Renewable energy in the water-energy-food nexus

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Energy resilience at the food-energy-water nexus | Asia Clean Energy Forum 2017

The water, energy and food *nexus*

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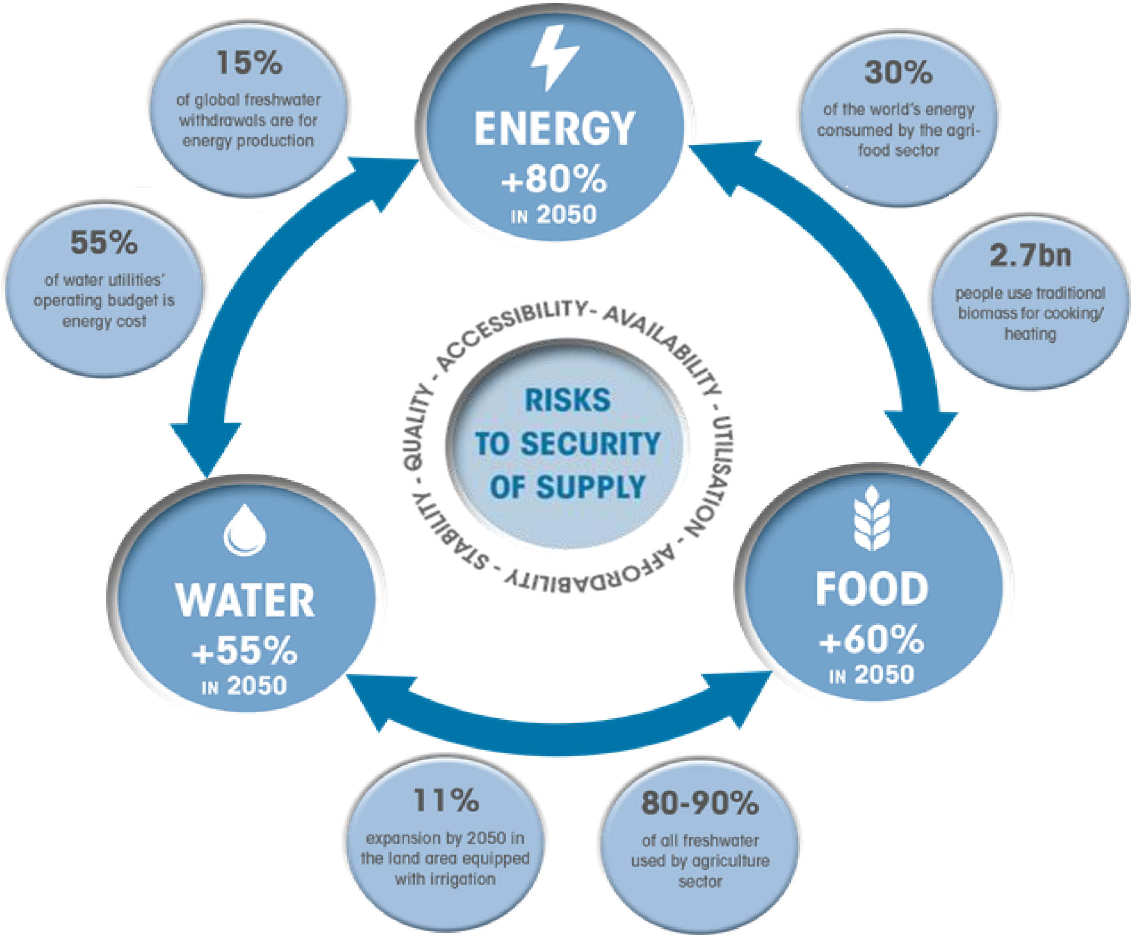

A transformation in one sector has ripple effects on others

The energy sector transition

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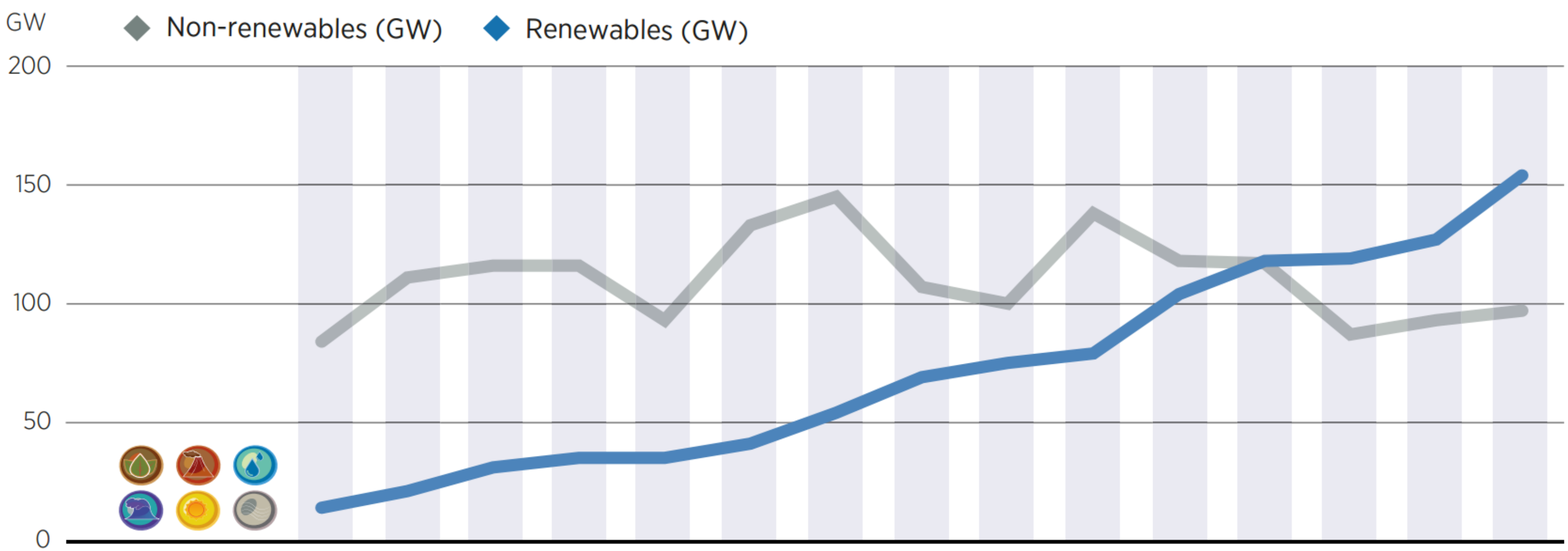


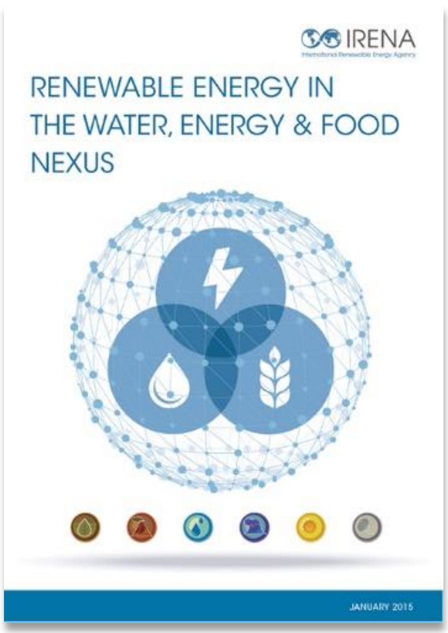
	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Renewables (GW)	14	21	31	35	35	41	54	69	75	79	104	118	119	127	154
Non-renewables (GW)	84	111	116	116	93	133	145	107	100	138	118	117	87	93	97

Source: IRENA statistics

What does the energy transition mean for the nexus?

Assessing the role of RE in the Nexus

Assessing impacts of the transition across sectors crucial to tap into synergies, address trade-offs and maximise benefits.



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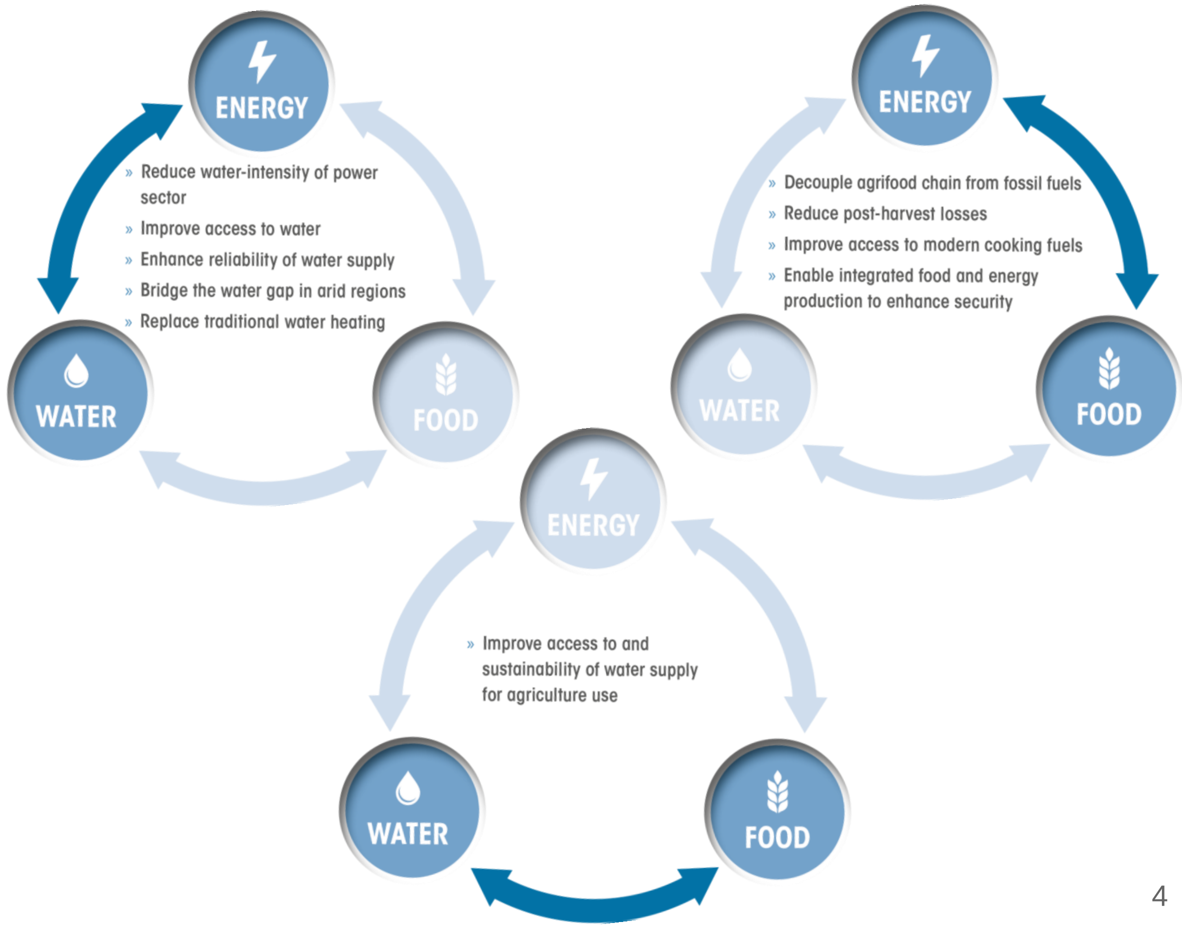

Renewable energy in the food supply chain

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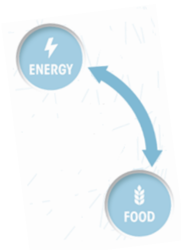


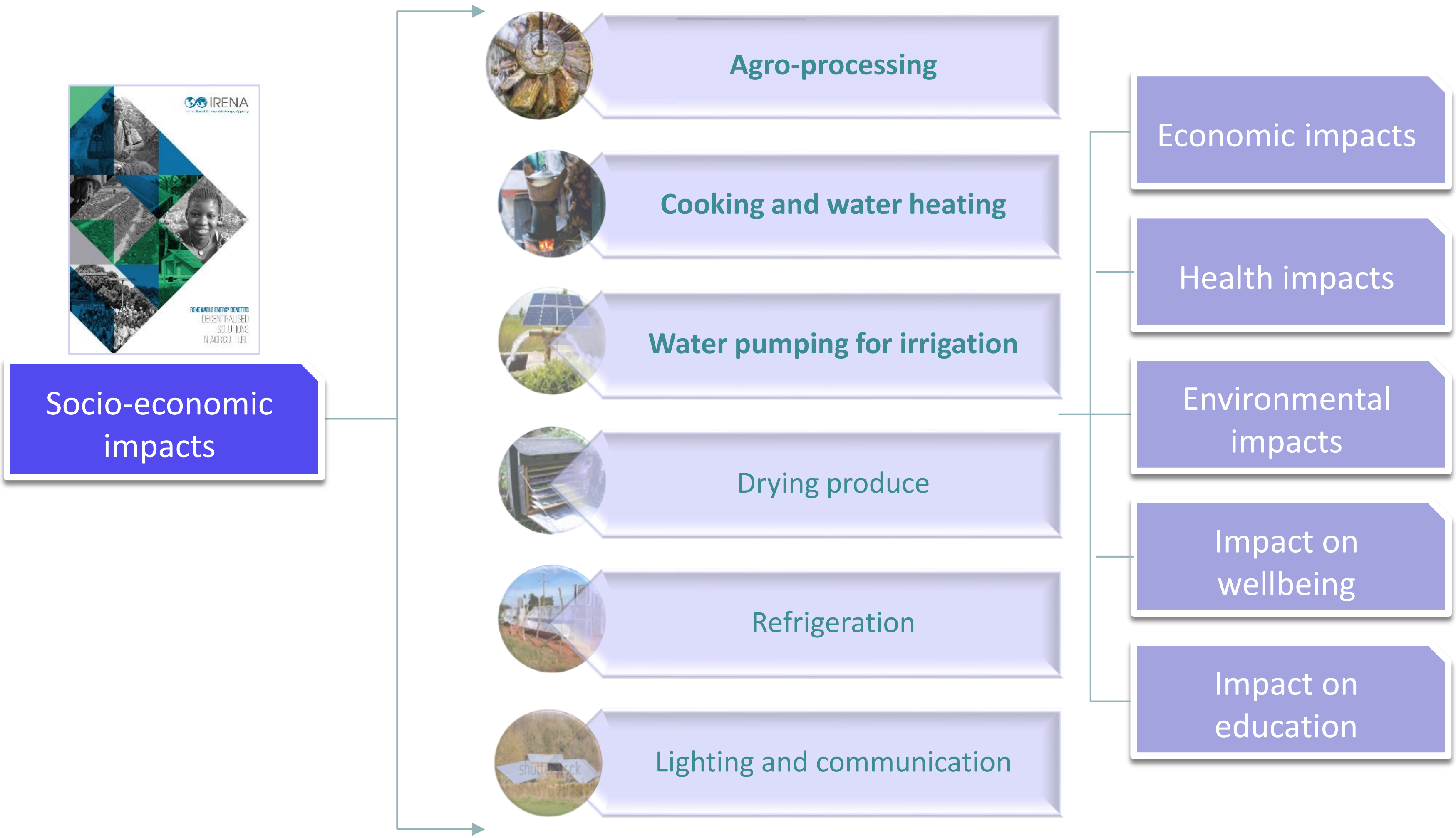
Energy inputs (traction, electricity, mechanical, heat/cooling) →

Primary Production	Post-Harvest and Storage	Transport and Distribution	Processing	Retail, Preparation and Cooking
• Solar, wind-based water pumping • Biofuels for tractors and on-farm machinery • Solar-based desalination, heating and cooling for protected cropping • Biomass residues use for on-site energy generation • Indirect renewable energy inputs for fertilisers	• Solar, geothermal food drying • Solar cooling and refrigeration	• Biofuel use for transportation and distribution • Solar cooling and refrigeration	• Solar, wind, hydro-based milling, threshing • Renewable energy-based electricity and heat applications	• Renewable energy-based water purification • Modern biomass use for cooking applications

Source: Based on FAO, 2011b; Practical Action, 2012

Source: IRENA (2015) based on FAO (2011) and Practical Action (2012)

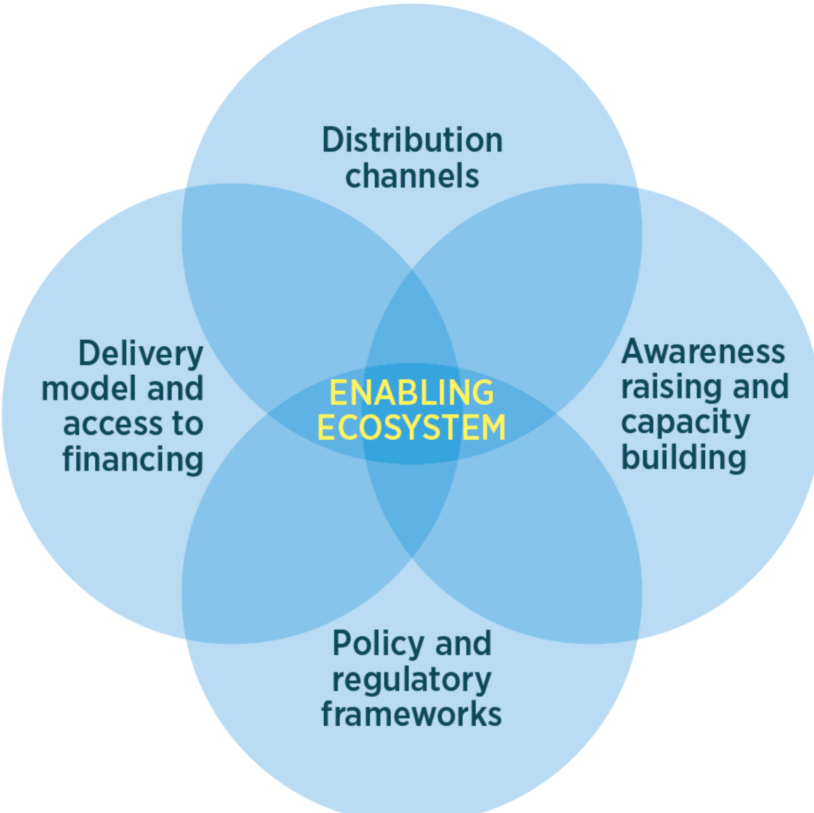
Assessing socio-economic benefits of renewables in agri-food chain



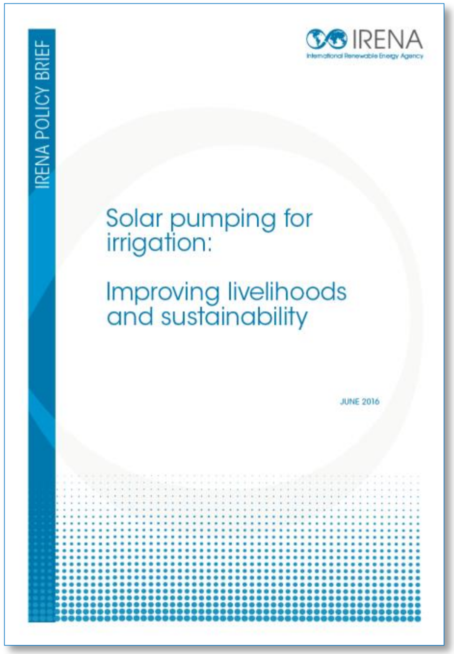
Off-grid renewable energy applications in the agriculture sector offer substantial opportunities for stimulating socio-economic development

Solar water pumping for irrigation

Solar-powered irrigation increasingly adopted in many contexts, with multiple benefits: resilience, cost-savings, productivity, lower pollution.



Source: IRENA



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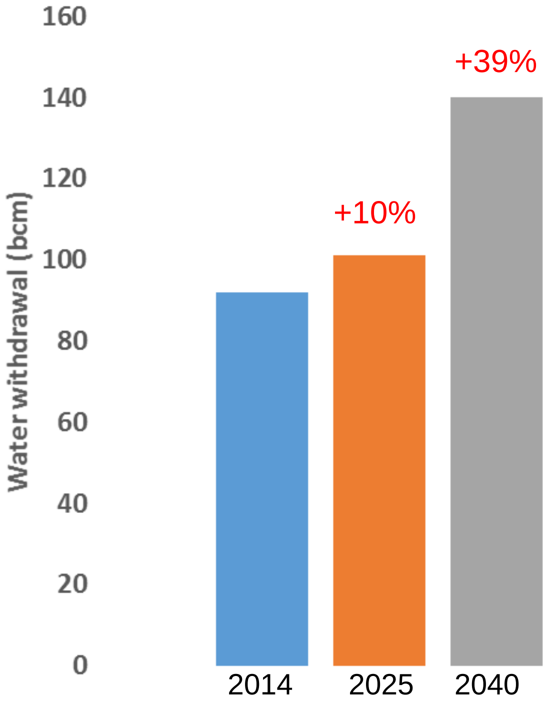
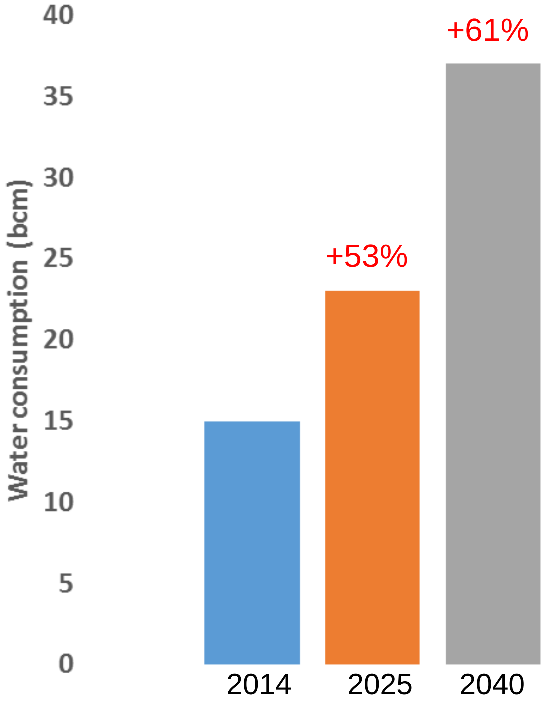
Water for energy

In 2014, energy sector accounted for ~10% of total worldwide water withdrawals and ~3% of water consumption.





Source: IEA, 2016

- Rapid growths in water withdrawal in developing Asia as power generation capacity grows to keep pace with demand.
- Competition for limited water resources compelling governments to adopt measures that reduce the water intensity of power generation.

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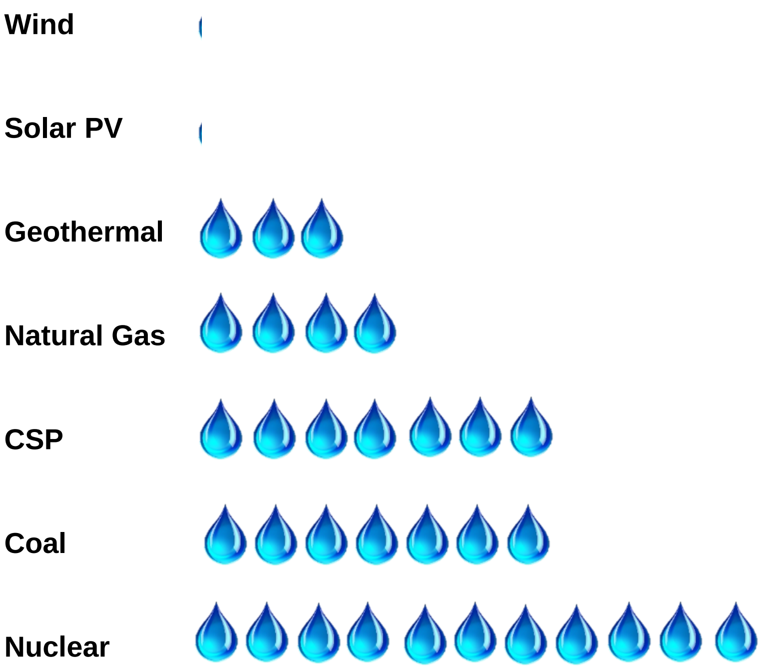
Some renewable energy technologies (e.g. solar PV, wind) are significantly less water intensive than conventional

Operational water withdrawals



Operational water withdrawal, median values.
1 drop = ~100 gal/MWh. Source: based on NREL data

- In producing electricity:
  - Wind consumes the least amount of water during operation compared to conventional technologies
  - Solar PV consumes up to 25 times less water than nuclear, gas and coal
- Water impacts of more water-intensive technologies need to be accounted for and managed
- Trade-offs between cooling technologies and carbon

Renewable energy in the water–energy nexus: Case study of China

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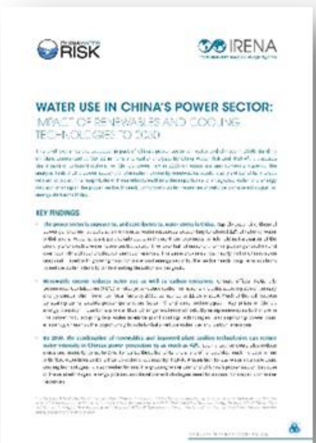
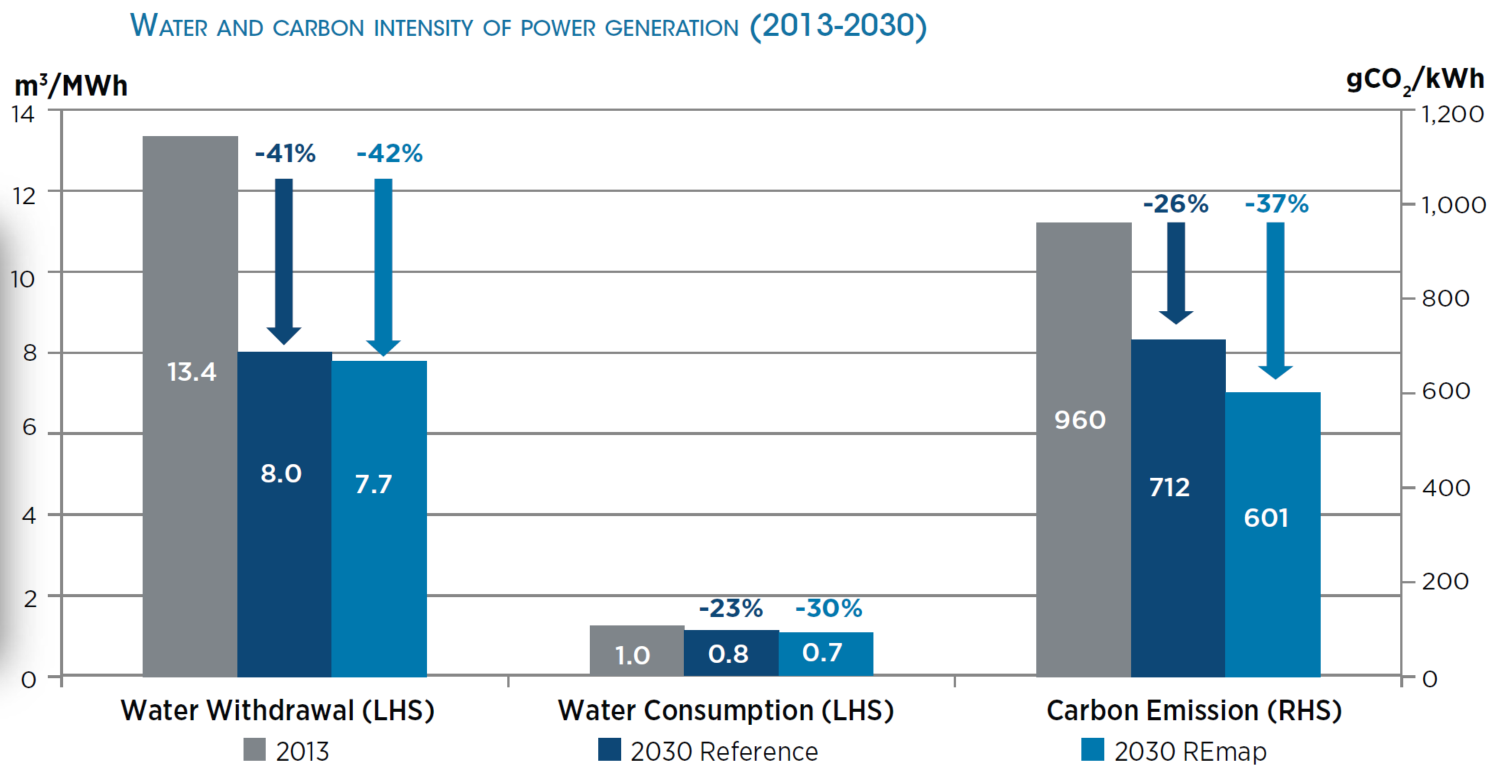
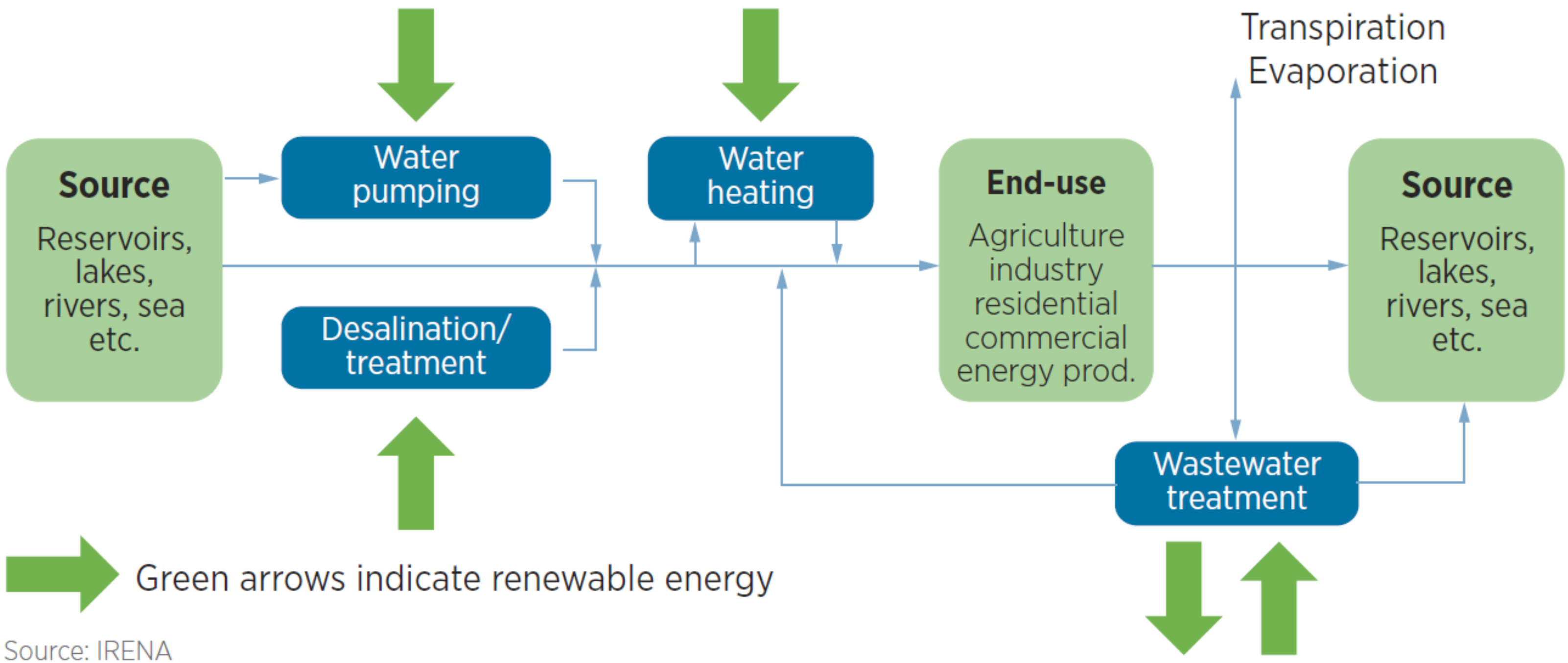
An increase in RE deployment in line with NDC objectives and IRENA's REmap 2030 options, coupled with improvements in cooling technologies, could reduce the water- and emissions-intensity of power generation by up to 42% and 37% respectively by 2030.





Energy for water

Renewable energy integration in the water supply chain can improve accessibility, affordability and safety



Source: IRENA

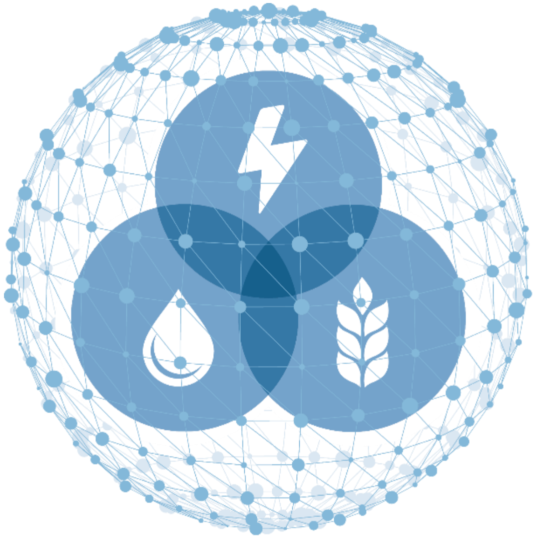
Steps towards integrated planning

- Identifying entry-points for water into energy planning and programme design:
  - Introducing water constraints in centralised energy sector planning tools (*e.g.*, in South Africa with WB/Thirsty Energy)
- Building a data and information base that can inform decision making:
  - Reporting water use of power infrastructure (renewable and non-renewable) and cooling tech adopted
  - Establishing common statistical frameworks for gathering country-level data related to ‘water in energy’ and ‘energy in water’
- Adopting an end-use application oriented approach to renewable energy deployment could unlock new applications and innovations – from kWhs to services
- Agricultural and water energy demands can serve as effective anchor loads for rural electrification initiatives

Linkages between renewables and SDGs

Achieving the Sustainable Development Goal on energy will transform the energy system while helping meet other SDGs

Source: IRENA



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Thank you!

IRENA's work on the nexus

2013 → 2017

- IRENA's nexus work stream launched in 2013 to address the knowledge gap on interactions of renewables in the nexus.
- **Highlights:**
  - First major publication focusing on the RE dimension of the nexus in January 2015
  - Case study on impact of renewables on water intensity of power in China
  - Renewables-based desalination: GCC Market Analysis
  - RE Benefits: Decentralised Solutions in Agri-Food Chain
  - Policy brief on Solar Pumping for Irrigation

Key Policy Messages

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Foster innovation and flexibility in the delivery of solar pumping solutions

Account for target groups and market sustainability when designing financial instruments

Focus on after-sales support and capacity building

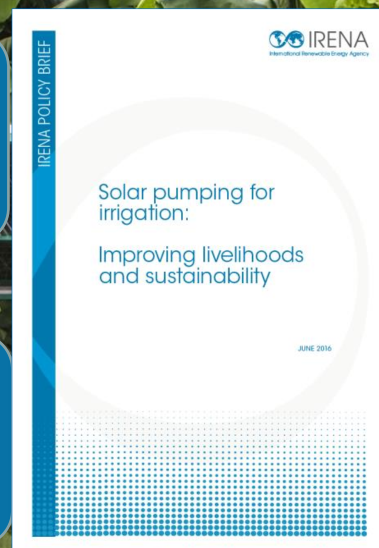
Package energy and water-efficient solutions

Assess the direct and indirect impacts on water resources

Monitor performance and gather data

Consider the influence of availability and cost of energy on the choice of crops grown

Adopt an integrated approach to programme design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Solar pumping for irrigation:

Improving livelihoods and sustainability

JUNE 2016