhance their effectiveness in the formulation, implementation and monitoring of conflict-sensitive ex-ante (proactive) drought management.

The UN DESA pilot project focuses on close coordination and partnership with key government offices, institutions, and ministries, including Ministries of the Environment, Natural Resources, Agriculture, Economic Development, and Planning, and facilitates open communication and transparency between all stakeholders. By providing these countries with research tools, quantitative models and decision support tools, and increased collaboration among agencies provide countries with means to develop integrated assessments to facilitate sustainable development (UN DESA/ESWCA 2013).

#### **IV. Jordan Case Study for Water Scarcity, Agriculture and Energy**

Jordan is a country that would benefit from an integrated approach to planning and policy. Jordan is characterized by resource scarcity in water, energy, food and agriculture. The crisis in Syria and political instability in the Middle East has resulted in an influx of refugees. High internal population growth places increasing strains on the country's already limited resources. Additionally, resource management is largely siloed by resource types and agencies.

##### ***Water***

Jordan's water resources are extremely limited. Jordan currently has a per capita water supply of 145 cubic meters per year (Hadadin 2010). Jordan's water supply consists of four primary sources of water that the country utilizes: precipitation, surface water, groundwater, and wastewater. The country receives approximately 680 MCM per year. Precipitation events range from less than 50 mm to 600 mm in the western highlands with evaporation rates of over 90 per cent and groundwater and surface water recharge rates being 5.4 per cent and 2.4 per cent respectively (Nortcliff 2008).

With high population growth of 2.8 per cent and influxes of refugees increasing demand, per capita water use is projected to decrease to 91 cubic meters by 2025 (Nortcliff 2008; Jiries 2011). Current water demand exceeds the available renewable water resources causing water deficits between 187 MCM and 240 MCM. Water deficits are expected to increase to 360 MCM by 2020. Figure 2 illustrates historic and projected uses of Jordan's water supply.

Due to water stress, Jordan has a water-rationing system since 1987 which supplies water through its network once or twice weekly to manage the resource. (Venot 2007, Potter 2007). Though this infrastructure is impressive, 54 per cent of the water entering the city's distribution system has been classified as unaccounted for with half lost through leakage. The remaining unaccounted for water is due to illegal use of water, inadequate billing and metering (Potter 2010).

##### ***Agriculture***

The agriculture in Jordan is characterized by severe shortfalls of land and water, and fragmented land holdings. Only 4.3 per cent of land is arable. Of this, about 84 per cent is rain fed with the remaining 16 per cent irrigated. Agricultural production contributes approximately 5 per cent to GDP and consists of just over 12 per cent of Jordan's total exports. Approximately 92 per cent of the population has access to food although the country imports most of its staple grains and food supplies.

Fruit, vegetables, cereals and milk are the major food groups. Results from HEIS 2008 study highlight the importance of cereals, fruits and vegetables in the diet: about 500 gram of cereals per person per day, mainly bread and rice. Consumption of fruit and vegetables is more than 400 grams per person per day. The daily meat (mainly poultry and lamb) is 150 grams per person per day (FAO, FAOSTAT, 2011). Figure 3 illustrates the composition of Jordan's food supply.

Most local agricultural production is fruit and vegetables (tomatoes, cucumber, citrus fruits, bananas), and this production receives the most support from government. Local production of cereals has decreased since the early 1960s while starchy roots, animal products, fruit and vegetables have increased over the same period (FAO, FAOSTAT, 2011). Jordan is self-sufficient in fruit and vegetable production since 1970.

Within arable land, there is decreasing use of land for cereals. Land under field crops (cereals, pulses, tobacco and vegetables) has fallen steadily (over 32 per cent from 1992 to 2001), while land under fruit trees and olives has increased (about 64 per cent from 1992 to 2001). This is due to increasing urbanization and population growth, which has caused a prioritization of water efficient agricultural products.

### *Energy*

Jordan is an energy importing country and faces challenges as a result. Over 97 per cent of energy is imported with 80 per cent being gas from Egypt via the Arab Gas Pipeline. Government statistics indicate that in 2012 the use of crude oil and oil products accounted for approximately 88 per cent of Jordan's total primary energy demand, with domestic sources of oil and natural gas contributing less than 2 per cent.

Transportation accounts for half of Jordan's energy consumption and will continue to increase. Household consumption accounts for 23 per cent. Industry is the third largest user of energy for the country at 13 per cent. Total electricity consumption has increased 58 per cent, from 6.6 to 10.4 billion kWh in 2001 to 2011.

Annual electricity consumption per capita rose 25 per cent between 2001 and 2011, from 1,280 to 1,598 kWh per capita. However, primary energy intensity has decreased 18 per cent over the past decade, from 266 to 217 kg of oil equivalent per \$1,000US GDP respectively indicating an improvement in the cost of converting energy into GDP.

In the wake of political unrest in the Sinai Peninsula and in Syria, energy imports have become increasingly volatile, resulting in natural gas imports to fall from 89 billion cubic feet (bcf) in 2010 to only 17 bcf in 2012. Since much of the country's electricity generation comes from natural gas, the disruptions have resulted in frequent power shortages and blackouts. The gap in natural gas supply for power generation is filled utilizing highly expensive imported diesel.

## ***Integrated Resource Management***

Jordan has made resource management a priority. This is highlighted by the numerous large scale projects and initiatives that the country has committed to. However resource management and policy development remains institutionally segregated or siloed.

Jordan's water resources are managed by three institutions: The Ministry of Water and Irrigation (MWI), the Water Authority of Jordan (WAJ), and the Jordan Valley Authority (JVA). Of these institutions, MWI is the official body responsible for the overall water and wastewater system, related projects, planning and management, and is also responsible for national water strategies and policies, and allocating financing (GTZ 2004). The WAJ was established as an autonomous corporate body, with financial and administrative independence linked with the Ministry of Water and Irrigation.

WAJ is responsible for public water supply and waste water services, as well as water resources, planning and monitoring, construction, operations and maintenance. The project management unit of the WAJ is responsible for regulating water and wastewater utilities. JVA has been established for the social and economic development of the Jordan Rift Valley including the development, utilization, protection and conservation of water resources. The King Abdullah Canal represents the backbone of the JVA water distribution system in the north of the Dead Sea. WAJ and JVA are by law responsible for water supply and wastewater services in Jordan (GTZ 2004) .

In response to food insecurity, Jordan administers a range of subsidies and tax breaks. These include maintaining bread prices; subsidizing barley, cooking gas, livestock to cushion against fodder price increases; maintaining electricity prices for small consumers; and reducing taxes and import duties on inputs for production. Wheat import requirements for 2010 to 2011 were estimated at about 1 million tons. Since Jordan is a net importing country of cereal and has a weak fiscal balance, it is placed within the category of the most vulnerable countries to both quantity and prices risks respectively (UNDP 2013).

To solve the country's pressing energy issues, the Jordan Ministry of Energy and Mineral Resources implemented the National Energy Strategy for 2007 to 2020, with the main goals of diversifying energy resources, increasing local energy resources, reducing dependency on imported oil, and enhancing environment protection.

The country will achieve this objective through three primary focus areas:

- Maximizing the utilization of domestic resources such as oil shale and natural gas,
- Expanding the development of renewable energy projects and
- Generating electricity from nuclear energy.

In 2007, the Jordanian government updated its Energy Master Plan, a comprehensive strategy for the energy sector that it hoped will transform the existing energy mix from one heavily reliant on oil and natural gas to a balanced mix with a higher proportion of energy supplied by nuclear power, oil shale, and renewable sources. This comprehensive strategy for the sector requires an estimated investment of between fourteen and eighteen billion dollars US over the period 2007 to 2020.

Additionally, the country has made energy efficiency a priority. The Law on Renewable Energies and Energy Efficiency enacted on April 12th, 2012 provides the Jordanian government with tools to reach the National Energy Efficiency Strategy targets. Jordan has created a fund to support energy efficiency and renewable energy initiatives, which is financed by the Jordanian government and international donor agencies such as the French Development Agency and the World Bank.

Recent UN studies highlight the interconnections between water scarcity, agriculture, energy, as well as climate. Limited resources and increasing demand underscore the need for integrated approaches to policy and project development that expose both trade-offs and synergies. Most of Jordan's water use is in agriculture, while agricultural contribution to GDP and total employment in this sector is less than 5 per cent.

Additionally, water supply accounts for 25 per cent of Jordan's total electricity demand (Hoff 2011). Besides food imports, the focus of Jordan's water strategy is on large-scale supply-side infrastructure projects, including fossil groundwater transfer from the Disi aquifer and the Red Sea to the Dead Sea combined with desalination.

Given Jordan's high water prices and the large costs and energy demands associated with new projects, conventional supply-side water management is reaching its limit. Demand management options have not yet been implemented and have great potential. Demand management options include: greater reliance on food imports (with associated virtual water imports); reducing water loss in urban systems which is over 50 per cent of total volumes (Potter 2010); substituting treated waste water for freshwater use in agriculture; increased energy efficiency in the water sector; and energy recovery from waste water.

Integrated water and land planning could preserve productive rain-fed agricultural land that is currently being lost at high rates to the expanding city of Amman (Hoff 2011). Jordan's National Water Strategy also explicitly supports the goals of increasing the energy use efficiency of its water supply and wastewater treatment, and of using alternative energy to meet 20% of energy demand for water pumping (MWI 2008).

## **V. Conclusions and Recommendations**

Addressing water energy and agriculture together and applying an integrated approach to planning based on the SDGs can lead to water, food, and energy security optimization by increasing resource efficiency, ascertaining and reducing tradeoffs, exploiting and building synergies, and improving collaboration and governance across sectors. An integrated approach aids in identifying and addressing externalities across sectors which may otherwise be overlooked.

The global framework and tools available to implement the SDGs are important and diverse. Public and private finance, financial approaches, instruments and options and a range of public private partnerships support government, the private sector and civil society in the implementation of the SDGs.

Similarly, community based and owned management supports integration between different levels of government within a country, and also represent a grassroots bottom up approach to implementation of the SDGs. Community based and owned projects also assists in the implementation of those SDGs which require community engagement and involvement.

Modeling and assessment tools such as CLEWD illustrate the numerous benefits of an integrated approach to resource planning and can support broad implementation of many SDGs with the expansive focus on climate, land, energy, water and development.

The Jordan case study and recommendations arising from it provide learnings for water scarcity and implementing SDGs that could be considered across West Asia and North Africa. Most of Jordan's water use is in agriculture, while agriculture contributes less than 5 % to the economy and employment. Besides food imports, Jordan's water strategy focuses on large-scale supply infrastructure projects. Jordan's supply water management options are reaching their limit. Fortunately, there is potential in demand management.

Options include greater reliance of food imports with high virtual water values, improving the efficiency of the urban water systems including reducing the loss rate, using re-cycled water and treated waste water for agriculture, exploiting renewable energy for desalination, recovering heat from waste water, and increasing efficiencies in all sectors. Furthermore, integrated land and water planning could preserve rain-fed agricultural land from development.

Jordan's National Water Strategy supports increasing energy efficiency across water supply and treatment, and using renewable energy to meet energy demand for water. A shift in focus to an integrated approach to water and resources, such as is present under the SDGs, could benefit Jordan by exploiting the interconnections. Potential benefits include: avoiding sunk costs that preclude funding other project, improving the efficiency of the water system, improving the resilience of the economy and population, and improving collaboration and cross sectorial coherence across government.

## VI. References

- Comair, George, C. Ingenloff, G. Shin, D. C. McKinney (2013). "Water Resources Management in the Jordan River Basin." *Water and Environment Journal* 27: 495-504.
- Energy Information Administration (EIA), Country Statistics: Jordan, U.S. Department of Energy. <http://www.eia.gov/countries/country-data.cfm?fips=jo>
- Gesellschaft für Technische Zusammenarbeit. National water master plan for Jordan. G. a. M. f. W. a. Irrigation (2004).
- Hadadin, Nidal, M. Q., Emad Akawwi, Ahmed Bdour (2010). "Water Shortage in Jordan-Sustainable Solutions." *Desalination* (250): 197-202.
- Hoff, H. Understanding the Nexus. Background Paper for the Bonn 2011 Conference: The Water, Energy and Food Security Nexus. Stockholm Environment Institute, Stockholm.
- International Fund for Agricultural Development. 2007. Country strategic opportunities programme. International Fund for Agriculture Development (<http://www.ifad.org/gbdocs/eb/92/e/EB-2007-92-R-16.pdf>)
- International Energy Agency (IEA) (2010). Energy statistics of non-member countries: Jordan. <http://www.iea.org/countries/non-membercountries/jordan/> accessed 12.07.14
- Intergovernmental Panel on Climate Change. Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation, Field, C.B., V. Barros, T.F. Stocker, D. Qin, D.J. Dokken, K.L. Ebi, M.D. Mastrandrea, K.J. Mach, G.-K. Plattner, S.K. Allen, M. Tignor, and P.M. Midgley (Eds.) (Cambridge University Press, 2012).
- Intergovernmental Panel on Climate Change. Summary for Policymakers. In: *Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S. K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (Eds.)]. (Cambridge University Press, UK and US).
- International Energy Agency (IEA). Energy statistics of non-member countries: Jordan (2010). <http://www.iea.org/countries/non-membercountries/jordan/>
- Jiries, A.. Water Resources in Jordan. *Advanced Water Supply and Wastewater Treatment: A Road to Safer Society and Environment*. P. Hlavinek, I. Winkler, J. Marsalek and I. Mahrikova, Springer Netherlands: 193-199 (2011).
- Sustainable Development Solutions Network Leadership Council (SDSN Leadership Council), Indicators and Monitoring Framework for Sustainable Development Goals: Launching a Data Revolution for the SDGs (Revised Working Draft, July 24, 2014).



McCornick P.G., Awulachew S.B. and Abebe M. Water-food-energy-environment synergies and tradeoffs: major issues and case studies. *Water Policy*, 10: 23-36 (2008)

Ministry of Energy and Mineral Resources, 'Summary of the Updated Master Strategy of Energy Sector in Jordan for the Period (2007-2020) (2007). (<http://www.memr.gov.jo/Portals/0/energystrategy.pdf> accessed 18.03.14).

Ministry of Water and Irrigation (2008): *Water for Life, Jordan's Water Strategy 2008-2022*, Ministry of Water and Irrigation, Amman

Muir, Magdalena A K., Wei L. *Financial Approaches- Exploring a Framework and Approaches to Support Implementation of the Sustainable Development Goals* (2014).

Nortcliff, S., et al.. *Jordan's Water Resources: Challenges for the Future*, Geography (University of Reading) (2008)

Potter, Robert B., K. D., Stephen Nortcliff. Issues of water supply and contemporary urban society: the case of Greater Amman, Jordan. *Philosophical Transactions of the Royal Society A*.(368): 5299-5313 (2010).

Potter, Robert B., Darmame, K., Nortcliff, (2007). "The provision of urban water under conditions of 'water stress', privatisation and deprivatisation in Amman." *Bull. Coun. Br. Res. Levant*(2): 52-54.

Raddad, K. *Water supply and water use statistics in Jordan*. Vienna, IWG- Environment, UN (2005).

Sustainable Development Solutions Network Leadership Council (SDSN), *Indicators and Monitoring Framework for Sustainable Development Goals: Launching a Data Revolution for the SDGs* (Revised Working Draft, July 24, 2014).

Sovacool, Benjamin K., Muir MAK. *Summary of Community Based and Owned Approach to Microhydro Project Development, with the Intent of Improving Agricultural Productivity, Business Opportunities and Gender Equity in Tanzania and Elsewhere* (2014)

Sovacool Benjamin K., *Deploying Off-Grid Technology to Eradicate Energy Poverty*. *Science* 338 (October 5, 2012), pp. 47-48. (<http://dx.doi.org/10.1126/science.1222307>).

Sovacool, Benjamin K, IM Drupady. *Energy Access, Poverty, and Development: The Governance of Small-Scale Renewable Energy in Developing Asia* (New York: Ashgate, 2012). <http://www.ashgate.com/isbn/9781409441137>

United Nations (UN) *Prototype Global Sustainable Development Report*. Online unedited edition. New York: United Nations Department of Economic and Social Affairs, Division for Sustainable Development, (1 July 2014). <http://sustainabledevelopment.un.org/globalsdreport/>

UN Department of Economic and Social Affairs (DESA), Global Governance and Global Rules for Development in the Post-2015 Era (2014).

UN DESA/Economic and Social Commission for West Asia (ESCWA) Technical Report: The analysis, mapping and identification of critical gaps in preimpact and preparedness drought management planning in water scarce and in-transitioning-settings countries in West Asia/North Africa. Project 121C “ROA-207” (2013).

UN DESA/ESWCA, Strengthening National Capacities to Manage Water Scarcity and Drought in West Asia and North Africa (2013)  
(<http://sustainabledevelopment.un.org/content/documents/4433Final%20UN%20Report%20Revised%2014%20July%202014.pdf>)

United Nations Development Programme. Food and Nutrition Security in Jordan towards Poverty Alleviation, United Nations Development Program (2013).

United Nations Environment Programme: Towards a Green Economy in Jordan- a scoping study (2011).

UN Food and Agriculture Organization (FAO), Global water information system (AQUASTAT). FAOs Information System on Water and Agriculture (2008).  
([http://www.fao.org/nr/water/aquastat/countries\\_regions/jordan/index.stm](http://www.fao.org/nr/water/aquastat/countries_regions/jordan/index.stm))

UN FAO. Global water information system (AQUASTAT). Statistical databases. Food and nutrition profile, Jordan Nutrition and Consumer Protection Division (2011).  
<ftp://ftp.fao.org/ag/agn/nutrition/ncp/jor.pdf>

UN High Level Political Forum (HLPF). Moderated dialogue: From Silos to Integrated Policy Making (June 30, 2014 to July 9, 2014, New York).  
<https://papersmart.unmeetings.org/en/ecosoc/sessions/high-level-political-forum-on-sustainable-development,-convened-under-the-auspices-of-the-economic-and-social-council/programme/moderated-dialogue-%E2%80%9Cfrom-silos-to-integrated-policy-making%E2%80%9D/>

UN Intergovernmental Committee of Experts on Sustainable Development Financing (IGCE SDF). Report of the Intergovernmental Committee of Experts on Sustainable Development Financing: Final Draft (August 8, 2014).

Venot, Jean-Philippe, F. M., Yousef Hassan. "Irrigated Agriculture, Water Pricing and Water Savings in the Lower Jordan River Basin (in Jordan)." *Agricultural Water Management* 18 (2007).

World Bank. Jordan – Country brief. World Bank. Washington D.C. (2010)  
(<http://web.worldbank.org/WBSITE/EXTERNAL/COUNTRIES/MENAEXT/JORDANEXTN/0,menuPK:315140~pagePK:141132~piPK:141107~theSitePK:315130,00.html> accessed 16.03.14)



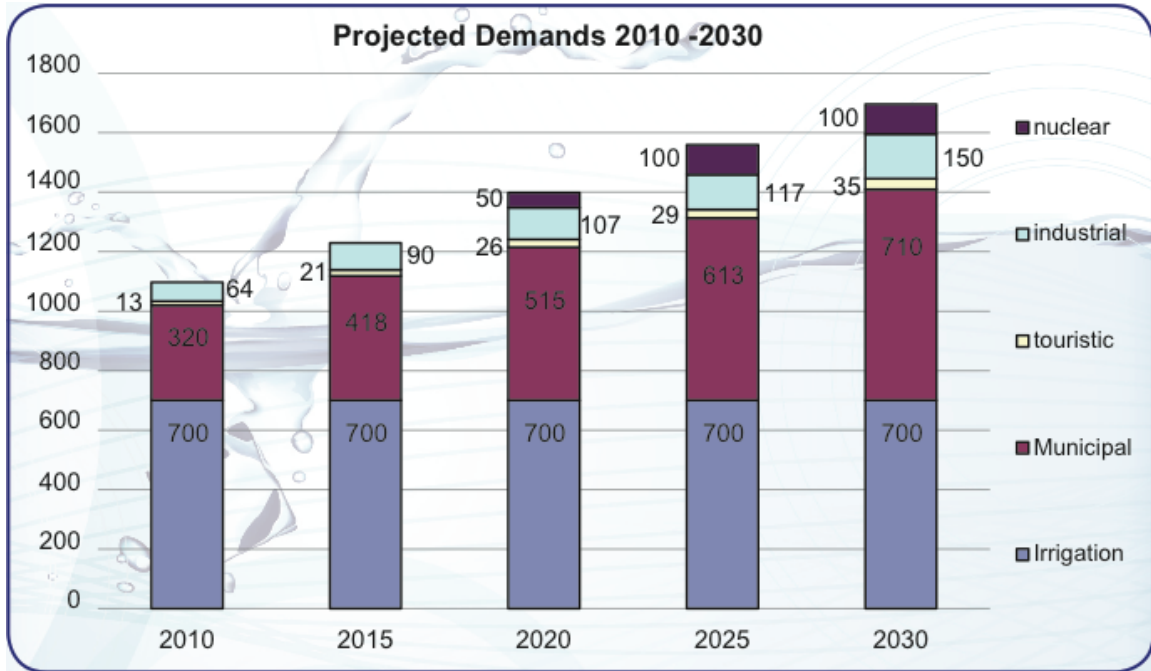


Figure 2: 2012 Annual Report M. o. W. a. Irrigation. Amman, Jordan (LEMA 2012)

Food groups	Supply for human consumption in g/capita/day									
	1965-67	1970-72	1975-77	1980-82	1985-87	1990-92	1995-97	2000-02	2005-07	
Fruit/vegetables	703	372	289	324	517	477	451	419	459	
Cereals	349	414	418	432	428	457	443	407	439	
Milk/milk products	119	144	163	203	212	203	155	167	211	
Sweeteners	88	75	95	127	119	117	99	113	132	
Meat/offals	24	42	49	79	111	92	90	100	108	
Starchy roots	28	21	38	46	34	42	48	48	63	
Vegetable oils	24	28	27	26	28	36	43	48	50	
Pulses/nuts/oilcrops	34	29	31	48	42	41	32	51	46	
Other	9	12	12	14	14	13	11	15	15	
Fish/shellfish	4	4	7	9	13	9	13	12	15	
Eggs	9	13	14	18	17	24	21	17	13	
Animal fats	1	1	1	3	4	3	3	3	2	

Figure 3: Jordan food supply for human consumption (FAO 2011)