

Technical and economic analysis of an integrated power and desalination plant in Texas

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September 21, 2017

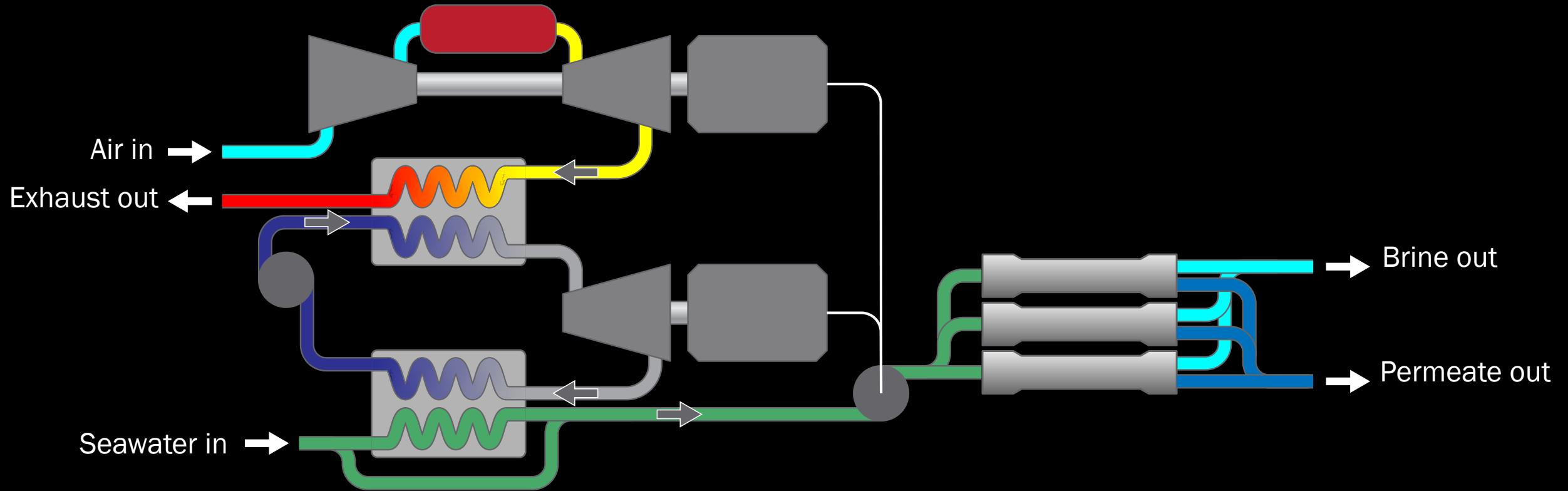
Texas Desal 2017



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Power plants consume water, and reverse osmosis desalination plants consume electricity. Integration can benefit both processes



Integrating power and desalination plants has several potential benefits

- Water intake infrastructure can be shared
- Lower emissions intensity for desalination
- Lower energy costs for desalination plus
- Revenue can be supplemented through electricity sales

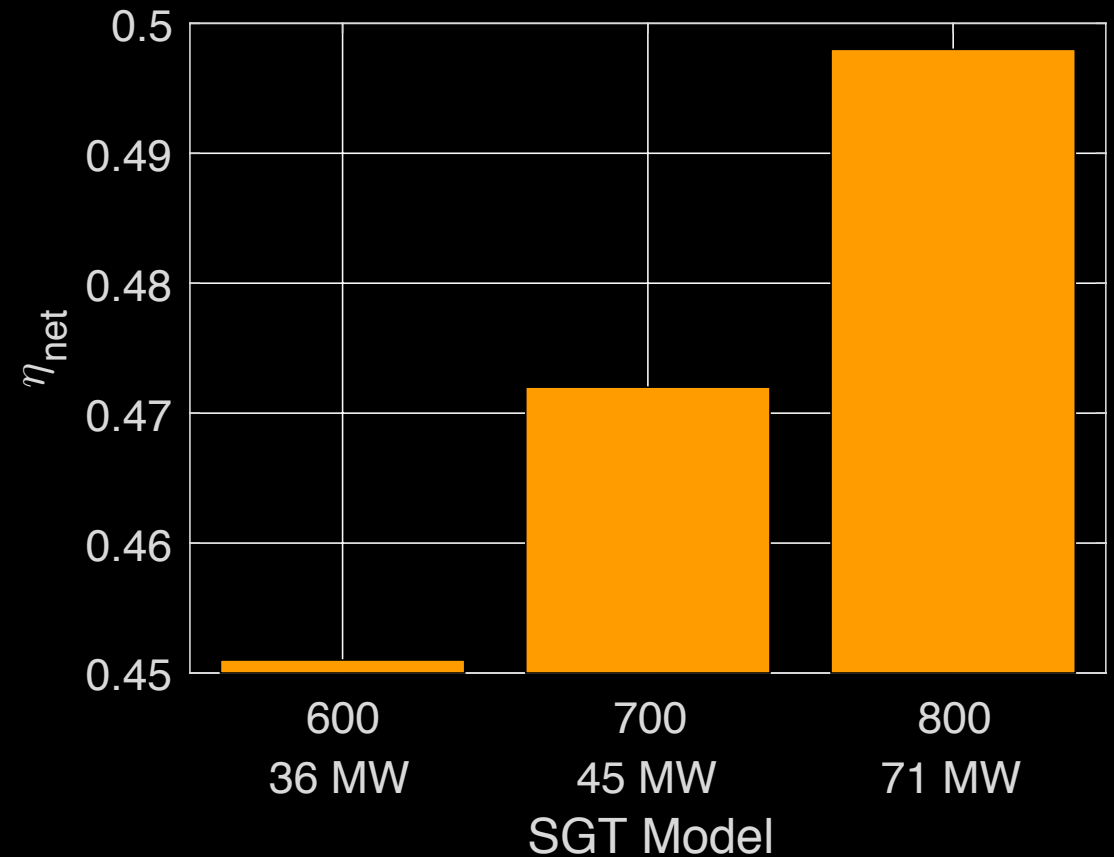
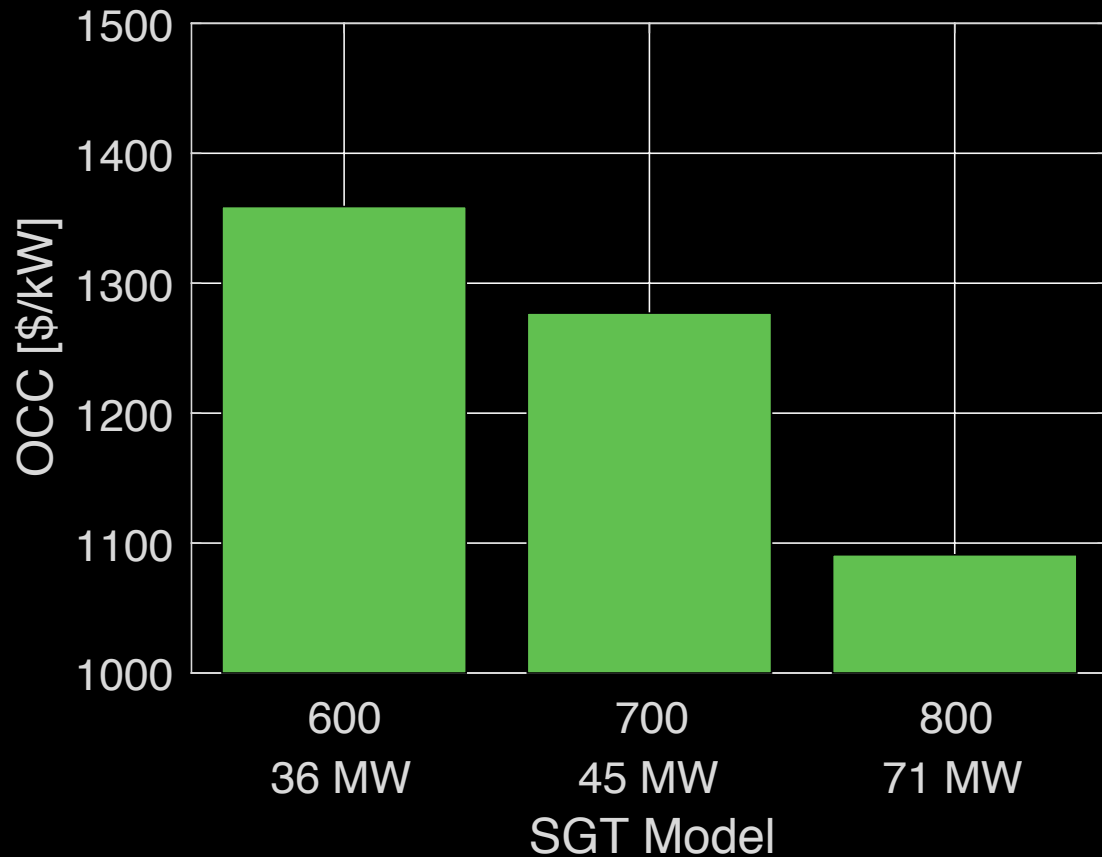


“Built-to-size” levelized cost analysis used for seawater RO plant integrated with CCGT

- Maximum rate of output of RO plant based on maximum power output of CCGT plant
- “Credit” method accounts for revenues from electricity sales
- Energy costs are based on the energy intensity of desalination, the cost of fuel, the efficiency of the CCGT, and the O&M for the power plant
- Capital costs include the capital and fixed costs of the power and desalination plants



Siemens has a range of combined cycle offerings that could be integrated with a reverse osmosis desalination plant

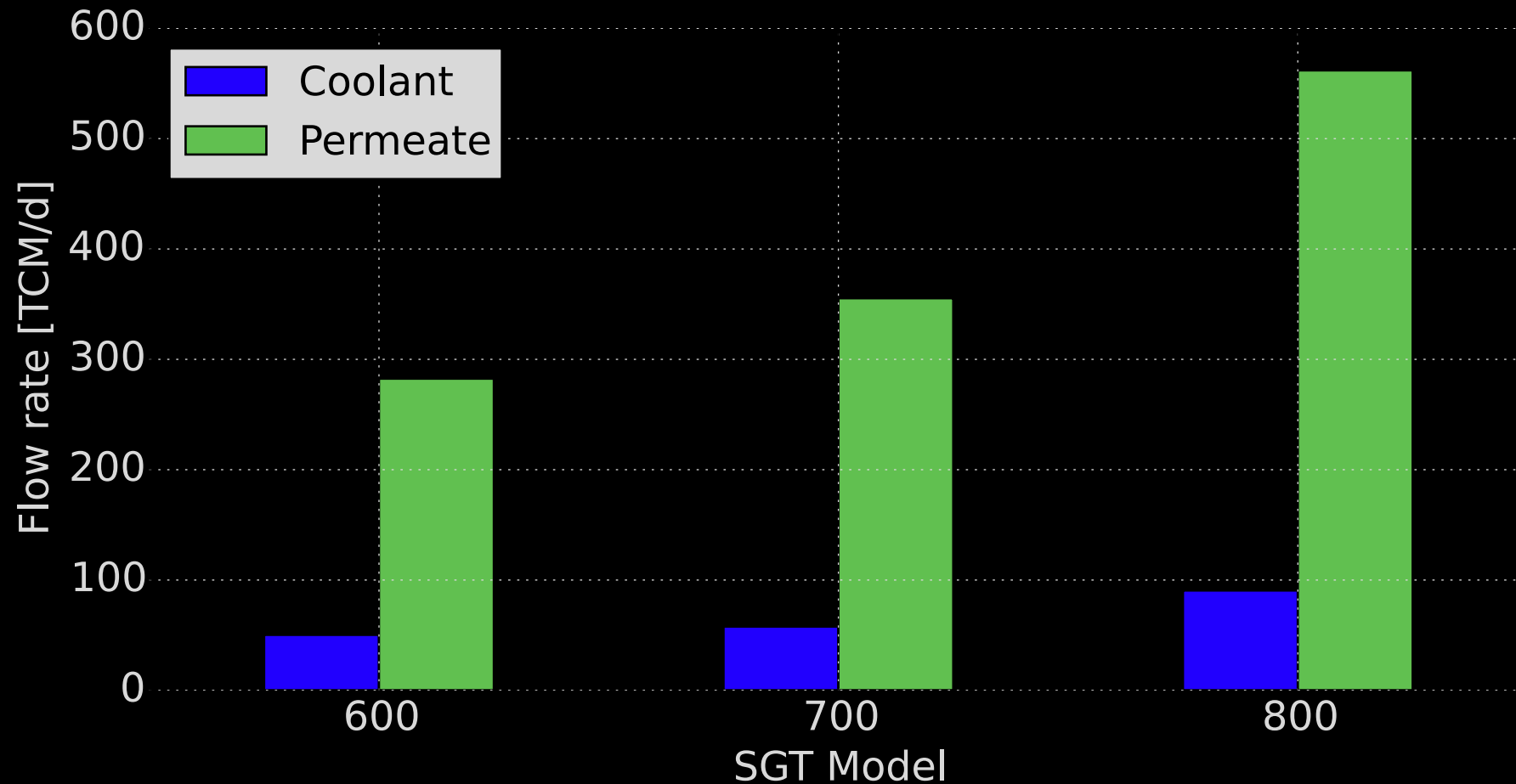


The operating cost for RO accounts for chemicals, labor, parts, and membranes [¢/m³]

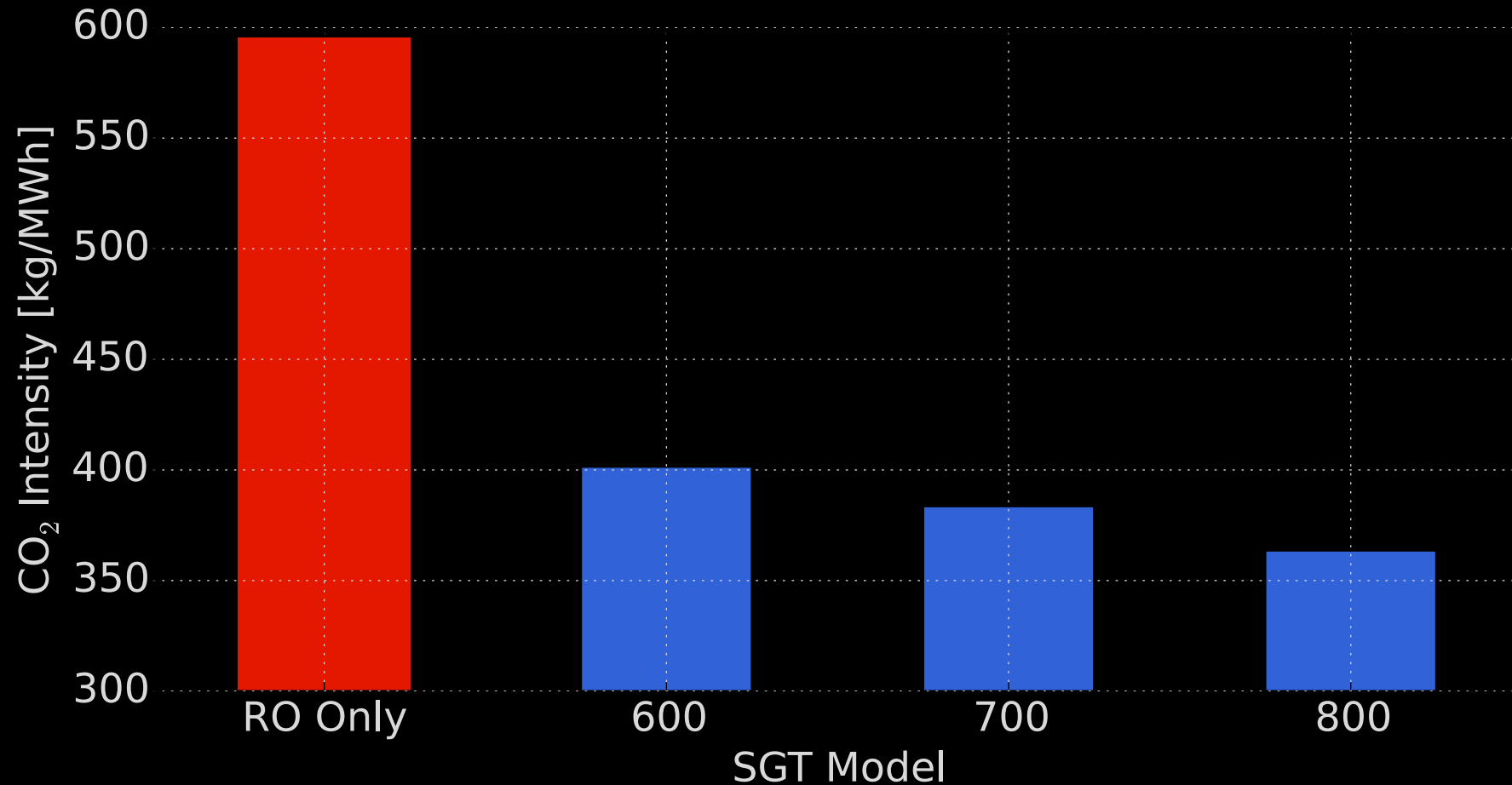
C_{chem}	7.0
C_{labor}	6.7
C_{parts}	3.0
C_{mem}	3.0
<hr/>	
C_{RO}	19.7



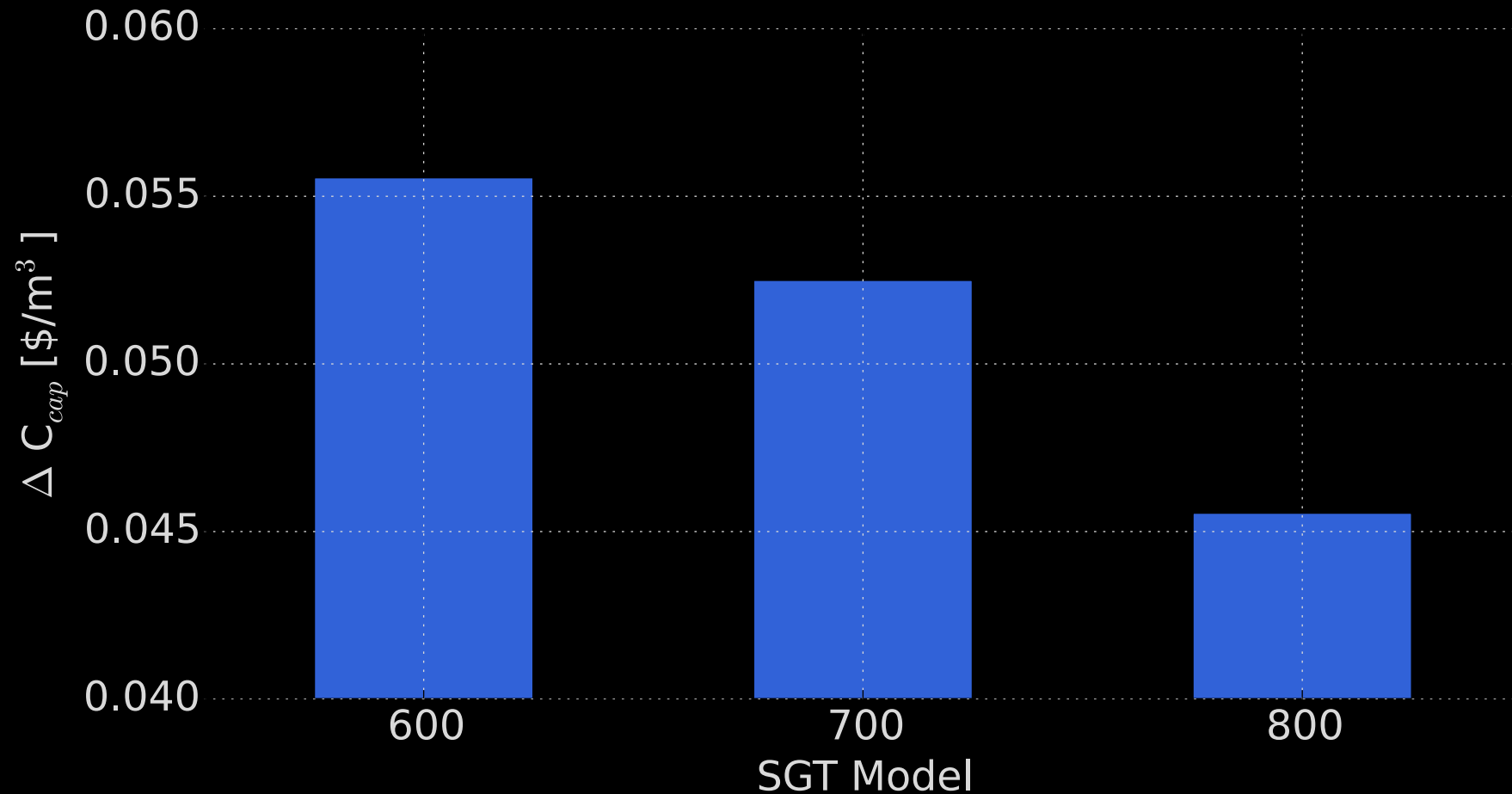
The necessary flow rate of power plant coolant is significantly less than the flow rate of seawater going into the desalination plant



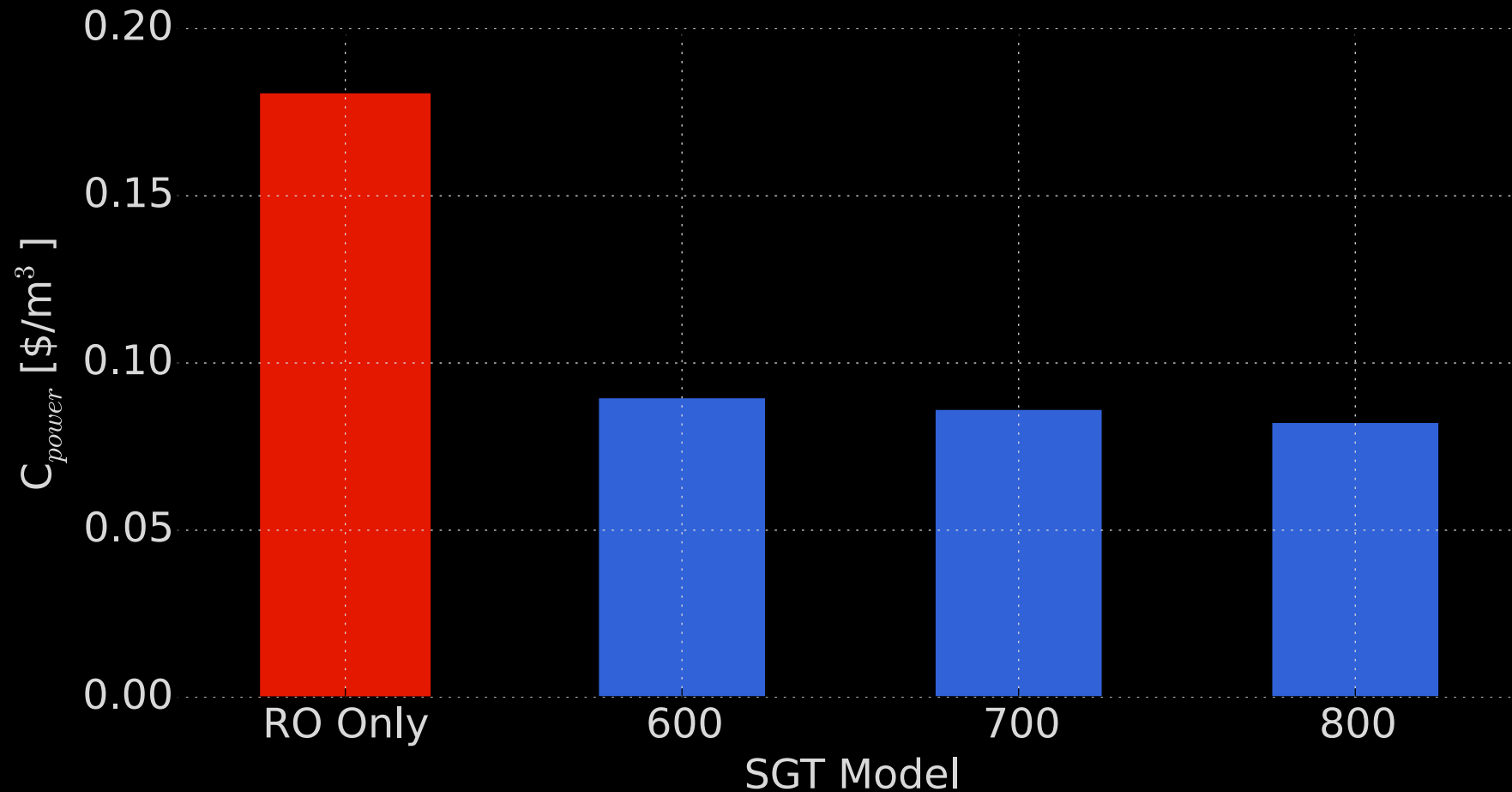
The CO₂ intensity of the CCGT ranges from 359 – 380 kg/MWh compared to 595 kg/MWh for electricity from ERCOT from 2011-2014



The fixed and capital costs associated with the CCGT are added to the amortization cost of the RO plant



Integrated desalination plants benefit from reduced electricity costs and revenues from electricity sales



The LCOW tends to decrease for the larger, more efficient plants with lower overnight capital costs



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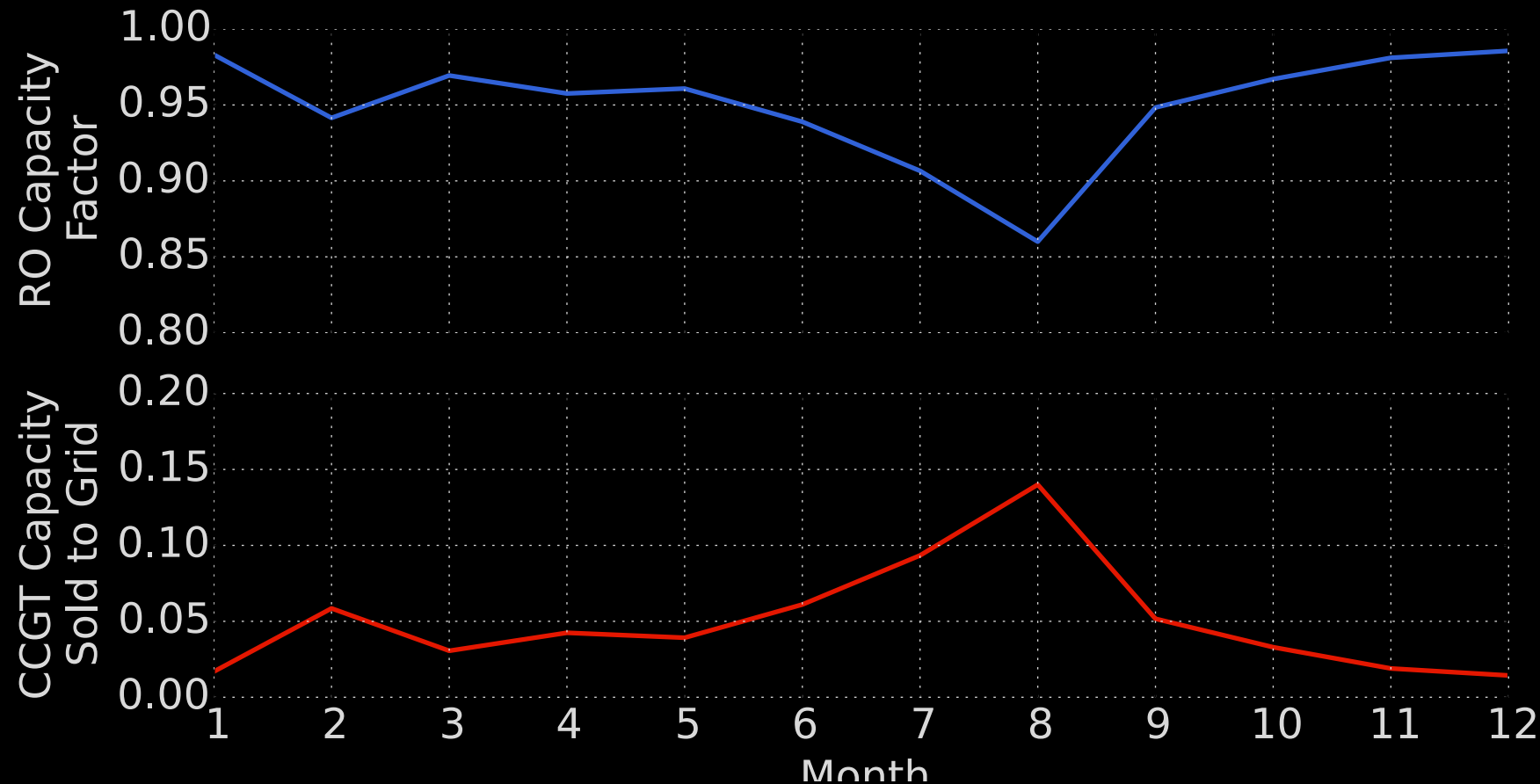


Current status and future work

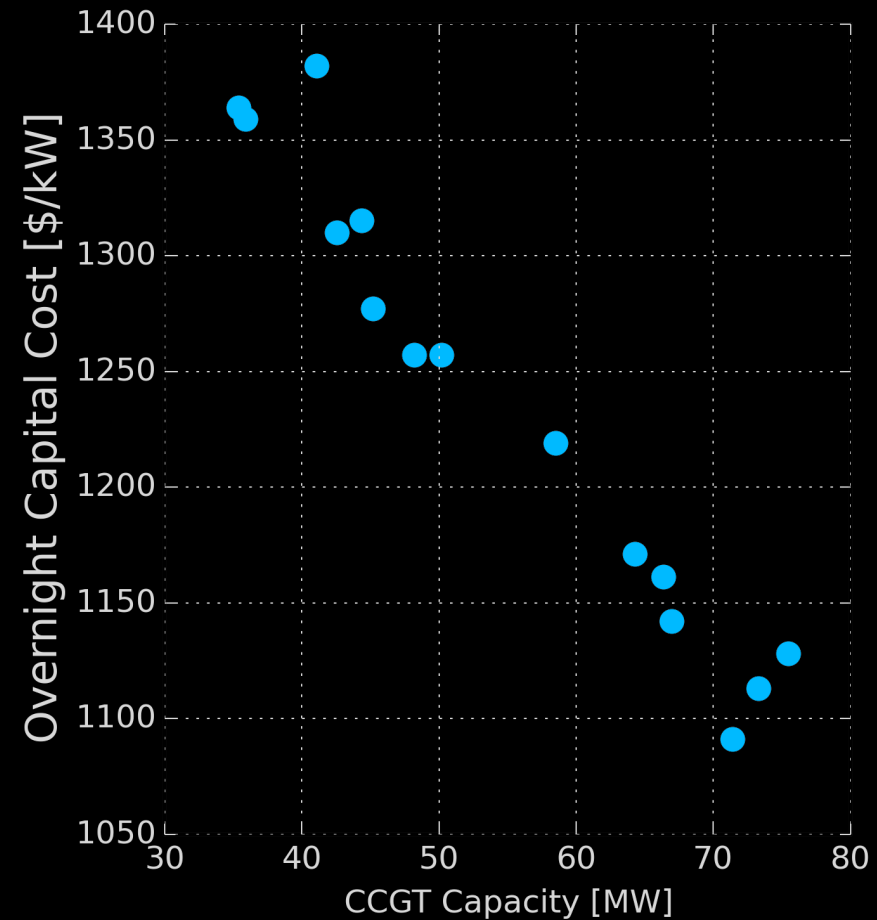
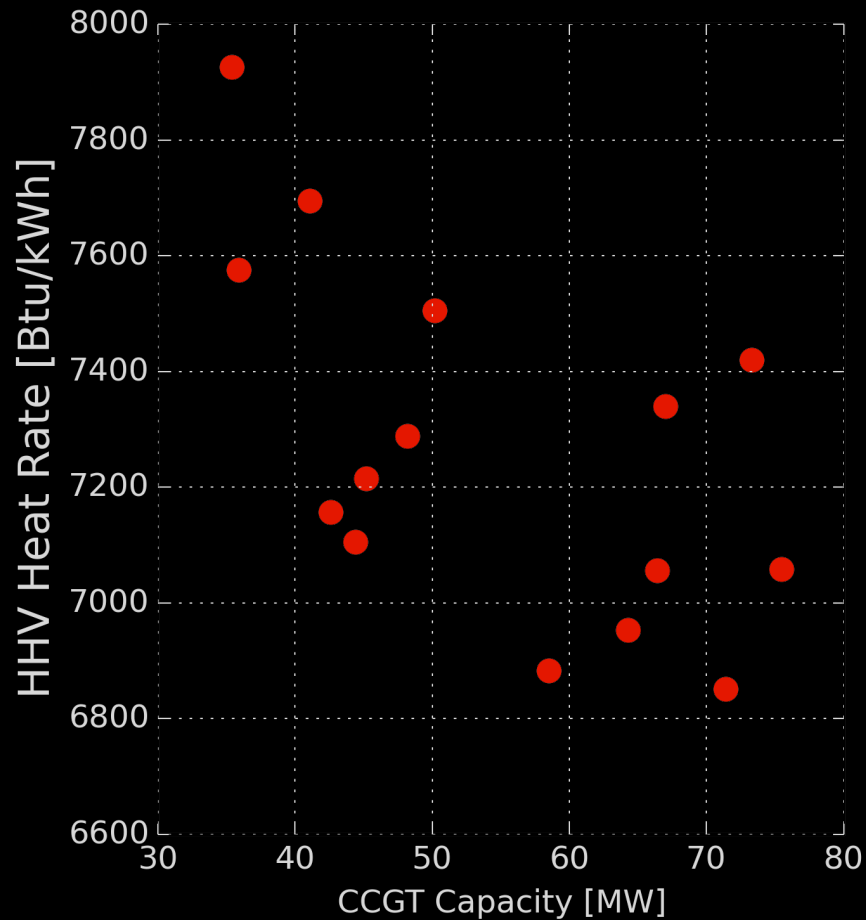
- A version of this research has already been submitted to the *Texas Water Journal* for publication



Monthly RO capacity factor decreases in the months where potential revenues from electricity sales are greatest



This analysis could be expanded to include additional CCGT designs



Acknowledgments

- Dr. Michael Webber
- Brittany Speetles
- Webber Energy Group
- Ahmed Zakaria
- Nawaf Alhajeri
- Fahad Al-Fadhli
- Darrell Thornley
- Steve Courtney
- Sam Kramer
- Gordon “Gordy” Gray
- Mark Ellison



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