Food-Energy-Water Nexus

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AIChE/NSF Food-Energy-Water Nexus Workshop

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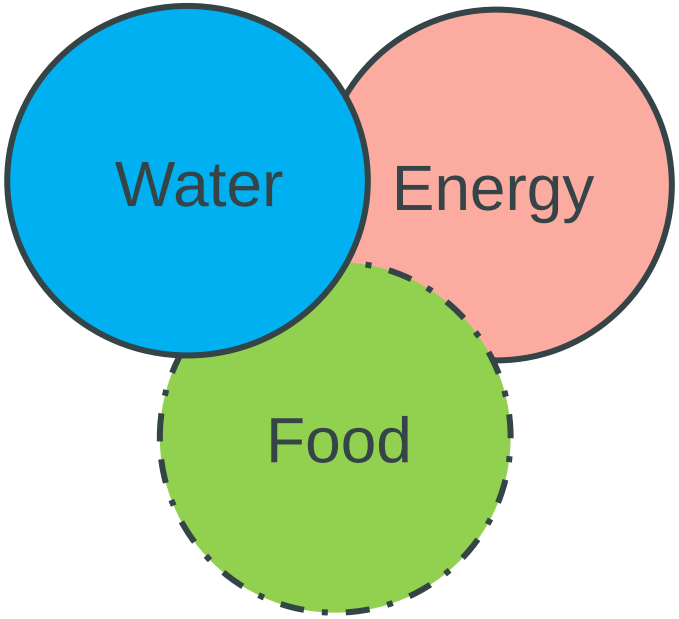
Delivering the Value Our Customers Want and the World Needs

Global Challenges	Market Opportunities	Science-Driven Solutions
	Bringing quality water to where it's needed	Reverse osmosis modules Microbial control Pipeline materials
	Using energy more wisely and creating new sources	Building insulation Structural adhesives for automobiles Solar shingles Gas-treating products
	More food, healthier food and less waste	Weed and insect control Seeds and trait technology Healthier oils Flexible food packaging

Food-Energy-Water Nexus



Minimizing Water Use in Energy & Production

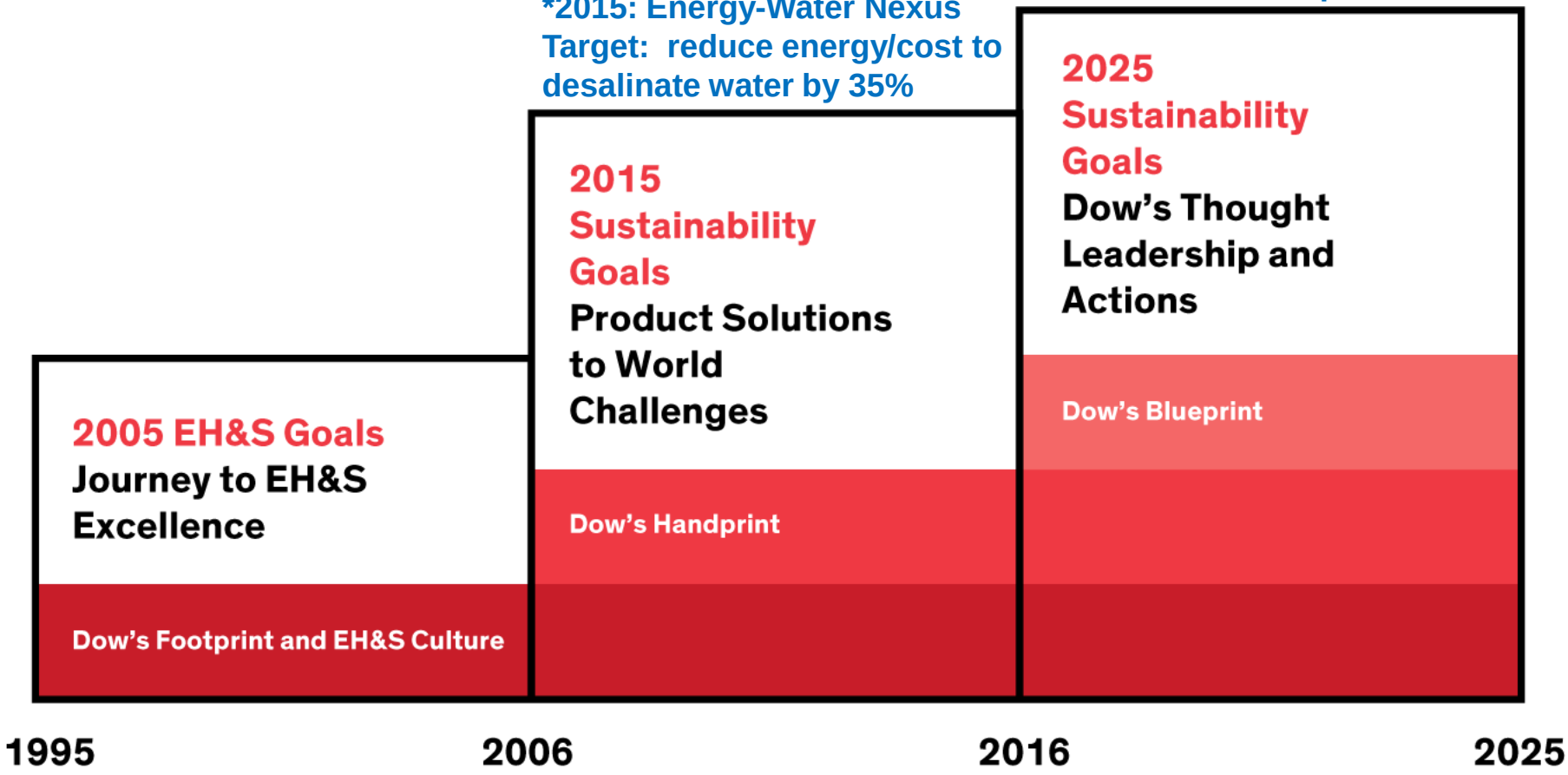
Minimizing Energy Use in Water Production

Minimizing Water/ Energy Use in Food Production

Dow's Sustainability Journey:
Footprint, Handprint and Blueprint

*2025:
-Advance Circular Economy
Wastewater reuse
- Reduce Freshwater intake
key water stress sites 20%
- Value Nature Capital

*2015: Energy-Water Nexus
Target: reduce energy/cost to
desalinate water by 35%



Footprint: World-leading operations and supply chain perfomance

Handprint: Products and services that help customers meet their challenges

Blueprint: Changes in technology, public policy, and the value chain that lead human society toward sustainability

Energy-Water Nexus
Innovation-led impact in membranes

44% REDUCTION

in energy required to desalinate brackish water, greatly surpassing **Dow's 2015 sustainability goal of 35 percent.**

206+ MILLION TONS

of CO_2 will have been saved by our sea water desalination customers by 2015 using our RO products, compared to the next best alternative technologies.

37

MILLION BARRELS OF OIL

is equivalent to the amount of energy our brackish water customers will save from 2005-2015 with two RO innovations (HRLE 440i and XLE 440i) .

30% ENERGY REDUCTION

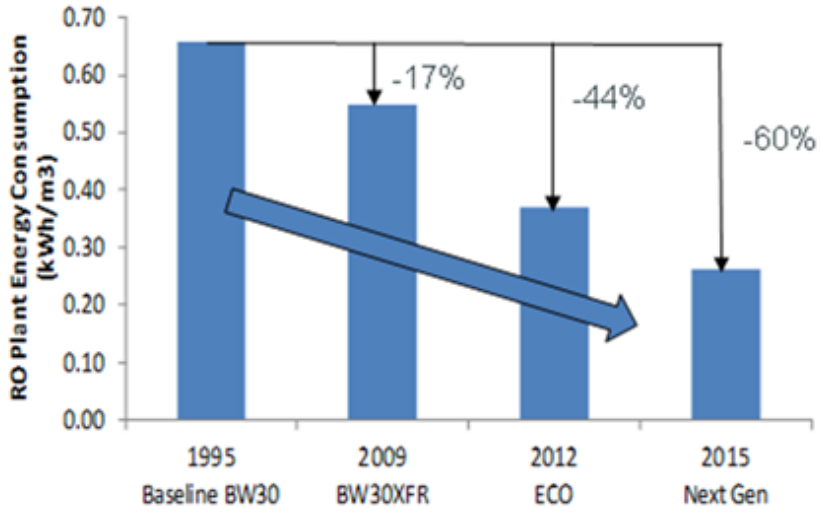
to treat brackish water with our new FILMTEC™ ECO elements.

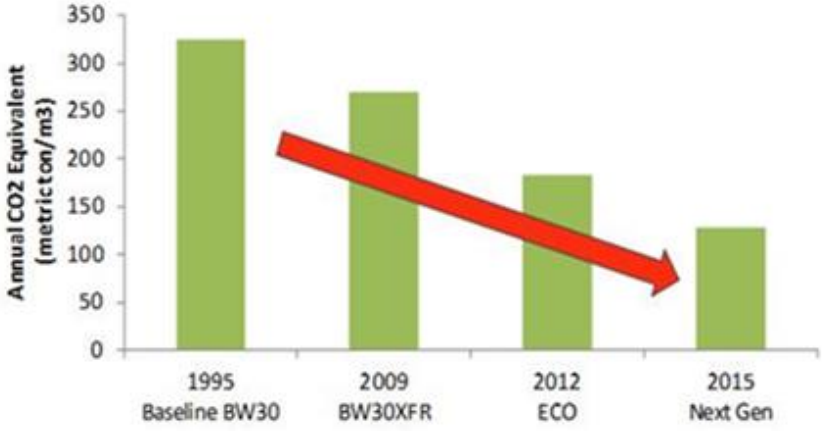
Energy-Water Nexus
Reducing specific energy requirement (kWh/m³)

Dow reduced the energy requirements of RO elements by 44%

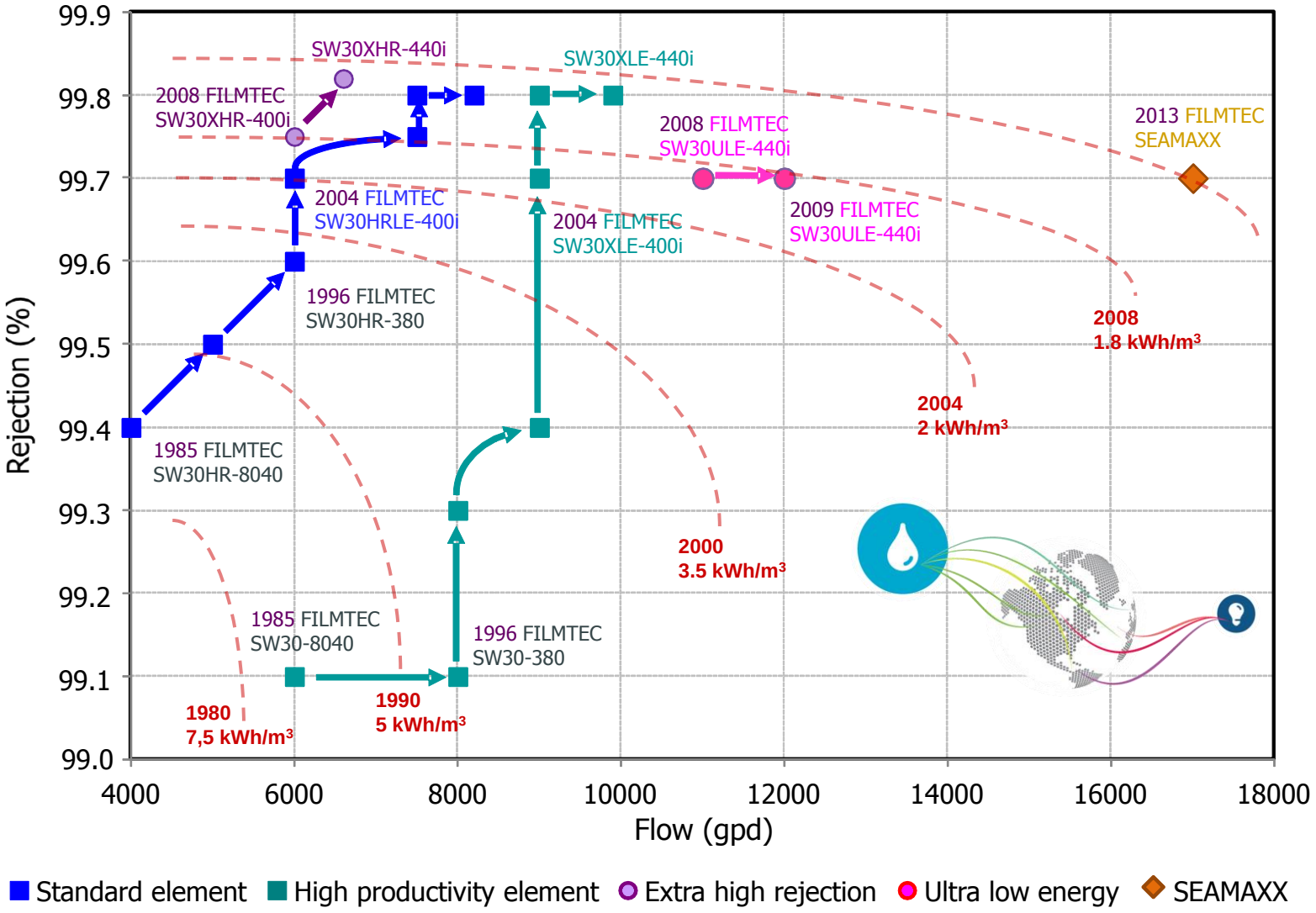
Impact of energy reduction obtained with ECO membranes is equivalent to:

- Electricity requirements for 225,800 U.S. homes for one year
- 169 million gallons of gasoline consumed
- Yearly emissions from 314,000 cars.
- Electricity requirements for 225,821 U.S. homes.



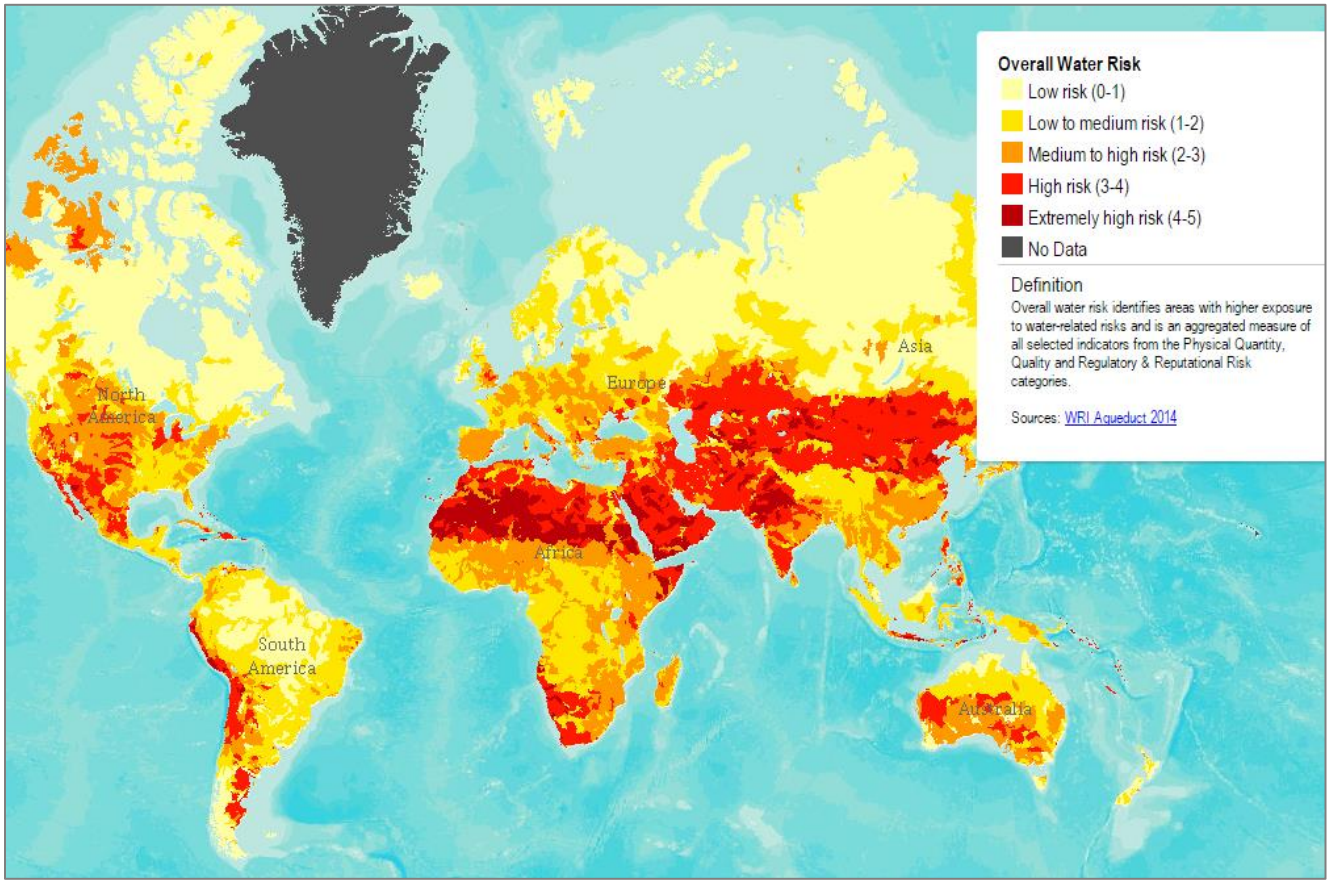


Energy-Water Nexus
Dow FILMTEC™- Three Decades of Innovation in SWRO



Water as a Risk

Companies are increasingly identifying water as a key risk to their supply chains and operations.



Source: World Resources Institute, Aqueduct Water Risk Atlas

Water Consumption

Municipal – 8%

Agricultural – 70%

Industrial – 22%

Shift to a Circular Economy model

Transition from a Linear Model …

…to a Circular Economy

Figure source: Northeast Recycling Council

This marks a ***shift from linear industrial processes***, whose by-products end up as waste to recovery and reuse

Active Stakeholders:

ELLEN MACARTHUR FOUNDATION
Rethink the future

EUROPEAN COMMISSION

Reuse Schemes for Industrial

point-of-source

RE-CLAIM

Source reclaimed water

on-site

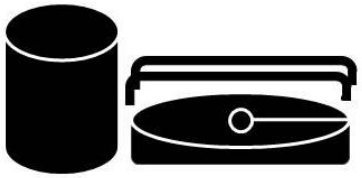
RE-CYCLE

Increase number of cycles

discharge

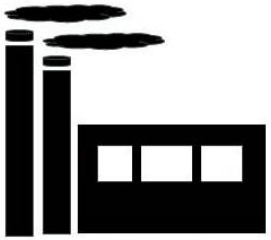
RE-SOURCE

Upgrade for alternate use

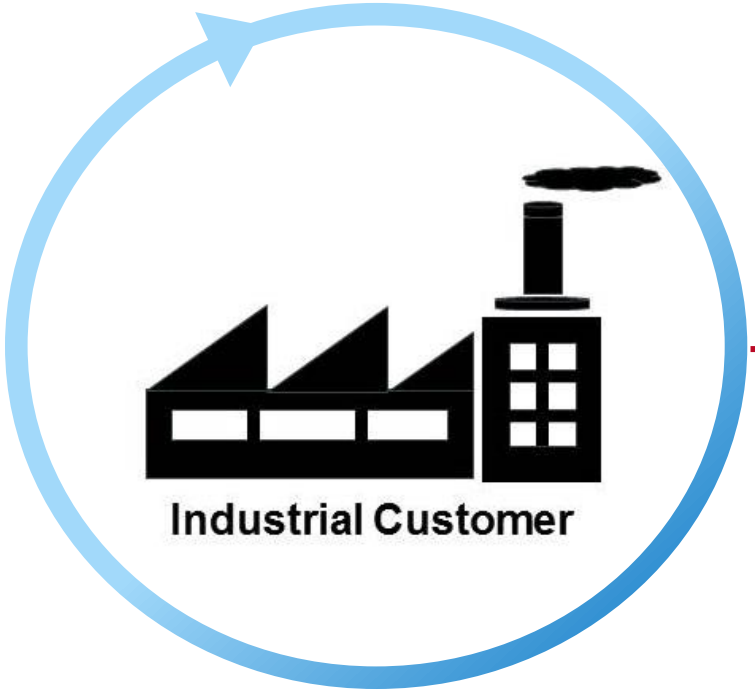


Municipal WW Facility

Graywater

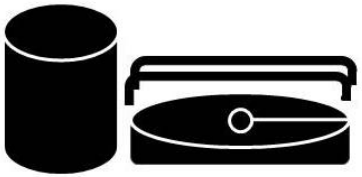


Industrial Customer

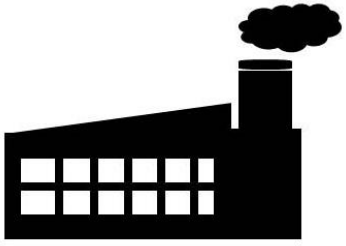


Industrial Customer

Agriculture



Municipal WW Facility



Industrial Customer

Circular Economy Dow Water Reuse Example

Terneuzen Municipal and Industrial wastewater reuse

Dow municipal wastewater reuse Terneuzen site in the Netherlands

Site accepts more than 2.6M gal/day municipal household wastewater daily

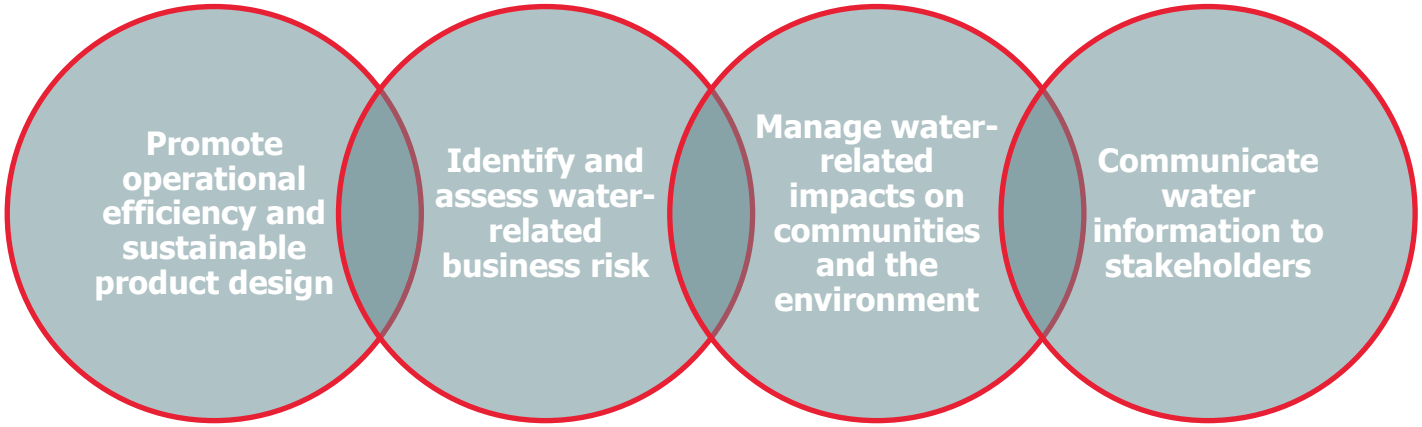
- Dow uses more than 70% of this water to generate high pressure steam
- Water is again used in cooling towers before evaporating. 3 Million tons a year was previously discharged after a single use

65% less energy use compared to Seawater Desalination

Reduction in energy use equivalent to lowering CO_2 emissions 6k tons/year

Corporate water assessments provide frameworks

Tools target 4 key target areas



Ceres

WWF

GrowingBlue
Water. Economics. Life.

GEMI
Local Water Tool™ (LWT)

Global watertool©

AQUEDUCT

VEOLIA WATER

World Business Council for Sustainable Development

WATER RISK MONETIZER
Informing better business decisions.

DOW

Quantitative methods to assess water risk

Assessment Tool	Assessing Water-Related Business Risks	Responding to Water Use and Quality Impacts	Conveying Water Information to Stakeholders	Provides quantitative-based methodologies	Translating Water Risk to Impact on Bottom Line
Ceres Aqua Gauge	✗	✗	✓	✗	✗
GEMI Local Water Tool	✓	✓	✓	✓	✗
GEMI Water Sustainability Tools	✓	✓	✗	✗	✗
WBCSD Global Water Tool	✓	✗	✓	✗	✗
Water Footprint Network	✓	✓	✓	✗	✗
WRI Aqueduct	✓	✓	✓	✓	✓
WWF Water Risk Filter	✓	✓	✓	✗	✗
Veolia Water Impact Index	✓	✓	✗	✓	✗
Veolia Total Cost of Water	✓	✓	✗	✓	✓

Assessment tools featured by U.N. CEO Water Mandate

Dow's 2025 Nature Goal

Our Goal is to apply a business decision process that values nature. Dow will deliver business value and natural capital value through projects that are good for business and good for ecosystems.

- Natural capital decision-making across a global business of this scale **has never been done before.**
- By 2025, Dow will **deliver $1B in value through projects that are good for business and good for ecosystems**.
- By 2020, **all R&D, capital and real estate projects at Dow will be screened** using Nature's Future Value (NFV) assessments, a tool we developed with The Nature Conservancy to measure the value of ecosystem services.

Engineered Natural Technologies Are Already In Use
The Seadrift Constructed Wetland Case Study

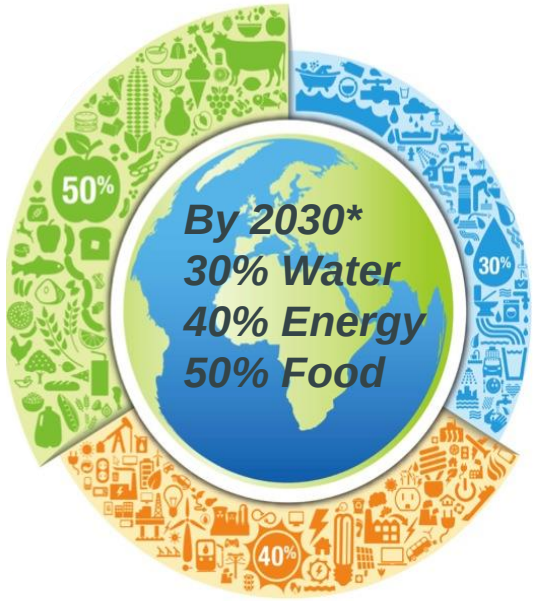
- **First known use** – Dow Seadrift Operations (1996)
- **Need -** Remove organic materials/ eliminate algae
- **Proposal** – Conventional wastewater treatment plant ($40 MM)
- **Decision** – 10-acre constructed wetlands ($1.4 million)
- **Savings** – >$48M initial investment, >$280M NPV
- **Benefit** – Home to a wide variety of wildlife and hosts educational tours

Food-Energy-Water Nexus

You don't manage…

… what you don't

~~Measure~~ value



*Source: World Business Council on Sustainable Development

Energy-Water Nexus
Strategies to Increase Efficiency of Water Use

Energy-Production efficiency

- Increase electricity generation efficiency
- Increase in use of photovoltaic and wind
- Increase use of dry/hybrid cooling technology

Increase Water use/reuse/recovery

- Recycle water within plant

Reclaim Water for reuse and enable degraded/impaired water sources such as:

- Waste water treatment plant discharge
- Storm water flow
- Saline aquifers
- Coastal waters and sea water desalination
- Produced waters

Minimizing Water Use in Energy & Production

Source: EPRI's "Increasing Thermoelectric Generation Water Use Efficiency" First Western Forum on Energy and Water Sustainability March 22 & 23, 2007