

Concept Proposal: Border Region Renewable Energy and Strategic Mineral Opportunities*

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Abstract

The international boundary between the US and Mexico is often overlooked as a region with significant economic potential. Instead, the border has become a self-fulfilling prophecy of crime and poverty. The Border Region Renewable Energy Corridor provides a means to enhance situational awareness by co-locating surveillance technology with renewable energy infrastructure. Large utility-scale renewable energy facilities can generate revenue, jobs and hope in a region that is ready to rebuild and prosper.

This presentation focuses on opportunities for exploiting renewable energy and mineral resources along the international border in southeastern California. The discussion explores how national security and economic exploitation of renewable energy resources are not mutually exclusive. In addition to producing solar and geothermal energy, the Corridor has significant economic potential for mineral extraction from geothermal well brines - if certain technical challenges can be addressed.

While similar to the more established Competitive Renewable Energy Zone (CREZ) concept, the Border Region Renewable Energy Corridor concept emphasizes the integration of surveillance technologies into its design and operational plans. The Corridor can enhance situational awareness along the border, establish over 800 megawatts of clean energy, and establish a clean source for strategic and economic minerals - such as lithium, gold, silver, zinc, and magnesium.

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What is Natural Security?

- **National Security + Natural Resources = Natural Security**
- In the 21st century, the security of nations will increasingly depend upon ensuring the security of natural resources, or “natural security.”
 - *energy, minerals, water, land, climate change, and biodiversity,*
 - *“Without an integrated, national-level approach that links together natural security challenges, the United States runs the risk of trading one dependency for another and exacerbating the consequences”.*
(source: www.cnas.org; Center for a New American Security)
- Examine how we can link emerging natural resource challenges – specifically energy, minerals and land with our national security imperatives.
- How can the US begin to integrate a border security mission with key natural security issues (energy and minerals)?

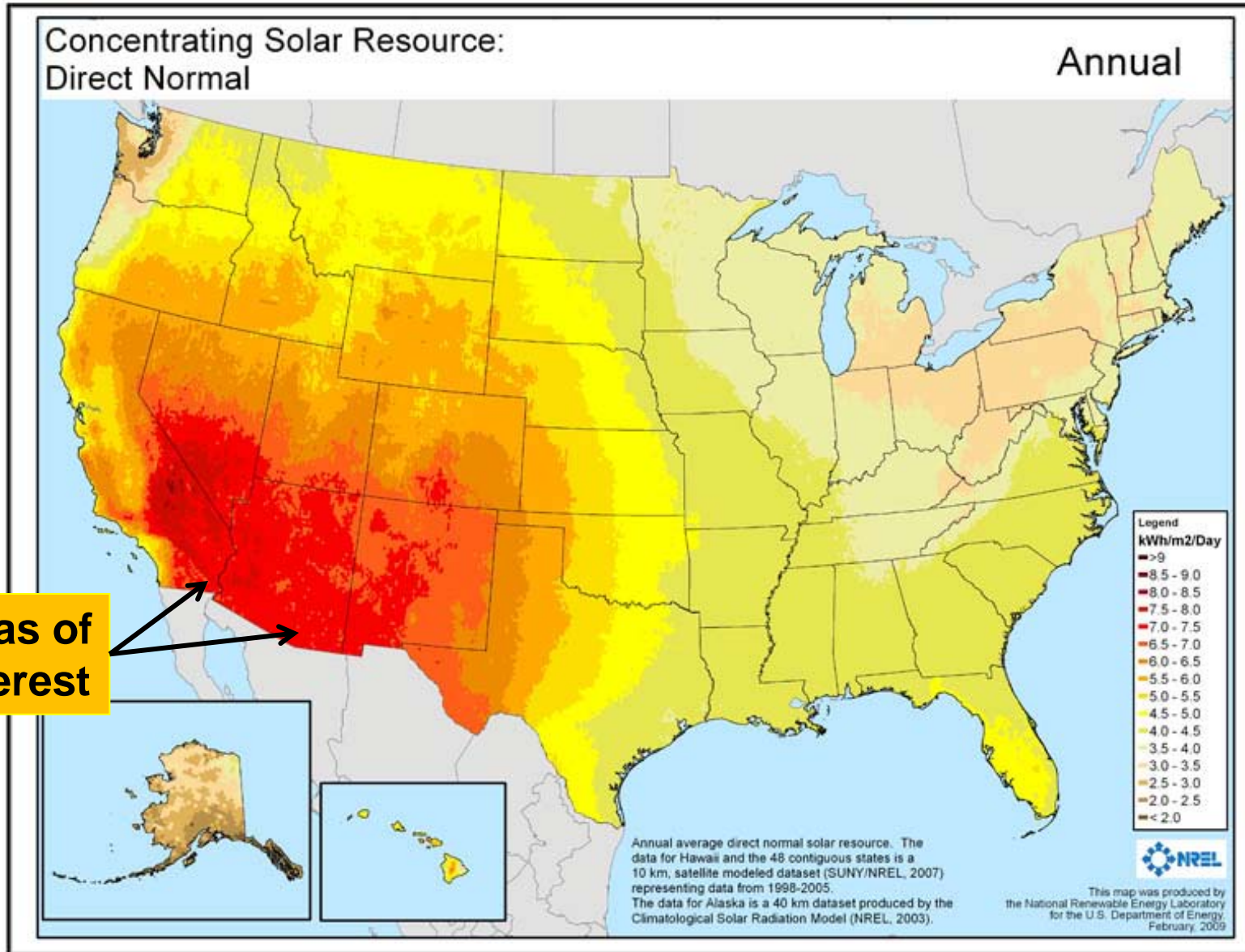


AGENDA

- Border Challenges
- Mission and Concept
 - *Current Approach: Virtual Fence – Single Mission*
 - *Proposed Approach: Integrating Surveillance and Renewable Energy*
- Southwest Border and Operational Control
- Siting Issues and Transmission
- Enhancing Border Security Via Productive Renewable Energy Infrastructure Development
- Master Planned Renewable Energy Park
- Benefits
- Project Roadmap
- Geothermal Resources
- Conclusion



Imperial County, CA and Pima County, AZ High Solar Radiation



Areas of Interest



US/Mexico Border – Challenges

- **Security Challenge**

- *Increasing illegal border crossings, related deaths and drug traffic and crime.*
- *The harsh and remote border environment has resulted in deaths due to dehydration, freezing, and drownings.*
- *DHS spent over 1.3 billion dollars on surveillance systems with limited coverage.*

- **Economic Challenge**

- *Arizona seeks diversification, jobs and economic growth.*
- *Imperial County, CA has the highest unemployment in the country – currently 30% with a largely undiversified economic base – primarily agriculture..*
- *Arizona and California spends millions each year to process illegal immigrants through the justice system.*

- **Energy and Environmental Challenge – Increasing Demand**

- *California has one of the most ambitious Renewables Portfolio Standard (RPS), requiring utility companies to increase procurement of renewable energy resources to 33% by 2020. .*
- *Arizona Public Service (APS) customers will grow from 1.1 million today to 1.7 million by 2025. (source: Arizona's Energy Future: APS Resource Plan 2009 Through 2025)*

- **Congress and the President are now seeking forward leaning alternatives to solve the nation's border security issues**



Border Security Via Infrastructure Development

- **Mission Statement:**

- *Establish a master planned renewable energy park to: create productive infrastructure; enhance border security; and exploit the full renewable energy potential of the border region.*

- **A Concept of Operations:**

- *Based on stakeholders' requirements/needs - including state, local and tribal stakeholders, environmentalists, public utilities, private landowners, DOE, DHS, and CBP.*
- *Enhance Border Security - a renewable energy park near the border can introduce infrastructure and surveillance through integration with DHS CBP's situational awareness architecture.*
- *Private Sector Participation - shared power generation facility developed specifically to site six or more alternative energy utility-scale power plants -- primarily solar and possibly geothermal.*



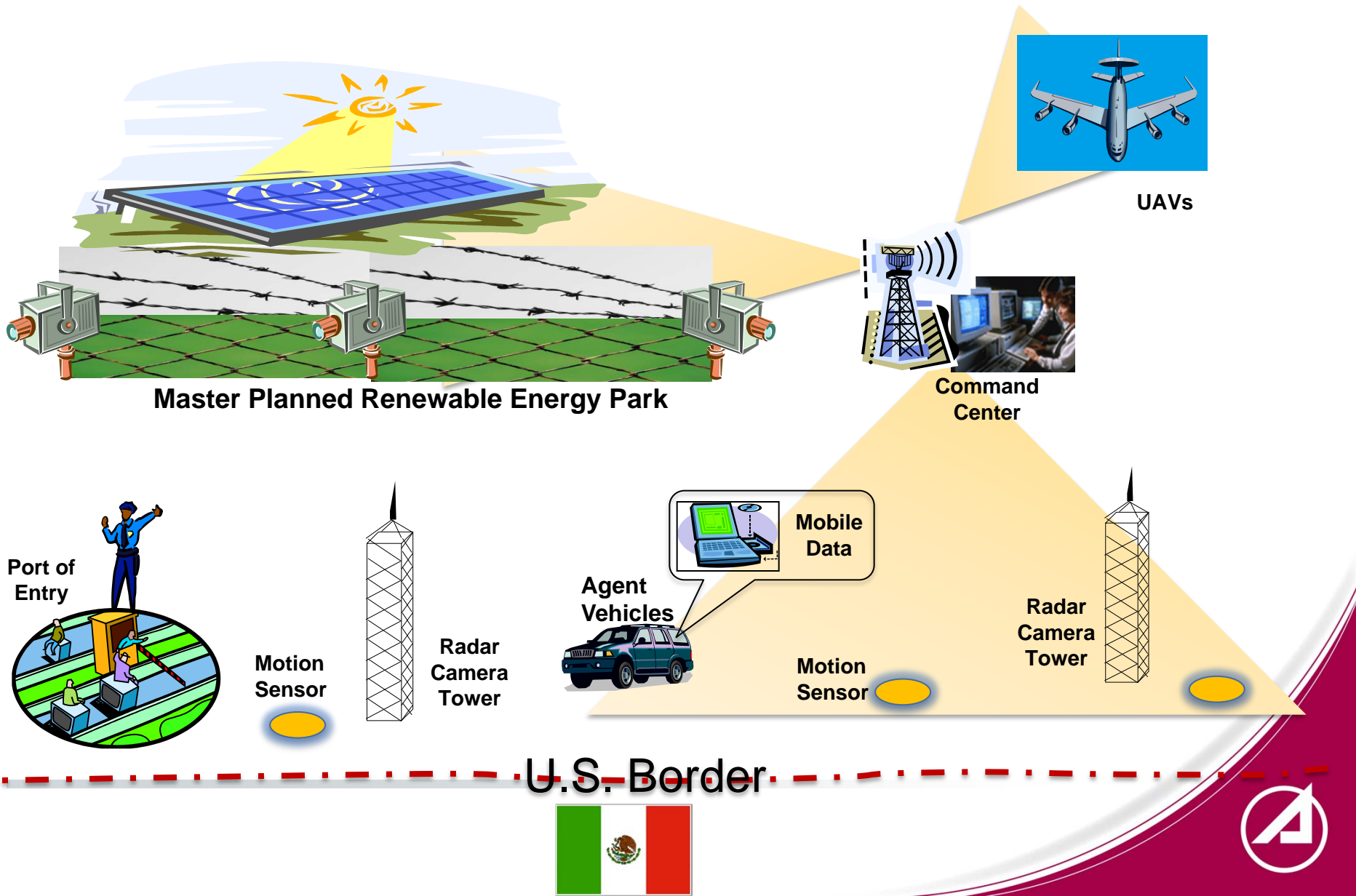
Current Single Mission Approach: “Virtual Fence” Focused on Surveillance

- **Status:** DHS’s Secure Border Initiative or SBInet has been plagued with problems since inception (2005). During March 2010 additional funding for the program was frozen for additional deployments.
- **Cost:** \$1.3 billion
- **Findings:**
 - GAO (June 2010) and Congress have noted that the existing program faces significant management challenges, lacks coverage, functionality, and has experienced many technical problems.
 - Border Patrol considers the SBInet *“capability to be useful, including providing continuous surveillance in border areas where none existed before”*.

SBInet Tower in Border
Patrol’s Tucson Sector
(Courtesy of CBP)



Proposed Approach: Renewable Energy Infrastructure Integrated with SBInet for Enhanced Situational Awareness



US Border Patrol – Levels of Border Security

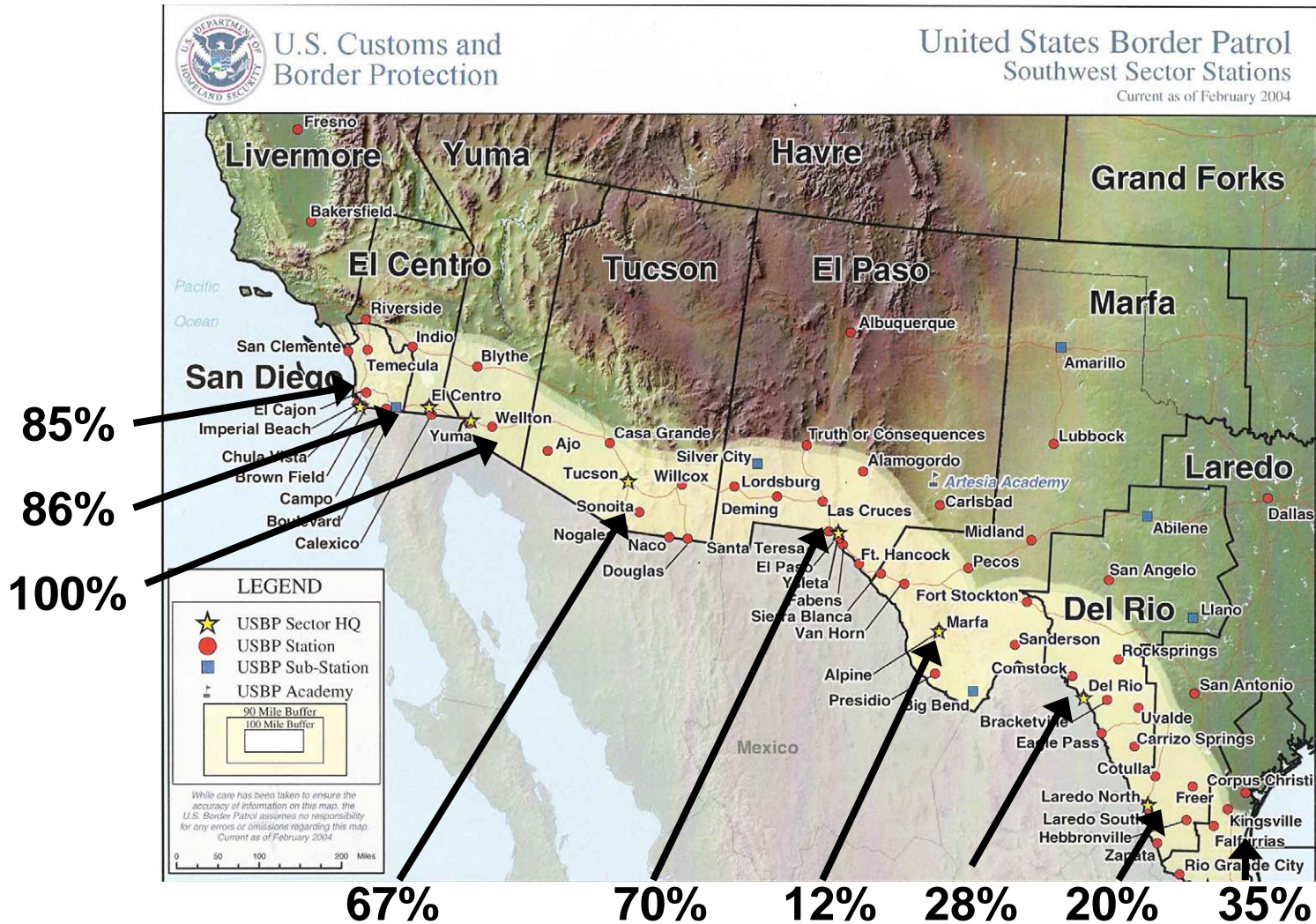
	Security Level	Definition
Operational Control	✓ Controlled	Continuous detection and interdiction resources at the immediate border with high probability of apprehension upon entry.
	✓ Managed	Multi-tiered detection and interdiction resources are in place to fully implement the border control strategy with high probability of apprehension after entry.
	Monitored	Substantial detection resources in place but accessibility and resources continue to affect ability to respond.
	Low-level Monitored	Some knowledge is available to develop rudimentary border control strategy, but the area remains vulnerable because of inaccessibility or limited resources.
	Remote Low activity	Information is lacking to develop a meaningful border control strategy because of inaccessibility or lack of resources.

- ***Out of nearly 2000 miles of southwest border during end of FY 2010, 873 miles were under operational control.***

- *Source: GAO Report February 15, 2011; “Border Security: Preliminary Observations on Border Control Measures for the Southwest Border”*



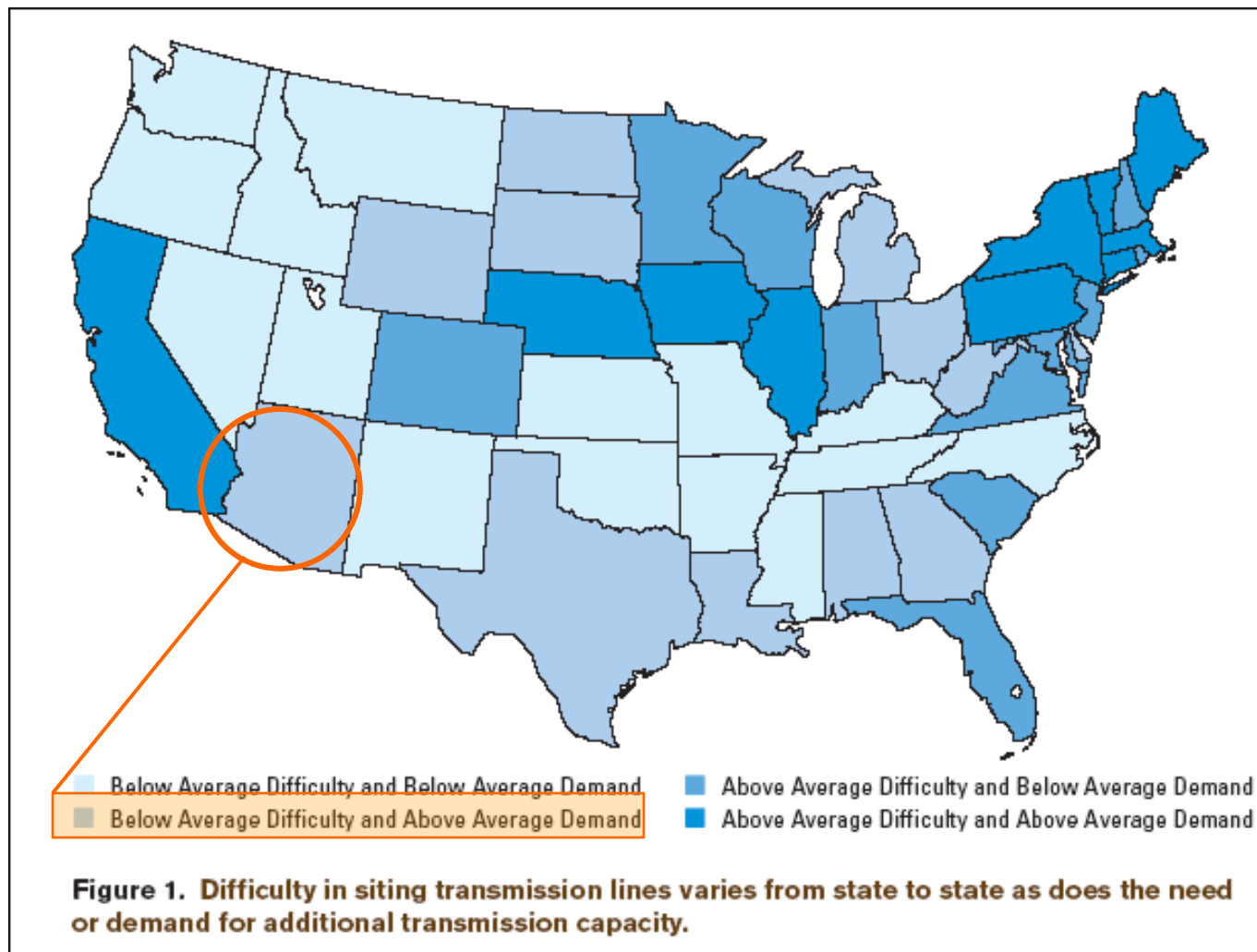
Southwest Border: Operational Control



Source: GAO Report February 15, 2011; "Border Security: Preliminary Observations on Border Control Measures for the Southwest Border"



Siting energy infrastructure has proven to be difficult in some states.



- Source: Resources for the Future; "Siting Difficulty and Renewable Energy Development: A Case of Gridlock"; by [Shalini P. Vajjhala](#); 2007



Transmission Transmission Transmission ...

- *“Renewable energy developers are faced with a chicken-and-egg problem. Without adequate and accessible transmission capacity, renewable projects are unlikely to cross the threshold of economic viability, and without adequate generation capacity to justify new transmission construction, investment in new lines also is unlikely.”*

(Source: Resources for the Future; “Siting Difficulty and Renewable Energy Infrastructure: a Case of Gridlock?”; Shalini P. Vajjhala)

- **Federal seed funding could break the impasse. Budget justification can be supported:**
 - a Border Region Renewable Energy Park serves a national security mandate due to its integration with Virtual Fence (SBI-net) surveillance infrastructure.
 - lower overall cost to taxpayers since a border region renewable energy park will ultimately generate revenue and jobs.



Master-Planned Renewable Energy Park: Details



Border Region Master-Planned Renewable Energy Park

Master-Planned Facility

- *Shared power generation facility developed specifically to site six or more alternative energy utility-scale power plants. Infrastructure may include . . .*
 - Roads
 - Lighting
 - Water & Sewer
 - Natural Gas
 - Telephone
 - Electricity
 - Substation
 - Transmission Lines
 - Power Aggregation & Conditioning
 - Back-up Gas Peaking Power Plant
 - Back-up Storage
 - Global PPA
 - Fire & Security
 - Meeting/Training Facilities
 - Convenience Store/Gas & Food/Restaurants
 - Worker Housing



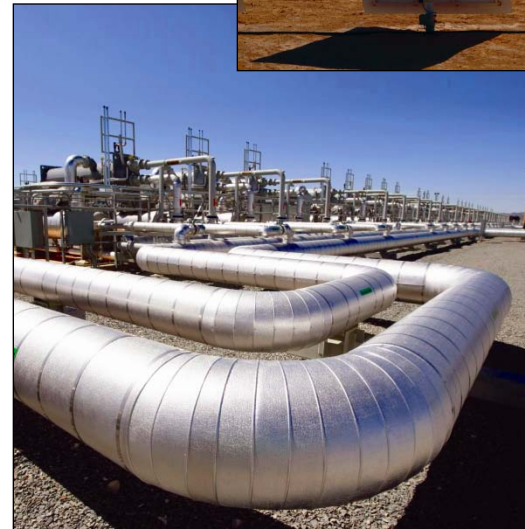
Source: CB Richard Ellis



Border Region Master-Planned Renewable Energy Park

Master-Planned Savings

- *Addresses key cost and time-consuming hurdles facing start-up technology and development companies including . . .*
 - Site Identification & Acquisition
 - Site Assessment
 - Permitting/Entitlements
 - Transmission/Interconnections
 - Governmental Approvals
 - Utility Rate Negotiations
 - Technology Limitations
 - Project Funding
- *Ensures success of all projects via aggressive cooperation between key partners.*
- *Offers even greater benefits if built on reservation land.*



Benefits

Example: Imperial County



Benefits: Revenue & Renewable Energy

	Metrics	Notes
Corridor Area	80 miles x .25 miles; 50% coverage = 6400 acres	<i>long linear corridor, provides optimal geometry for surveillance and security</i>
Energy	800 MegaWatts (MW)	<i>Requires 8 acres within the southeastern US to generate 1 MW of energy (source: NREL)</i> <i>Capacity factor for solar efficiency is approx. 30% or 2,102,400 MWhrs py</i>
Annual Revenue	\$231,264,000	<i>800 MW x 8760 hrs per year x \$110/MW x .30 effic.</i>
Annual Local Wheeling Revenue	\$4,608,000	<i>\$1920 per MW/month x 12 x 200</i>
Total Annual Rev	\$235,872,000	



Benefits: Jobs and Economic Diversification

- An additional 5730 jobs will significantly reduce Imperial County's current unemployment rate, which is 30%.
- Establishing a large utility-scale renewable energy corridor will help to stimulate and diversify the local economy – which is largely agricultural.

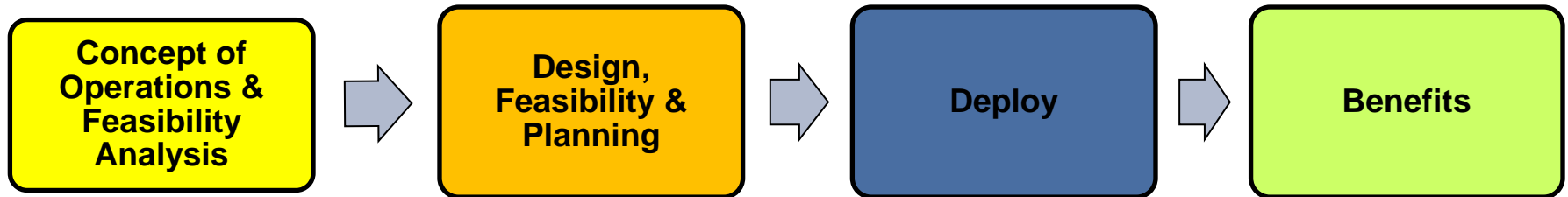
	Jobs	Metrics
Solar - 90% of total renewable		
manufacturing	3,648	<i>15.2 per MW installed</i>
construction & installation	1,704	<i>7.1 per MW installed</i>
<i>(source: Apollo Alliance and Urban Habitat, "Community Jobs in the Green Economy" 2007.)</i>		
Geothermal - 10% of total renewable		
geothermal energy plant	408	<i>1.7 jobs per MW</i>
<i>(source: Geothermal Energy Assoc.)</i>		
Total	5,760	<i>Note: manufacturing jobs may be created outside of Imperial County.</i>



Roadmap



Road Map



Time Frame: 12 Months

Stakeholder Analysis

- DHS HQ , & CBP
- Dept. of Interior - BLM
- Dept. of Energy
- Dept. of Commerce
- Department of State
- State of California
- Public Utilities
- County/Local Govt.
- Private Sector

Business Model Analysis

- Cost/benefit analysis
- Cost -sharing structure
- Budget
- Schedule
- Regulatory issues and drivers

Assess Area of Interest

- Desktop data research & analysis
- Regional reconnaissance
- Land use & competing interests
- Geology and soils,
- Solar & geothermal resources
- Ecosystems, environmental impacts
- Infrastructure availability

Time Frame: 1-2 Years

Lease & Permits

- Land Acquisition
- Land Use Laws
- Water Rights
- Mineral Rights
- Environmental Review
- Permitting

Establish Baseline Business Model

- Physical & baseline economic viability testing & modeling
- Resource expectation baselines
- Electric market analysis
- Land-use costs
- Land-use limitations (habitat & farmland conservation, PR, NIMBY, etc.)
- Grid compatibility, interconnection costs
- Site, scale & technology choice
- Generation potential revisions
- Feasibility Analysis

3years 12 – 36 months

Private Sector Cost – commercial solar and geothermal plants

Public Sector Cost – covers transmission upgrade, integration of utility-scale infrastructure into DHS border situational awareness

Permits

- NEPA, CEQA, NPDS, CAA, CWA, BLM, FERC
- Finalize Environmental Process (Finding of No Impact)

Obtain Financing

- Complete Power Purchase Agreement

Construct

- Construct
- Test & Evaluate

Generates:

231 mill PY
5760 jobs
800 MW capacity
 green energy



More Than Just Solar....



Border Region Geothermal Resources *“The Green Rush of the 21st Century”*



Mud Volcano Near the Salton Sea Key Geothermal
Resource Area (KGRA)

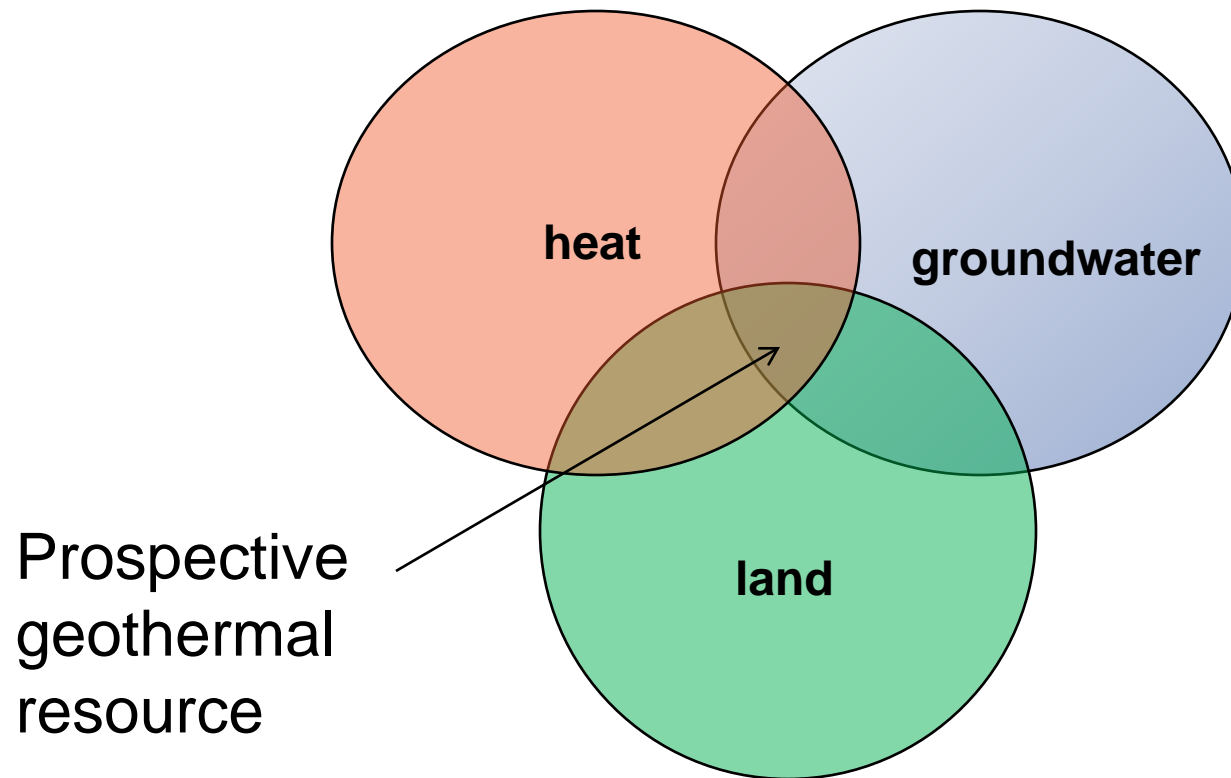


Geothermal Energy Background

- Currently geothermal power plants operate in six states: Alaska, California, Hawaii, Idaho, Nevada, and Utah. The potential to expand our geothermal energy capacity in the US is enormous . USGS scientists recently conducted an assessment of US geothermal resources. The assessment noted that:
 - *Current power generation capacity is approximately 9057 MWe (Megawatt electric) over 13 states from **identified** geothermal systems.*
 - *The mean estimated power production from **undiscovered** geothermal resources is an additional 30,033 MWe.*
 - *Even more remarkable, another estimated 517,800 MWe could be generated from enhanced geothermal systems by fracturing and stimulating hydrothermal reservoirs.*

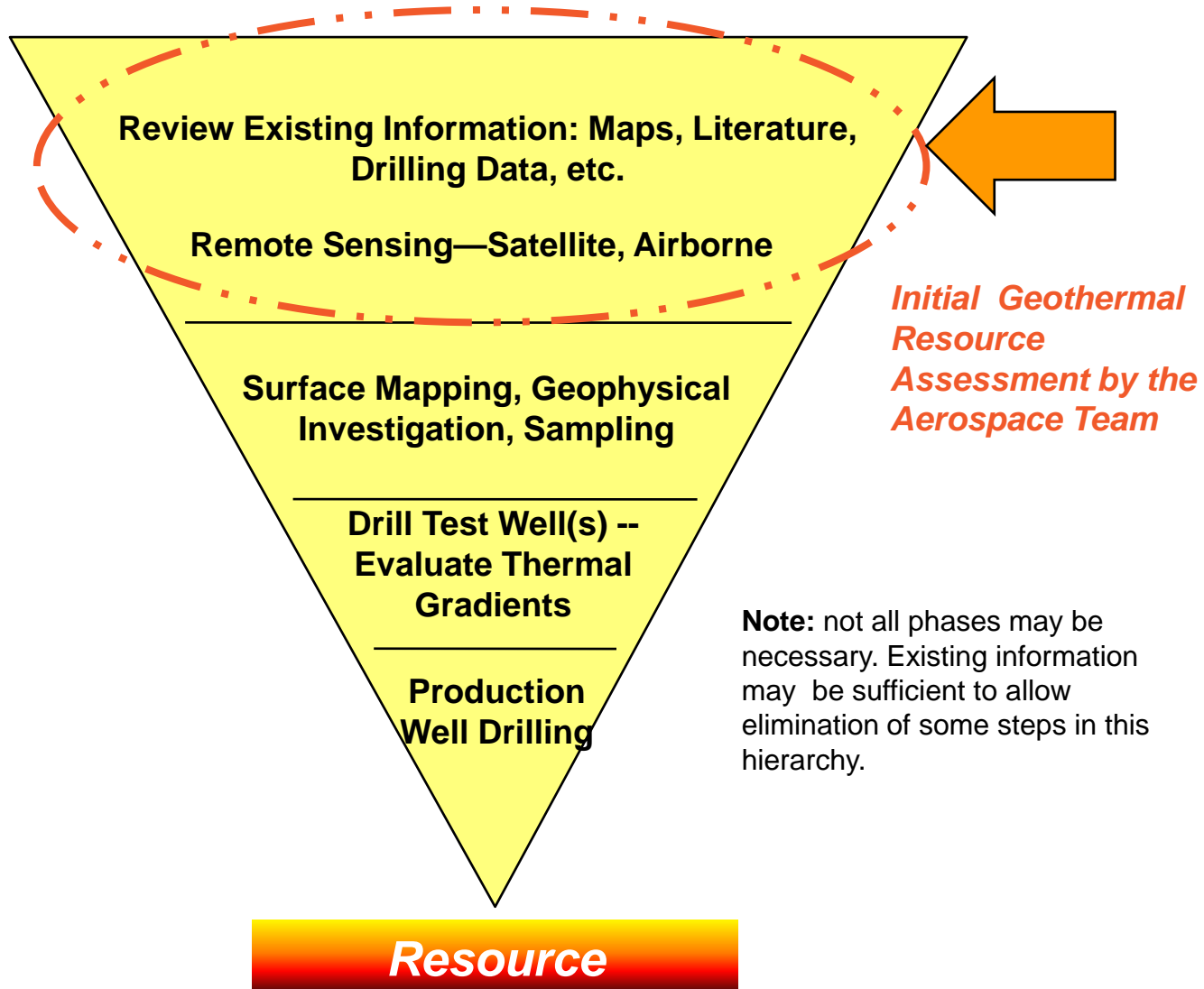


Project Approach



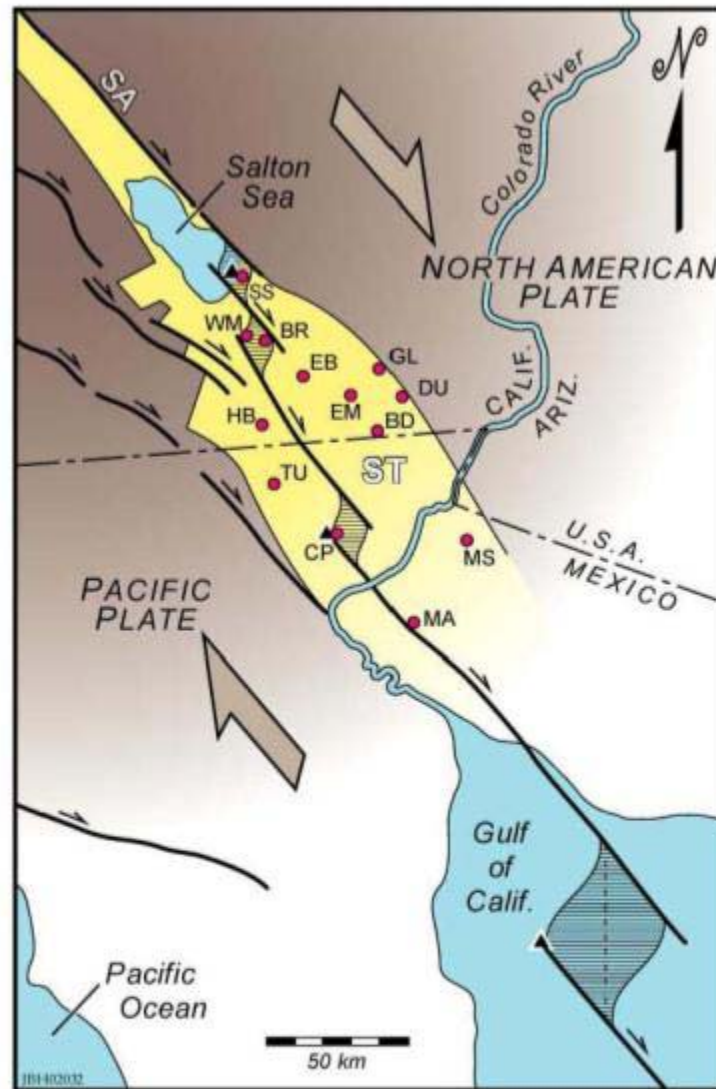
Prospective
geothermal
resource

Geothermal Exploration Hierarchy









Tectonic Setting

Transform Boundary
to Spreading Boundary



Source: Hulen et al,
saltonsea.ca.gov

-  Extent of "normal"¹ crystalline continental crust according to Fuis and Hohler(1984)
 -  4-5 m.y.-old incipient continental rift zone
 -  Pull-apart zone at extensional overstep
 -  Geothermal fields
 -  Quaternary volcanoes
 -  High-angle faults; arrows show displacement
- ¹Quotation marks are the writers'



Source: Geothermex, 2007.

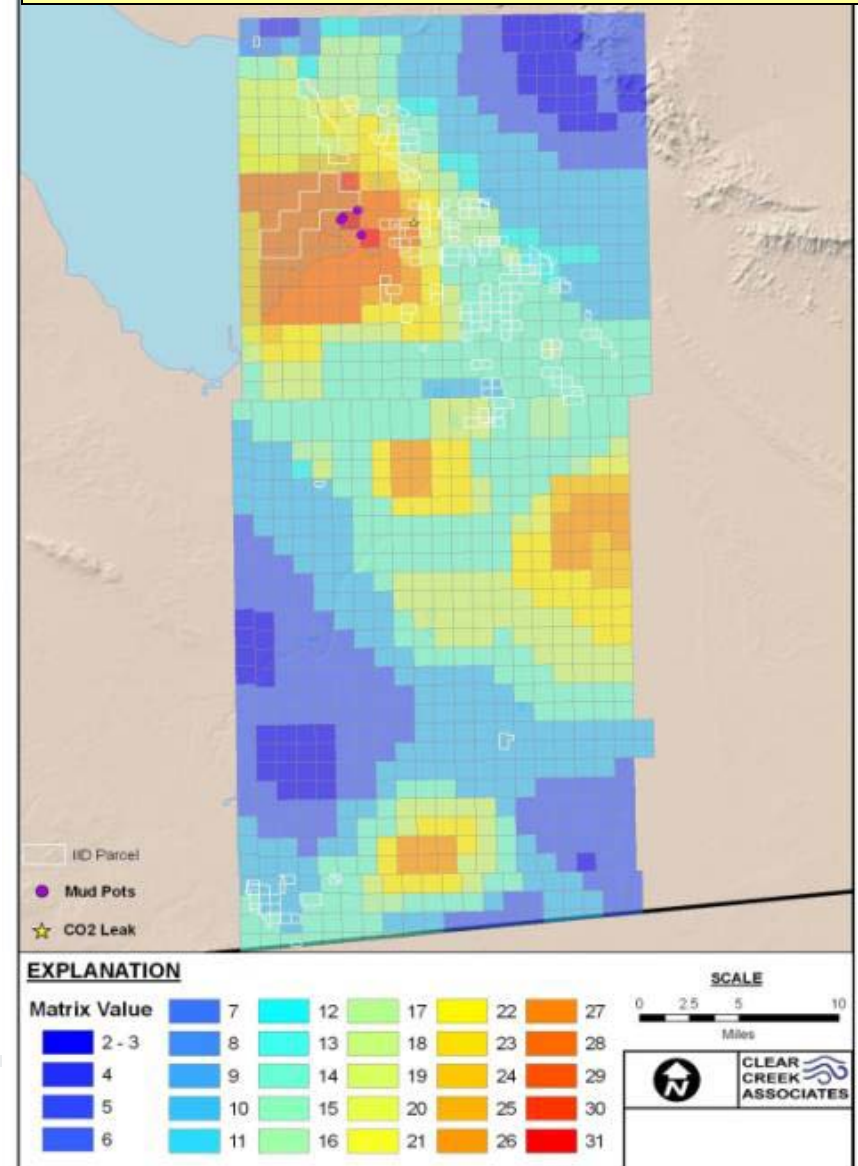
scale
10 miles

- Active Geothermal Areas
- Prospective Geothermal Areas

Prioritization Matrix

- Prioritization matrix spreadsheet used to evaluate:
 1. *Surface Manifestations (satellite, hyperspectral, & other remote sensing data).*
 2. *Gravity highs, associated with dense mantle material and geothermal zones.*
 3. *Resistivity survey results - lower resistivity associated with high heat flow due to the hot brine.*
 4. *Subsurface temperature – from borehole & well data.*
 5. *Other reported favorable zones (KGRAs)*
- Study area (about 960 miles²) divided into one mile² cells. Matrix scores ranged from 2 to 31.
- Prioritization matrix scores ranged from 2 to 31.
- **Aerospace/Clear Creek Findings:** Imperial Irrigation District lands include several properties with very high geothermal potential.

>19: Geothermal resources likely at exploitable levels
 16-19: Moderately high potential
 10-15: Lesser potential, additional data may increase the scores.
 0-9: low potential



Geothermal Brines: A Burden and Opportunity

- The quality of the Salton trough geothermal water is a significant hurdle and opportunity in the development of geothermal resources.
 - *High silica content causes scaling problems*
 - *Total dissolved solids can be very high ranging from 200,00 to 300,000 parts per million by weight. Typically, relatively deep and hot geothermal wells are associated with higher concentrations of brine.*
 - *Very hot temperatures – approximately 500 to 570 degrees Fahrenheit.*



Geothermal Production and Strategic Minerals

- Geothermal Brine Mineral Extraction – a triple win:
 - *cleans waste water;*
 - *additional revenue stream to a renewable energy source;*
and
 - *clean source of Lithium – a critical element for the lithium ion battery - an essential component for electric vehicles*



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Geothermal Brines: Mineral Extraction Opportunities

- Lithium
 - *Sales volumes for the major lithium producers were reported to be up more than 30% by mid-2010. Consumption by lithium end-use markets for batteries, ceramics and glass, grease, and other industrial applications all increased. (source: USGS)*
 - *Subsurface brines have become the dominant source of raw material for lithium carbonate. Lower production cost compared with the mining and processing costs for hard rock ores.*
- Symbol Materials – commercializing proprietary processes for the production of lithium, manganese, and zinc battery chemicals in Salton Sea Area.



Geothermal Brines: Mineral Extraction Opportunities

- **Through various methods, including solvent extraction and ion exchange, other target minerals can be extracted from geothermal brines:**
 - **Silica** – *high-grade silica is a key ingredient for the semiconductor industry. Supply is worldwide.*
 - **Zinc** - *Demand for zinc generally follows industrial production, used in galvanizing, zinc-based alloys, brass and bronze, and other uses. Supply is worldwide.*
 - **Manganese** - *US resources - low grade and high extraction costs. South Africa controls 75% and Ukraine approx. 10%. (source: USGS)*
 - **Rare Earths Elements (REEs)** - *China controls 98% of the world REE market. Critical ingredients in microelectronics – everything from smart Bombs to smart Phones. Further down-hole testing should be conducted to determine the REE content in geothermal brines.*



Conclusion



Conclusion: Natural Security

- Reduce dependence upon foreign oil and foreign mineral supplies.
- Fully exploit the renewable resources and minerals of the border region
 - *Solar Energy*
 - *Geothermal Energy*
 - *Brine Extraction of Target Minerals*
- Integrate with Surveillance and Security
- Create Jobs, revenue from electricity generation, and tax revenues
- Transform the border into a secure and prosperous region

