

# *Small Modular Reactors*

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## *Beyond Conventional Nuclear Energy Markets*

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# ***SMR Characteristics – Ingredients to Create a Disruptive Energy Technology?***

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- “Modularity” in capital cost outlays
- Competitive electricity cost/kw<sub>E</sub>
- Fuel supply security
- Factory production and transportation to use site
- Operational lifetime
- Operational security and proliferation resistance

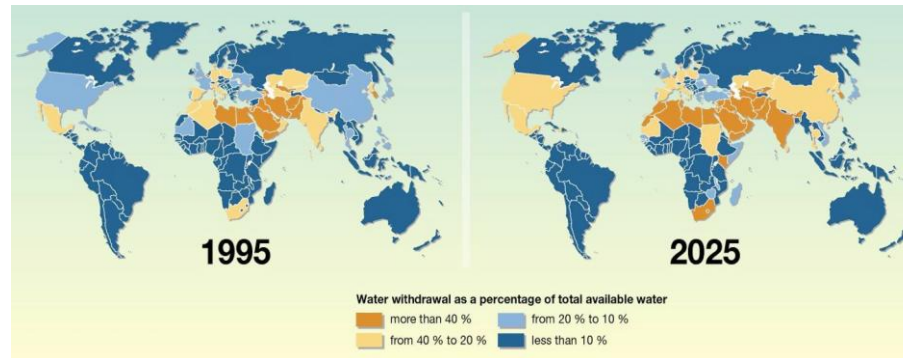
A key feature marking a disruptive technology (Clayton Christensen – *The Innovators Dilemma*)

*“Disruptive technology attributes, considered unattractive in established markets can become their greatest attributes in emerging markets.”*

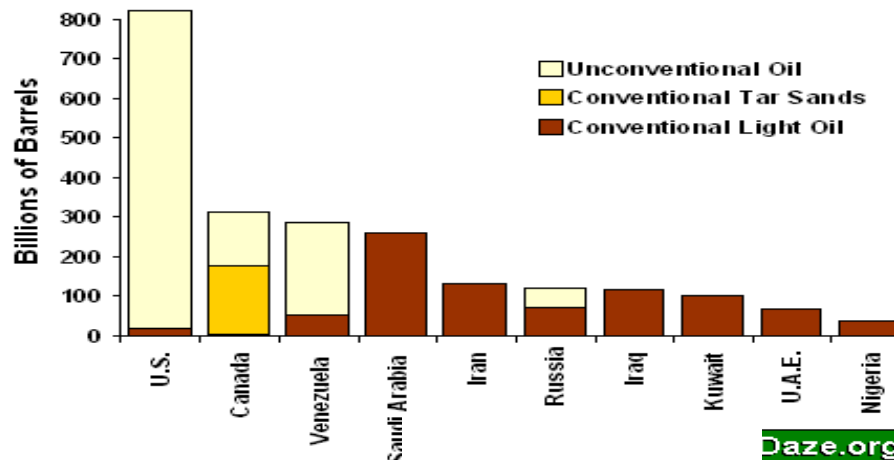


# “Unconventional” Market Examples

- *Addressing water scarcity*



- *Unconventional oil recovery*



# Desalination Market Needs and Opportunities

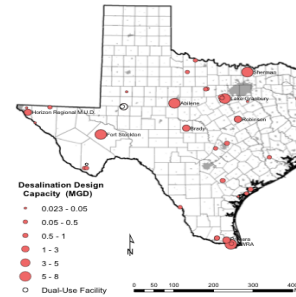
- Globally \$70 billion investment expected in next 20 years to increase desalination by 10 billion gallons/day (1% increase in drinking water)
- A major source for water to meet future US needs exists in underground brackish water aquifers



US brackish water locations  
brackish water



NM brackish water  
(Estimated > 10 billion acre-ft)



Texas  
(Current desalination locations)

- An on-site 100 MW<sub>E</sub> SMR coupled to a reverse osmosis plant ( 5 -10 Kwhr/m<sup>3</sup> H<sub>2</sub>O) can produce 25-50 million gallons of drinking water/day

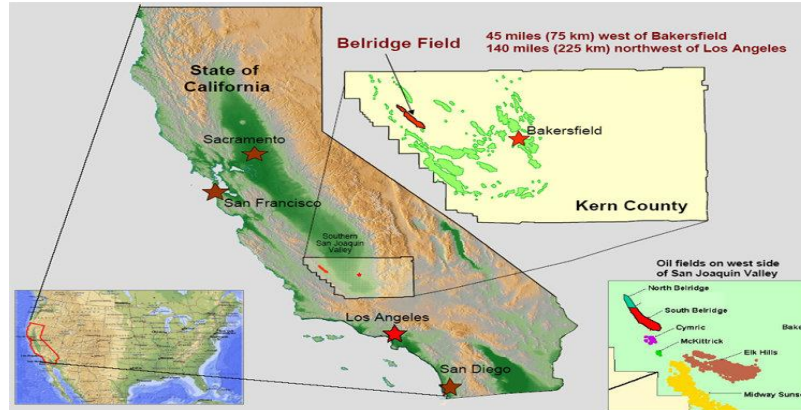


150,000-300,000 people



# ***SMR Application to Unconventional Oil Recovery – California Heavy Oil***

- 100 billion barrel resource – fields have been in production beginning before the 1950's



- Recovery requires heat – injected steam produced by natural gas – which adds 75-100 kg of CO<sub>2</sub> per barrel as compared with Saudi light crude – current production levels add about 15 million tons of CO<sub>2</sub> to the atmosphere yearly
- A small ( $\sim 25 \text{ MW}_E$ ,  $75 \text{ MW}_T$ ) can provide 200 M BTU/hr of steam/day – enough to support 20 fields or to provide steam and electricity during non need times
- Similar examples can be made for use of SMR in Canadian tar sands fields

# *Opportunity and Needs*

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## Opportunity

- SMRs factory production is “sized” to fit remaining US heavy industry manufacturing capabilities
- US companies could capture a “first to market” position advantage

## Needs

- The NRC regulatory process should be modified and streamlined to accommodate features of SMRs (technologies, factory production, etc.)
- Credits should be given to US manufacturers who undertake creation of factory facilities as well as to US-based manufacturer of ancillary components and systems
- A private-public partnership should be created to fund development of one to two SMR demonstration plants at locations in the US (military base, national lab, greenfield site)