# TECHNOLOGY TRANSFER AND RESOURCE EFFICIENCY

Water-Energy Nexus Operational Toolkit : Technology Transfer

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Economic and Social Commission for Western Asia

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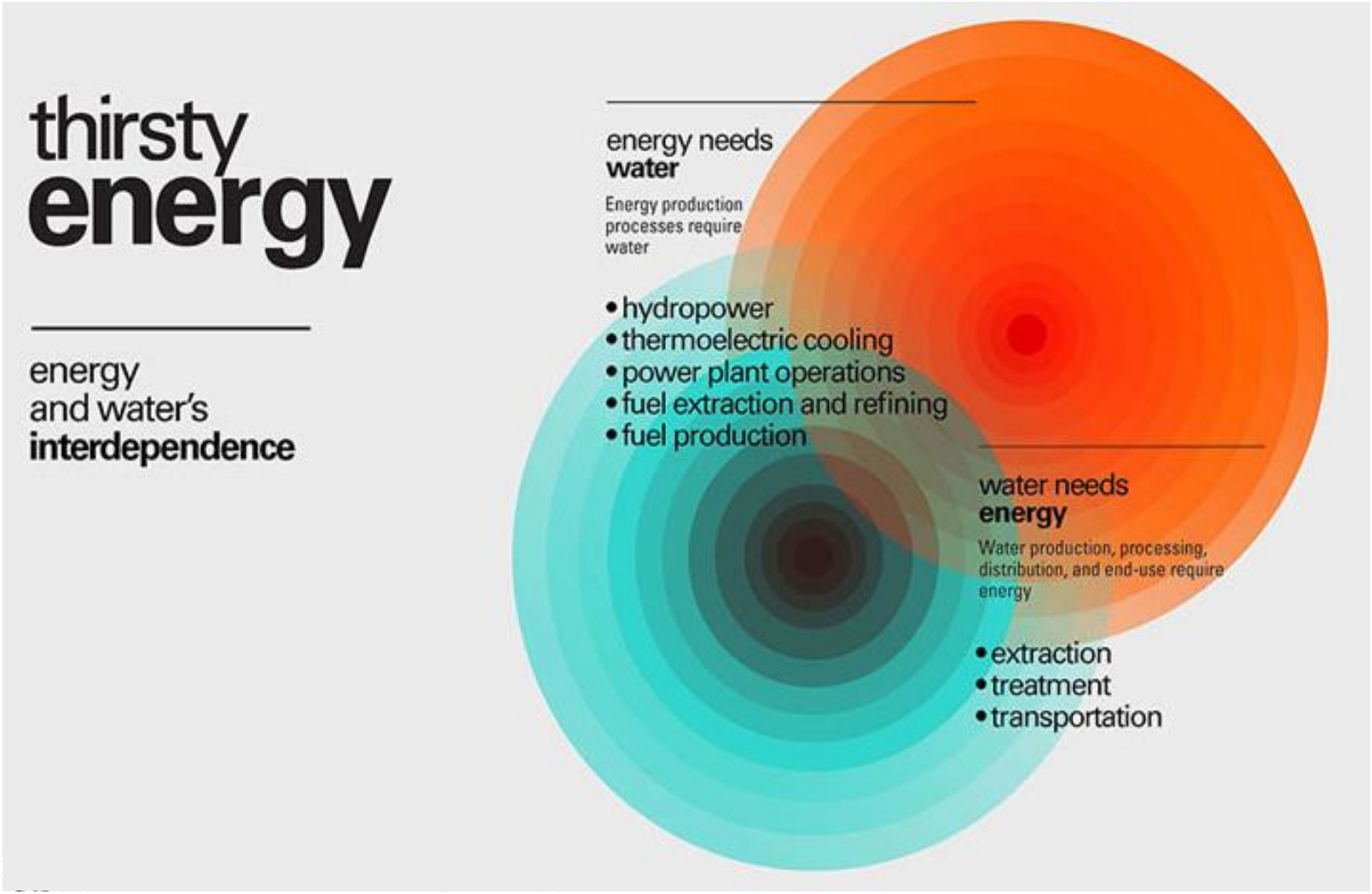
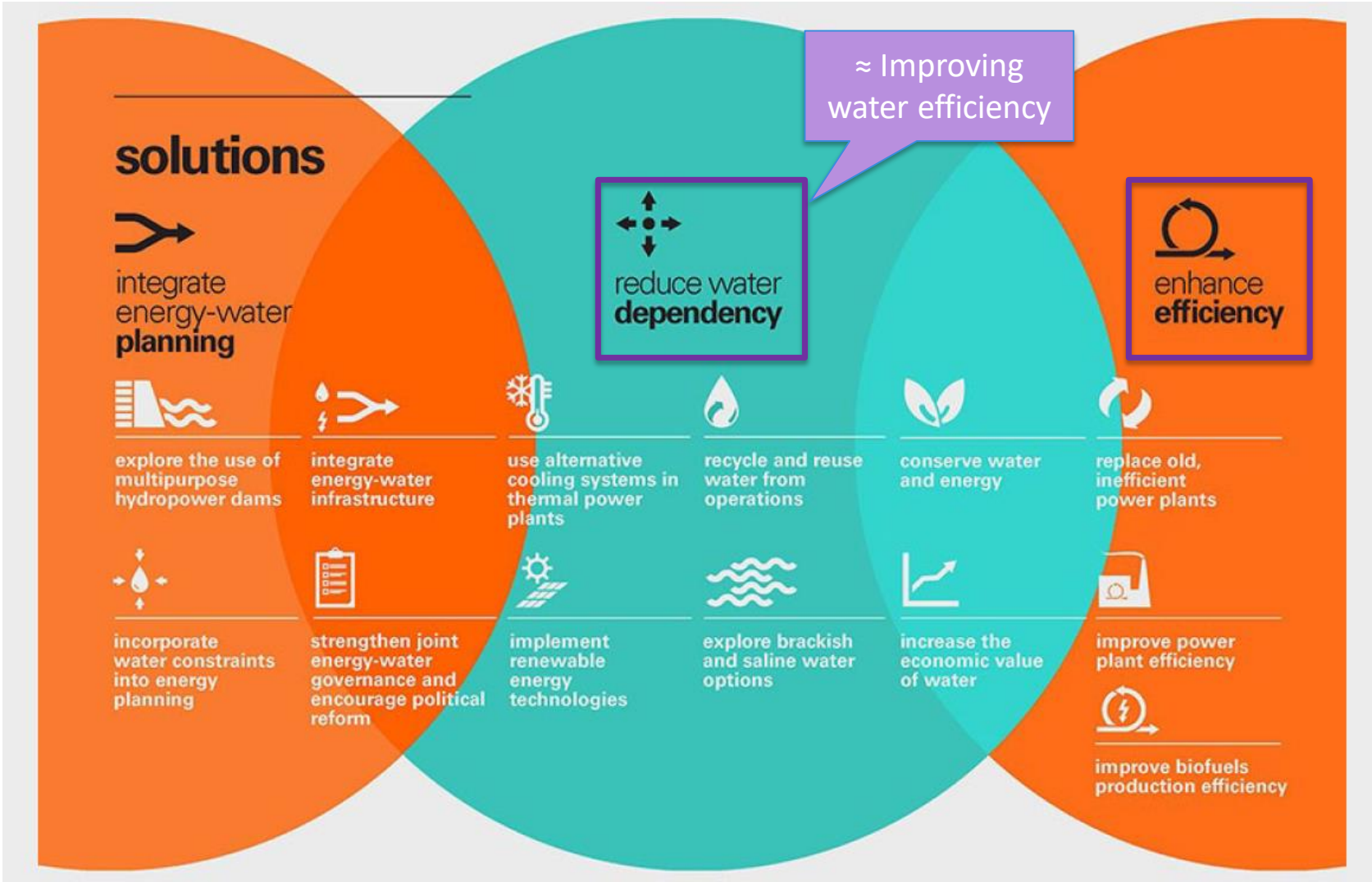
# Introduction

# W-E Nexus & Resource Efficiency




Source: The World Bank, 2014.

# W-E Nexus & Resource Efficiency




Source: The World Bank, 2014.

# Case Studies

# Turbine modernization program between Germany and China

- First implemented in 2004; technology was transferred from Germany to several coal-fired Chinese power stations
- This modernization of the turbines led to the more efficient use of coal and water in the power plants due to the optimization of the combustion process.
- This is an example of a TT project where very little R&D was involved; it is an example of the wider dissemination of already proven technologies.
- Some Arab countries are investing in clean coal, thereby having potential for such technology.

# DEPURANAT

- 3-year program established in February 2003; initiative of the European Water Framework Directive.
- Aim: to achieve sustainable wastewater management for rural areas using decentralized technology while also using the other products of the treatment process.
- 12 demonstrative pilot projects carried out in Spain, Portugal, and France and used to provide recommendations for other plants installed in the region.
- DEPURANAT program facilitated the direct involvement of the population in the target areas.

# DEPURANAT

- Various research centers, local authorities and private companies and associations involved.
- Technology used called the Natural Reclamation Systems (NRS)
- The pilot study led to the development of software which determines the ideal treatment technology as per the different variables associated with small-scale wastewater treatment systems.
- The DEPURANAT technology can be used to address water-energy nexus security in the rural areas of the Arab countries.

Water Pumping and Transport

# Improvement of Energy Efficiency of Jordan's Water Authority

Water Authority of Jordan

- Project also associated with MED-ENEC; GIZ, the German development agency, was also a partner.
- Funding mainly provided by the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety.
- Energy audit accounting for energy use of pumping stations followed by implementation of resulting recommended strategies.
- Led to the saving of more than 500,000 MWh of energy.
- This project represents a form on TT which can be implemented in all the Arab countries in order to make their water pumping systems more energy efficient.

# ReACT (Regenerative Activated Coke Technology)

- Helps make coal power plants cleaner.
- Emissions reductions achievable using ReACT are SOx removal efficiency: >98%, mercury: >90% and NOx: 20–40%.
- Completely dry scrubbing system → negligible water use.
- Additional benefits: producing sulfuric acid (a valuable byproduct), no solid waste production, easy integration into existing plants, plants can choose the desired level of NOx reduction, repeated recycling the activated coke.
- Technology currently already being used in Denmark and Japan (Isogo power station in Japan world's cleanest coal power plant from the perspective of emissions intensity (2015)).

Electricity generation sector

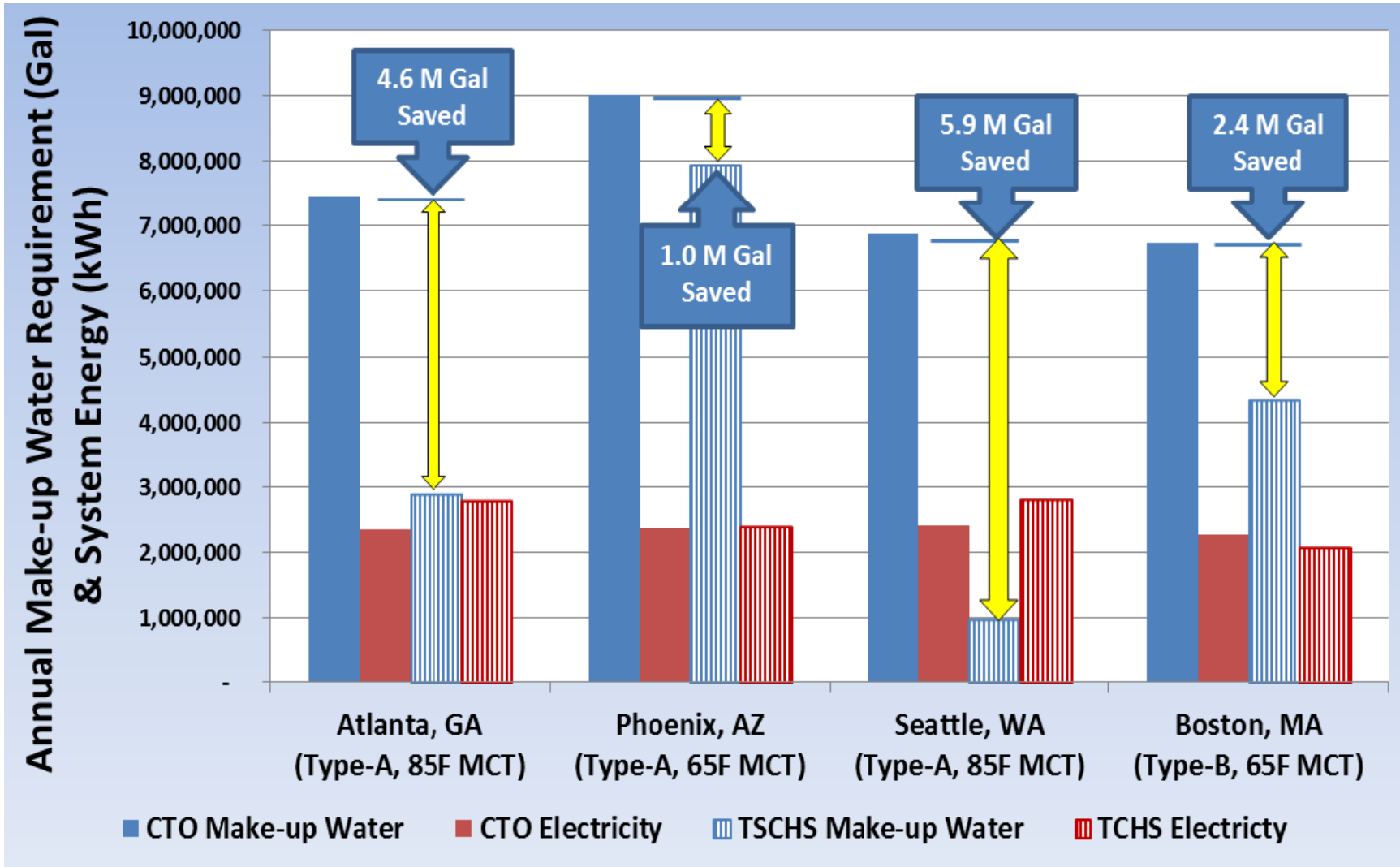
# Thermosyphon Cooler Hybrid Heat Rejection System

- Now rebranded as the BlueStream™ Hybrid Cooling System.
- For the development of this technology, EPRI (Electric Power Research Institute) collaborated with Johnson Controls.
- Helps increase water efficiency and is also applicable to nuclear power plants.
- Can easily be installed in incremental phases in existing power plants.
- Technology can also be used to provide water-efficient cooling systems for chiller plants, data centers, and petrochemical processing plants.

Electricity generation sector

# Thermosyphon Cooler Hybrid Heat Rejection System

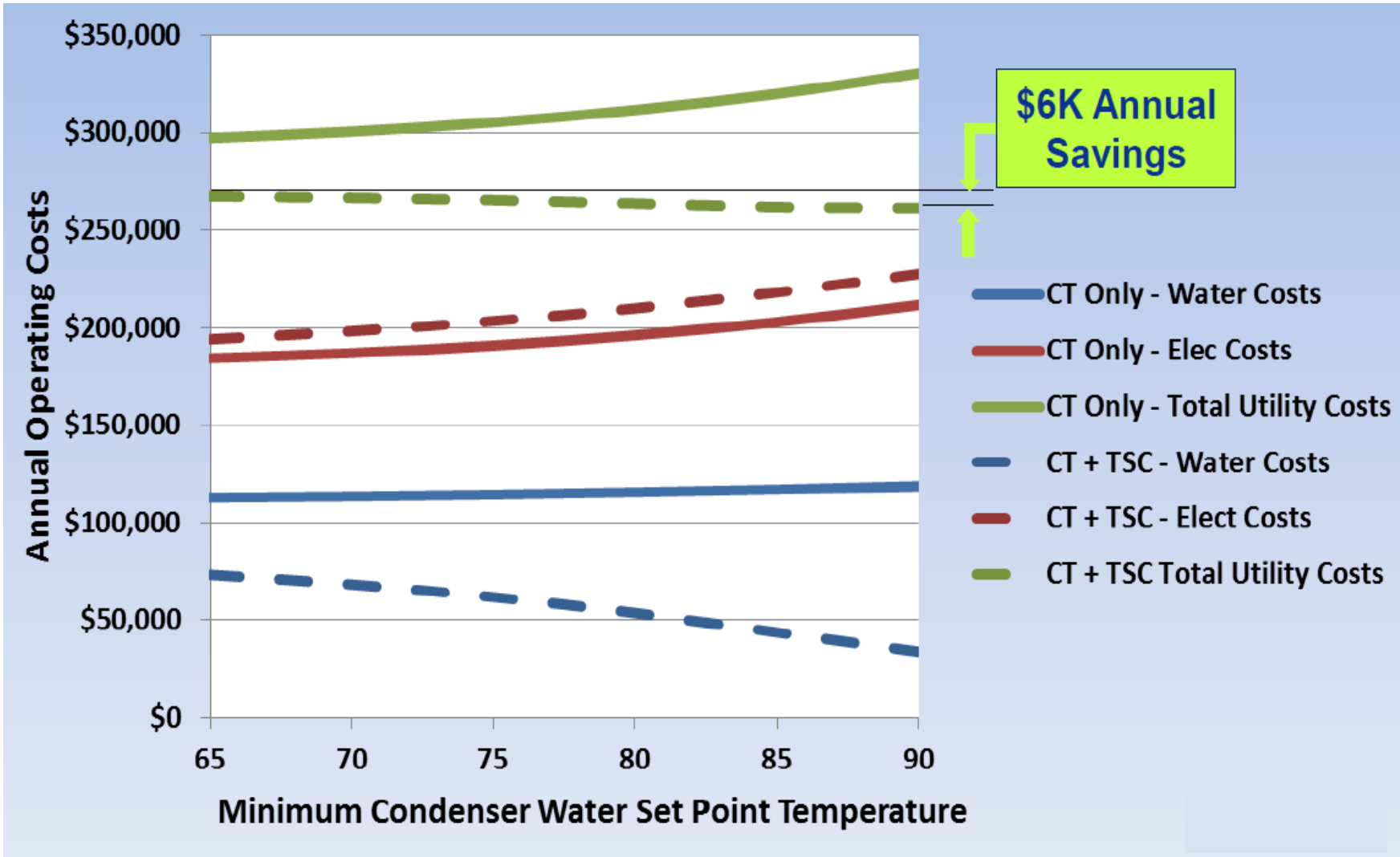
Annual water and energy savings of Cooling Tower Only (CTO) and TCHS systems (Carter, 2014)



Electricity generation sector

# Thermosyphon Cooler Hybrid Heat Rejection System

Annual operating costs of CTO only and CT+TSC Hybrid systems (Carter, 2014)



Oil and gas industry

# Oasys Water and Gradiant's Technology

- Oasys Water provides technology that helps to make fracking operations more efficient.
- The technology carries out forward osmosis which assists in water purification.
- Gradiant's technology treats flowback and produced waters generated as part of O&G operations, to the extent that they can be reused; advantage of no membranes being used.
- The use of both technologies has been proven.
- Oasys recently opened an office in Dubai.

GRADIANT
TECHNOLOGY FOR BETTER WATER

# Key Messages

# Key messages

- There are many example of how various entities can collaborate to facilitate successful technology transfer.

- There are also many different technologies available.
  - Local authorities must carry out the required due diligence to ensure that the technological option chosen is suitable for the intended region of use or the technology must be modified to take local conditions into consideration.

- Frequently the required technology is already being used in other countries; the transfer of the technology to the Arab countries must be facilitated.

- The case studies presented show that successful examples of TT are already present in the Arab world.
  - TT need not always be from outside the Arab world to within it, but can also be between Arab countries.

# THANK YOU

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