

November 2020



# **LOW IMPACT TECHNOLOGIES**

Concentrated Solar Multi-Effect Distillation and  
Dewatering Technology

# Problems Present Opportunity

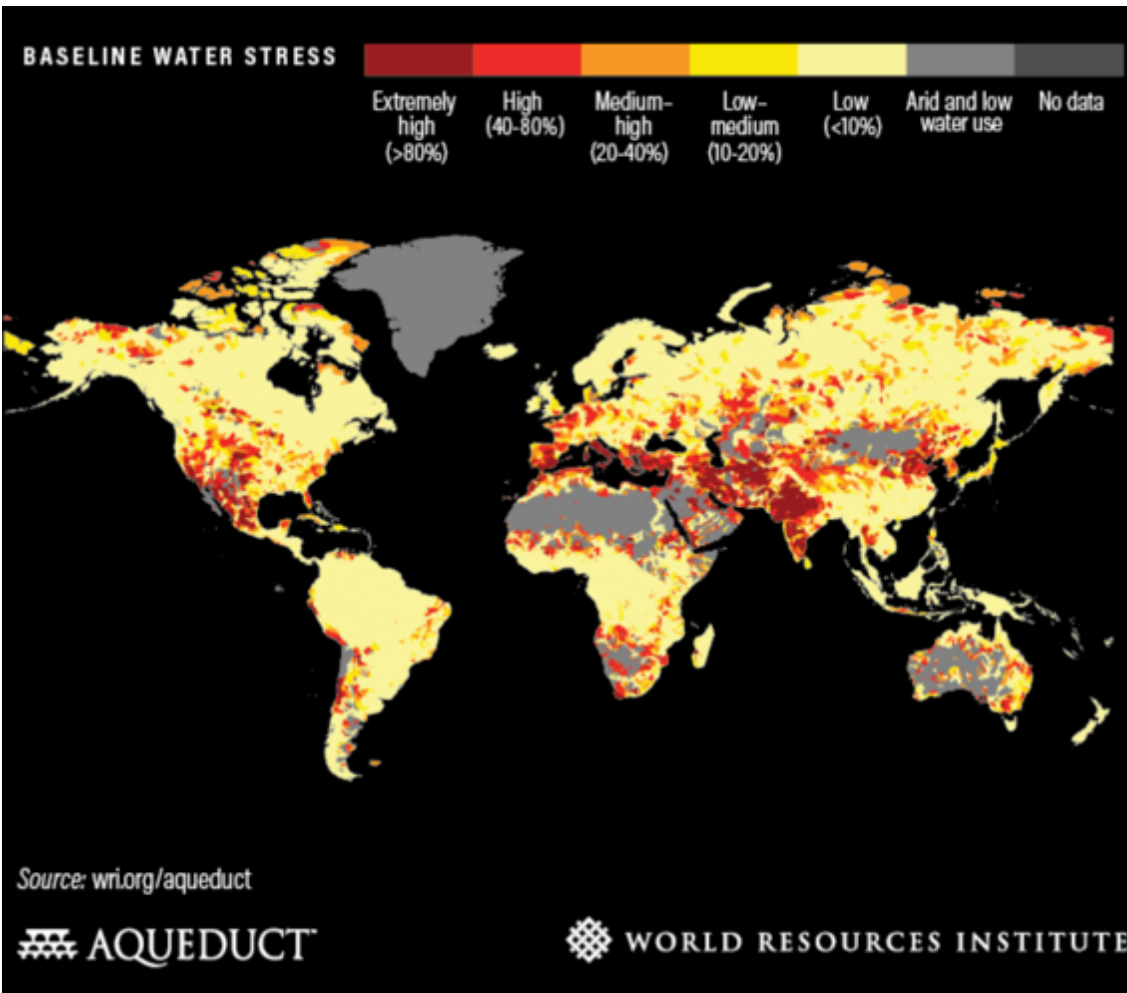
## SOCIOECONOMIC

- 2bn people in the world are still without access to suitable sanitation. WHO
- 800,00 children under 5 die every year due to preventable diarrhea-related issues Liu et al The Child Health Epidemiology Reference Group of WHO and UNICEF (2010)
- The National Bureau of Economic Research found that the impact of clean water technologies on public health in the U.S. is estimated to have had a social rate of return of 23 to 1 for investments in water filtration and chlorination during the first half of the 20th century.

## INDUSTRIAL

- In the US between 2012 - 14, the annual water usage was 116bn litres per year for shale gas and 66bn litres per year for unconventional oil. Integrated data from 6 to 10 years of operation yielded 803bn litres of combined flowback and produced water from unconventional shale gas and oil formations. Andrew Kondash, Avner Vengosh. **Water Footprint of Hydraulic Fracturing.** *Environmental Science & Technology Letters*, 2015
- Underground coal and uranium mining, and oil recovery enhancement extraction, use between 2.5 to 13 X more water (per unit of energy produced) than fracking. <http://www.sciencedaily.com/releases/2015/09/150915135827.htm>

# Problems Present Opportunity



- Twelve out of the 17 most water-stressed countries are in the Middle East and North Africa (MENA).
- The World Bank [found](#) that this region has the greatest expected economic losses from climate-related water scarcity, estimated at 6-14% of GDP by 2050.
- Yet there are untapped opportunities to boost water security in MENA. [About 82%](#) of the region's wastewater is not reused.
- The estimated total volume of water abstractions across Australia was 16,870 GL in 2017–18. This is 7 percent higher than the figure reported for 2016–17. LIT is looking to provide solutions for extractions less than 1% of Australia's annual water usage.
- Australian mines consume approximately 760 gegalitres of water per year 4.4% of total.

# Problems Present Opportunity

- New forecasts published by Global Water Institute have projected that the value of the global water market (representing the sum of both operating and capital expenditures by utilities and industrial water users, on water and wastewater) is expected to grow from \$770B in 2018 to \$914.9B by 2023.
- Global capital expenditure on water and wastewater by the mining industry increased by 23.5% to \$1.64B in 2019.
- Chile is set to become a key source of desalination project opportunities. A 128.5% increase in the use of seawater in the country's mining operations is expected over the next ten years, driven by continued investments in new mining projects, and the impact of a new regulation which makes desalination mandatory for mining operations with water needs exceeding 12,960m<sup>3</sup>/d.

# LIT licensed D&D Solar Technology



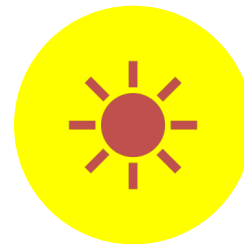
D&D has developed and Patented Technologies for the production of **Efficient Large Parabolic Troughs** at price less than 35% of the current state of the technology (per sq m of steel and glass construction).



D&D Sheetless Thermoforming (STF) is a worldwide Patented Technology capable of producing **the largest Thermoplastic/Thermoplastic Composite Parts at a much lower cost than any conventional process**, even if those processes could produce products of this size.



D&D has several patents on Trough Design that greatly simplify the logistics of the Troughs in the field. **D&D can produce a BTU of energy on par with natural gas usage.**



D&D has also perfected **an efficient, cost effective yet simple to operate Multi-Effect Solar Distillation and Dewatering System** which is easily integrated with the Thermal Solar System.

# 14 Years in the Making... Milestones

2006

- D&D Commenced Development of the STF line Manufacturing Technology in 2006 to enable manufacture of large parabolics and other parts.

2014

- D&D began developing Distillation Technology

2015

- CSMED small Test Units Built and Tested
- Commenced Design of Dewatering Technology in 2015

2019

- Commenced commercialisation market research in Australia, US, Africa, Sth America, Asia
- First STF CSMED Global License (Ex USA) Agreed with Low Impact Technologies (Australia)
- First Aus. Strategic Partner (JWA) selected. First 4 full scaled commercial test units agreed
- Commenced Manufacturing 4 commercial sized units

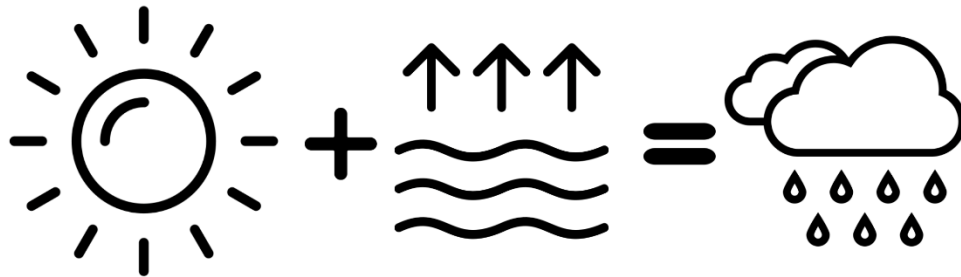
2020

- First unit completed and commissioned in Florida USA
- 4 Units to be delivered to JWA for testing with 4 separate companies in AUS. Resource Sector
- LIT to Build and Commission World First Bespoke Manufacturing Plant in Australia (Late 2020)

# V 1.0 Parabolic Trough with D&D Distillation Technology

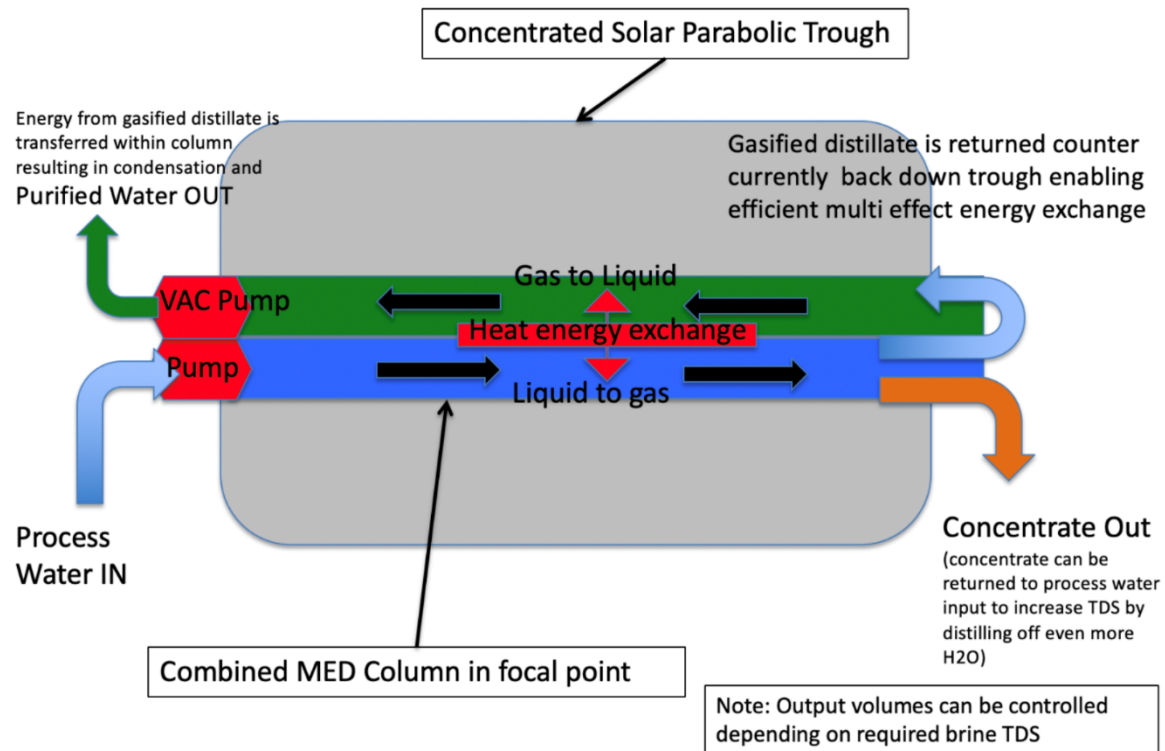


# Test Results



Mother Nature

Harnessing Solar Thermal Energy



# Test Results

## SAMPLE REPORT

*TTU Center for the Management, Utilization and Protection of Water Resources*

*Address: Box 5033 Cookeville, TN 38505-0001 Phone 931 372-3538*

*Web Site: <http://www.titech.edu/wrc/>*

<i>Customer</i>	<i>Street</i>					
<i>Contact</i>	<i>Address</i>	<i>TEST</i>	<i>Test Method</i>	<i>Result</i>	<i>Units</i>	<i>MDL</i>
<i>Sample No.</i>	Clean Water					
<i>Collection Date:</i>	5/22/2014					
1314476-001	Total solids (TS)	SM 2540B	12	mg/L	2	
<i>Sample No.</i>	Dirty Water					
<i>Collection Date:</i>	5/22/2014					
1314476-002	Total solids (TS)	SM 2540B	217247	mg/L	2	

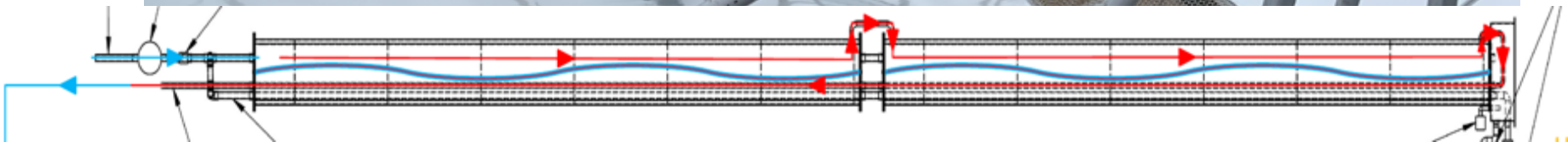
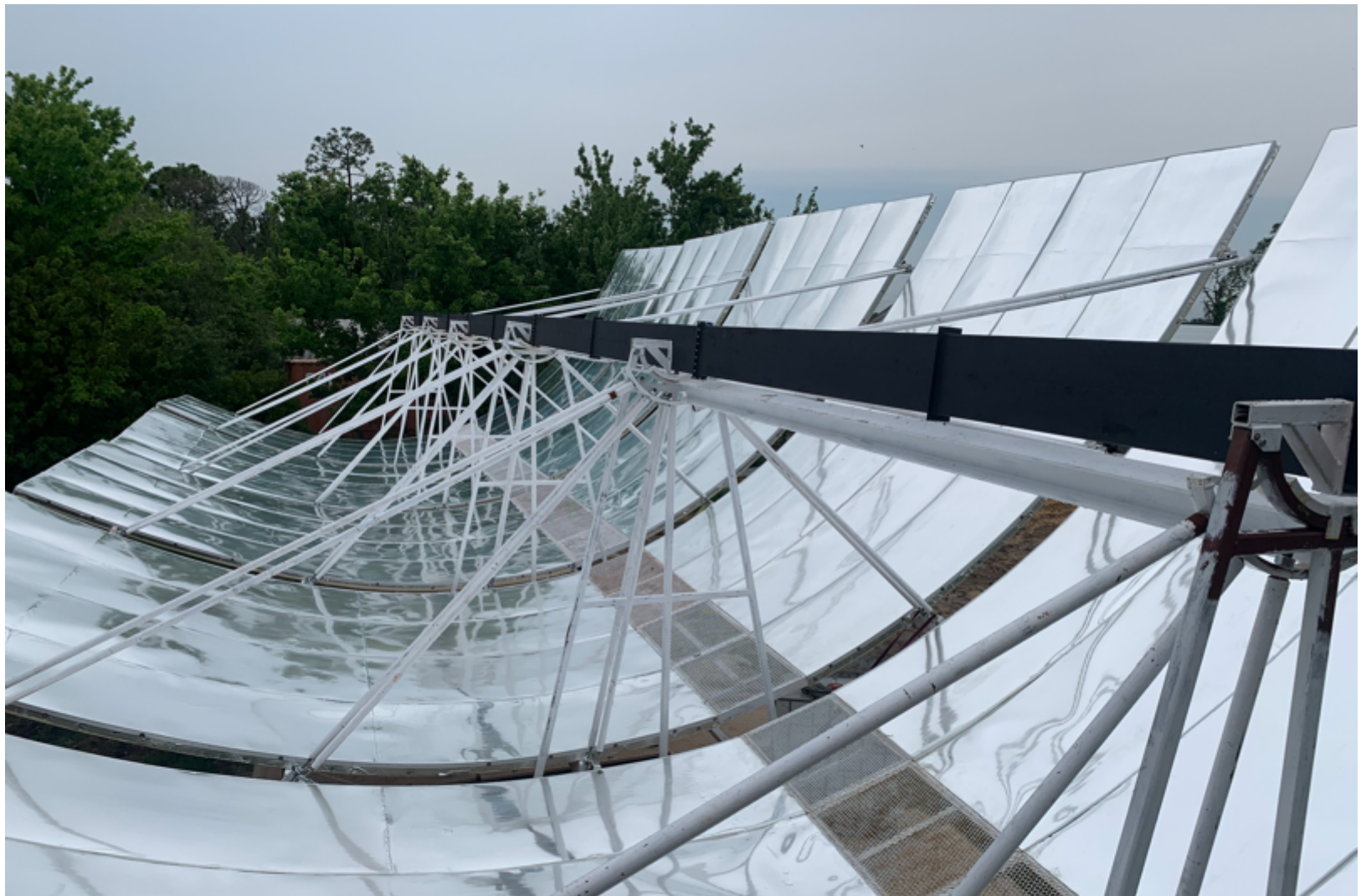
Distil Frack water from 217,247 ppm to 12 ppm  
In a single Pass

Tap water approx 300ppm

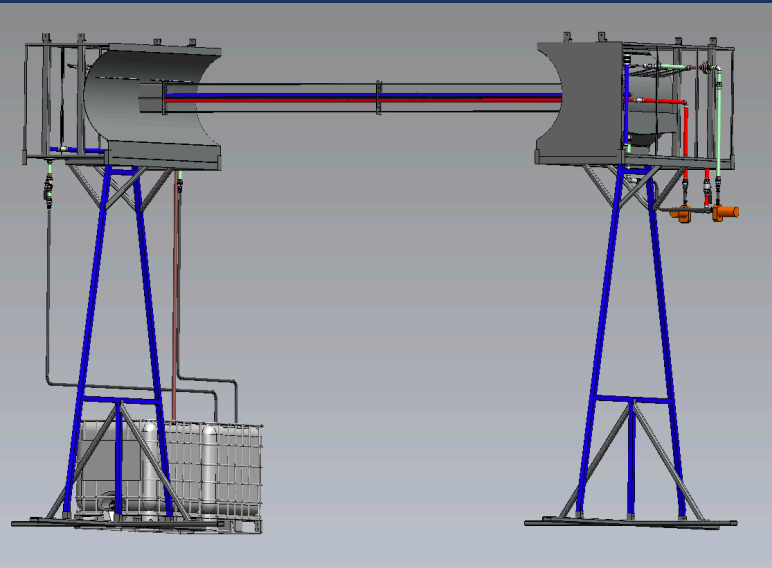
# V 2.0 Parabolic Trough with D&D Distillation Technology



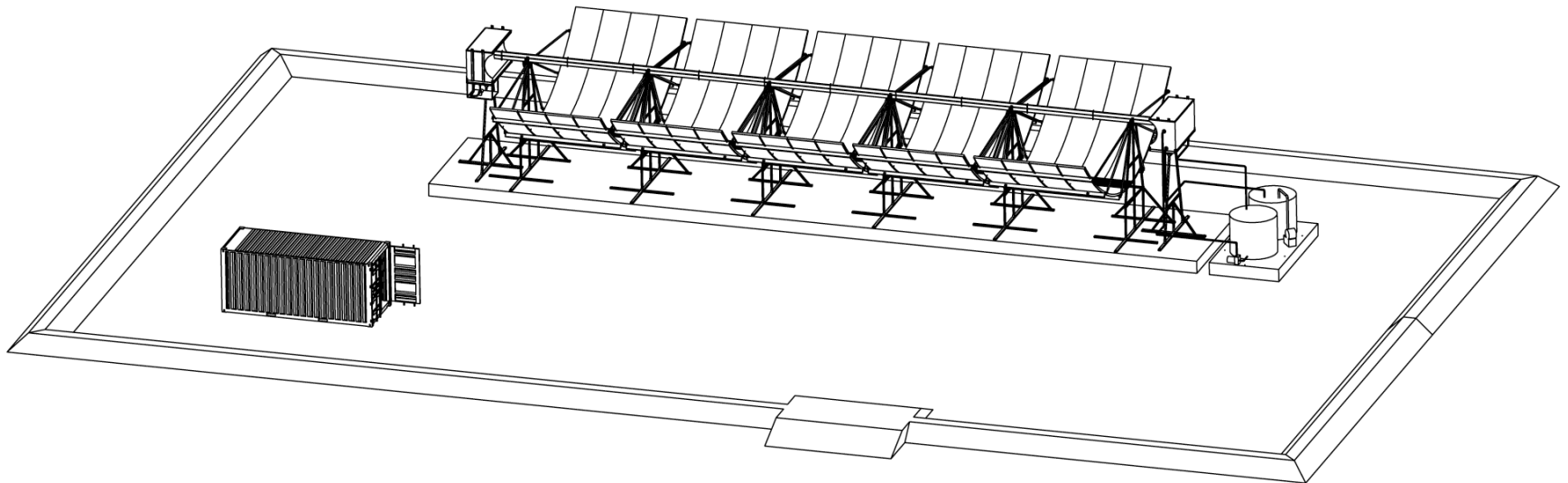
# V 2.0 Parabolic Trough with D&D Distillation Technology



# VAAD – Vacuum Assisted Atomised Distillation



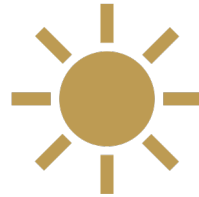
- Creating micro droplets of brine greatly increases surface area of the input brine for Evaporative Distillation to occur.
  - When placed at either end of the column, this Increases efficiency for CSMED Distillation System and utilises wasted energy that would be lost due to the Cosine Error.
  - Enables distillation operation in Low Light Solar conditions.
  - Increases daily hours of operation.
- Broadens the potential operational scope of D&D's Distillation Solution
  - Greatly Increases Geographical locations for CSMED systems;
  - Enables potential entry into, and innovation within, the current forced air evaporative space.



# D&D Ultra Large Parabolic Trough



Trough made in 6.2m “leaves” which can be containerised for shipment. These leaves are easily assembled in the field with a steel frame. The final distance across the trough is approximately 11m.

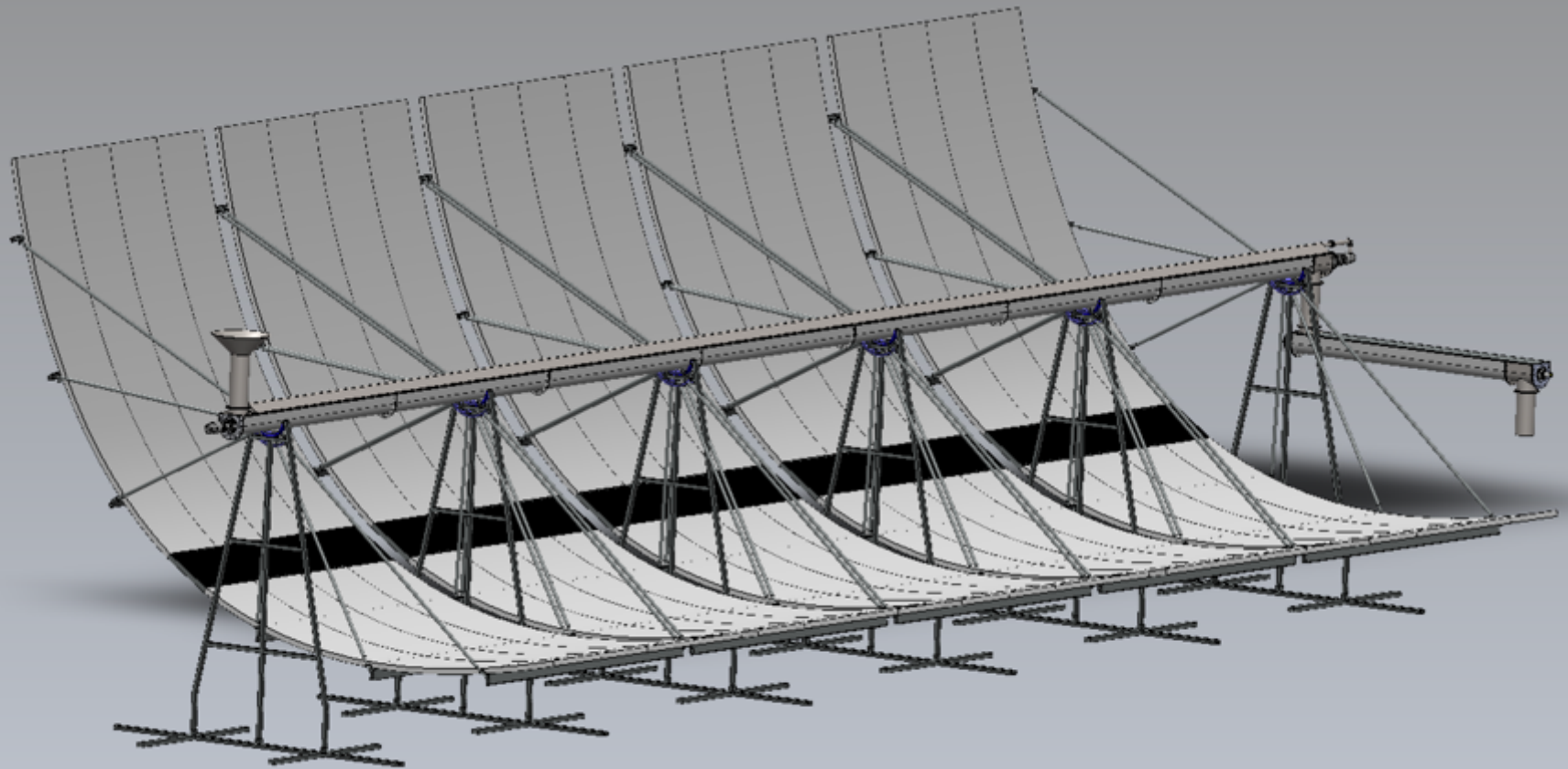


The total solar collection aperture distillation per trough is roughly 300 sq m., capturing **over 1,000,000 Btu's per hour**



**Depending on irradiance, the trough can produce over 30,000 ltrs distillate per day (around 10million litres (10ML) per annum) with solar radiation only.**

# Solar De Watering Unit – Zero Liquid Discharge

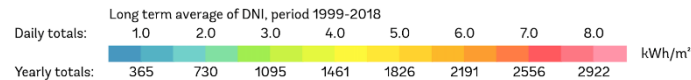
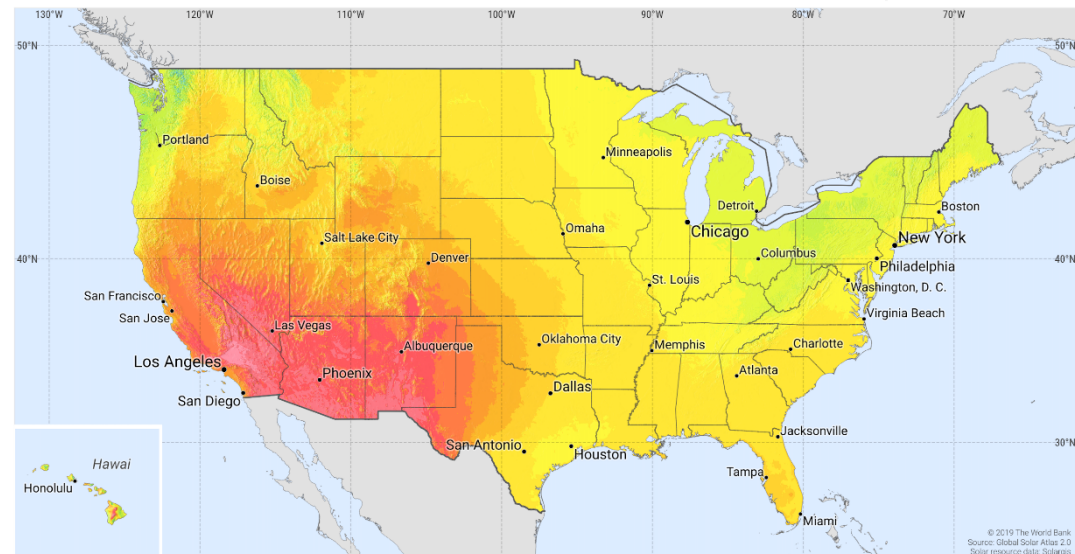


# Estimated Solar Dewatering Parabolic Trough Throughput

- The CSMED daily throughput is dependent upon Solar Radiation, % of water and % of water in the effluent.
- With such factors taken in account, the estimated daily throughput for one trough is 5000 US gallons of fresh water (potential extra revenue stream?) and 23,000 kgs of solid product, based on a 50% TDS.

SOLAR RESOURCE MAP

## DIRECT NORMAL IRRADIATION UNITED STATES OF AMERICA



# Applications

## Distillation Column

- Fitted in situ Horizontally along the mirrors focal plane
- Operates under a vacuum to reduce scaling and increase efficiencies of available solar energy
- Distils Water from almost any input source
- No use of Membranes or Filters

## Dewatering Auger

- Fitted in situ Horizontally along the mirrors focal plane
- Operates under a vacuum to reduce scaling and increase efficiencies of available solar energy
- Distils and removes up to 98% water from any precipitated input source
- No use of Membranes or Filters

### INPUT

- Hypersaline Brine, RO Discharge, Sea Water



- Resource / Industrial Process water, Mine Tailings



- Agricultural / Residential effluent



### OUTPUT 1

- Fresh Water



- Fresh Water



- Fresh Water



### OUTPUT 2

- Dry salts



- Dried minerals, Salts, Tailings

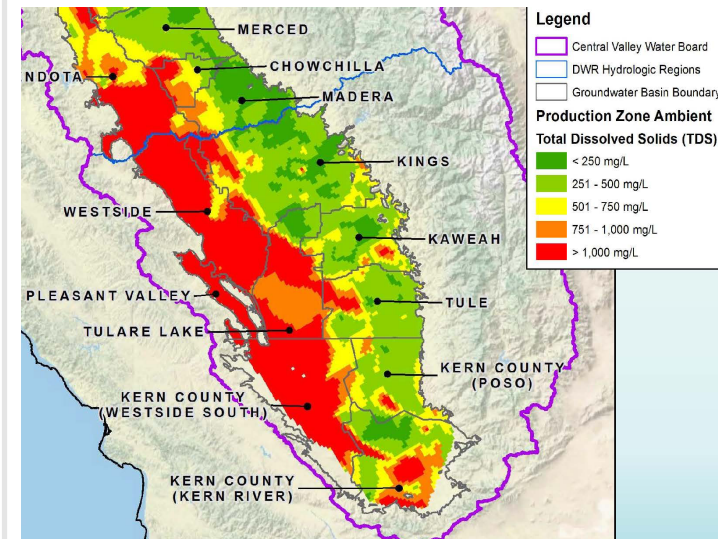


- Biosolids / Biochar

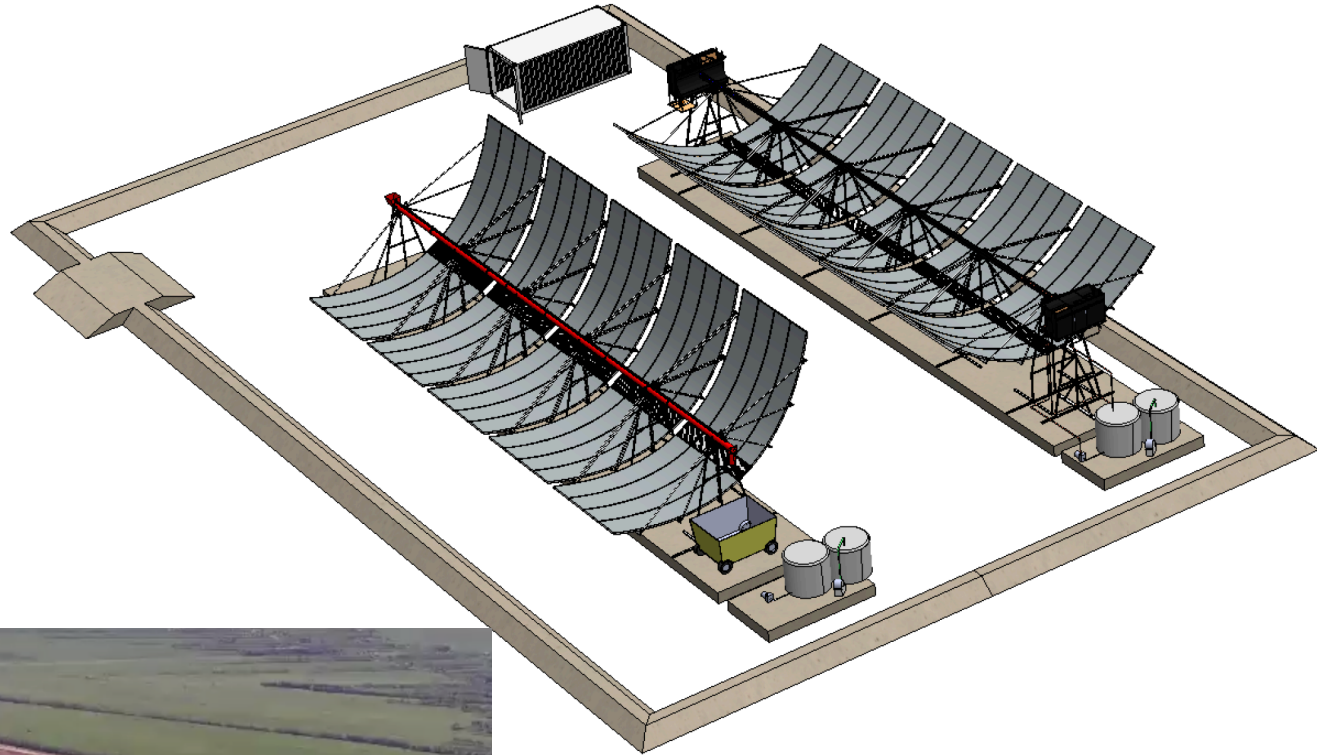


# Market Opportunity Example California - Tulare Basin

- **California currently produces 6.32 trillion litres of agricultural wastewater that can be treated.**
- **That is enough water for 46.3m people.**
- There is also 246 million cubic metres of industrial wastewater produced in central California alone.
- **D&D is working in partnership with Element Renewal to enable supply of around 2,500 units in Phase 1 of the Project.**
- **These fields will provide > 28 GL per year in distillate.** The distillate can be repurposed via shandyng, if required.
- **ZERO LIQUID DISCHARGE**



# Market Opportunity Mining



Dewatering Mine Tailings ponds using a field of Distillation and Dewatering (CSMED) Units

# Market opportunity Solar Sterilisation – Recycling Greenhouse Water

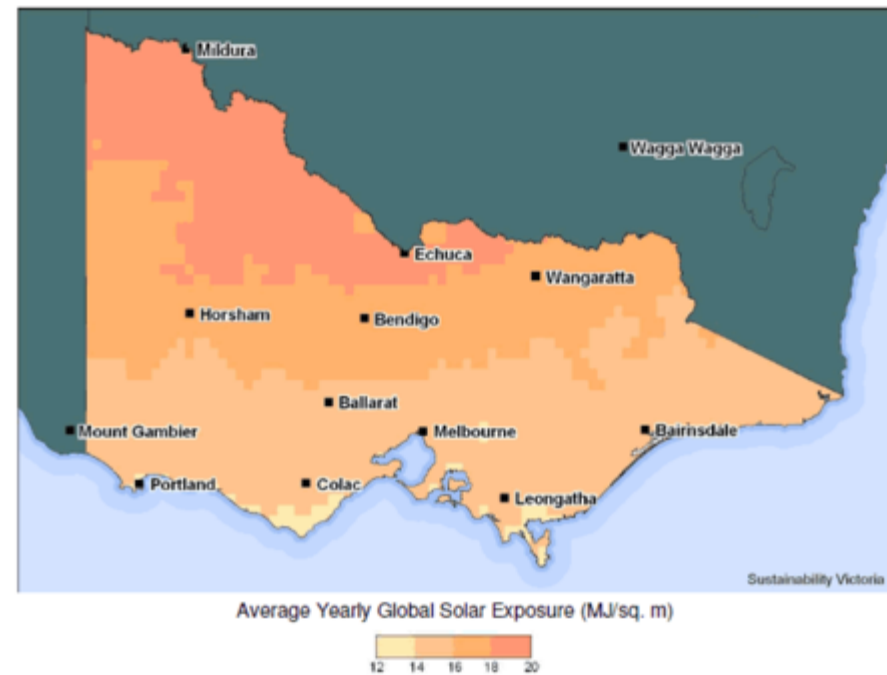
## National Greenhouse Waste Recycling Study May 2011

- Funded by Horticulture Australia Limited.
- There was around 1341 Ha of protected cropping in Australia (of which approx. 650 Ha for tomato lettuce and herbs were not included in the study outcomes below).
- Study determined the following savings for recycling / sterilising water per hectare
  - 7.5 ML @ \$2000.00/Megalitre = \$15,000.00
  - \$3.00 / m<sup>2</sup> @ 10,000 m<sup>2</sup> = \$30,000.00
  - **Total annual savings per hectare if a recycling sterilisation solution was employed \$45,000.00/ha.**

# Solar Sterilisation – Recycling Greenhouse Water

## D&D Solar Steriliser

- 2 year payback
- 15 year life



Farenheight

Input  
Temp

71.6 = 22 centigrade

204.8 = water heated to 96 centigrade

133.2 = temprature difference

25,000 = litres per day recycled

6613.8 = gallons

54,232.80 = lbs of water

7,223,810 = BTU's required to sterilise volume

3,000 = ft2 apperture per trough

290 = Btu per ft/hour

8,700,000 = Btu's produced by trough per 10 hour day

17,400,000 = total Btu's with multiple effect of 2x

1 Solar Steriliser will manage 2 hectares of process water

# Thank You & Contact Details



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