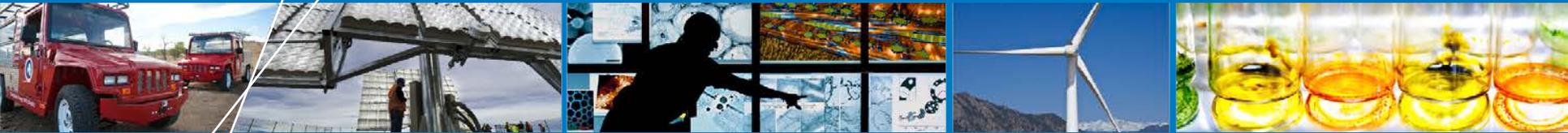


Solar Resource and Potential: Tools to Support Decision Making



Daniel Getman

June 11, 2014

Overview

- **About STAT**
- **About the DIY Solar Market Analysis Series**
- **Tools to Support Decision Making**

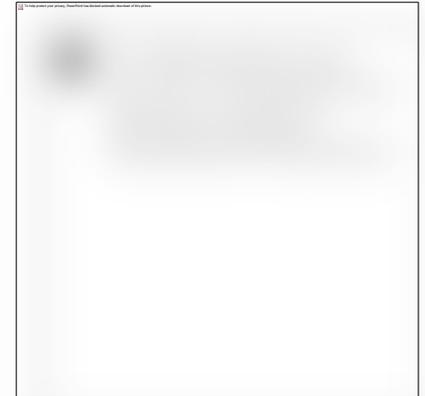


Art Institute of Chicago - 130.6 kW PV System

What is STAT?

Solar Technical Assistance Team (STAT)

- **U.S. Department of Energy (DOE) Solar Technologies Office, in coordination with the National Renewable Energy Laboratory (NREL)**
- **Objective**
 - Provide current, credible information on solar policy, program, and regulatory choices to entities positioned to impact the policy environment through:
 - Basic solar education for new officials and staff
 - Partnerships to address specific challenges
 - Topical learning opportunities



To learn more, visit:

http://www.nrel.gov/tech_deployment/stat.html

DIY Solar Market Analysis Summer Series

2nd Wednesday of EVERY MONTH
Noon – 1 pm MST

Wednesday
MAY 14th

Wednesday
JUNE 11th

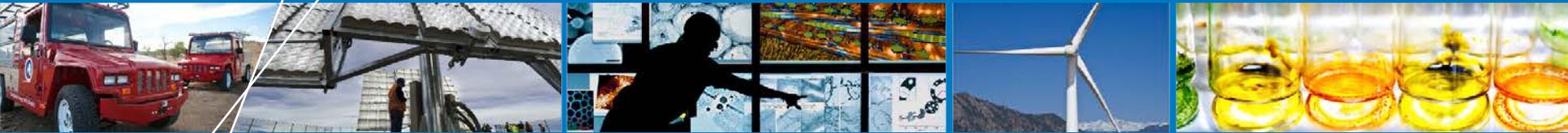
Wednesday
JULY 9th

Wednesday
AUGUST
13th

-
- **Top Solar Tools:** What are they and how do they help policymakers?
 - **Solar Resource and Technical Potential:** Finding, using, and making maps for decision makers
 - **PVWatts: What's New?** Tips and tricks for the latest update
 - **Community Solar Scenario Tool:** Learn to evaluate if a solar garden makes sense in your community

Subscribe here: http://www.nrel.gov/tech_deployment/stat_subscribe.html

Solar Resource and Potential: Tools to Support Decision Making

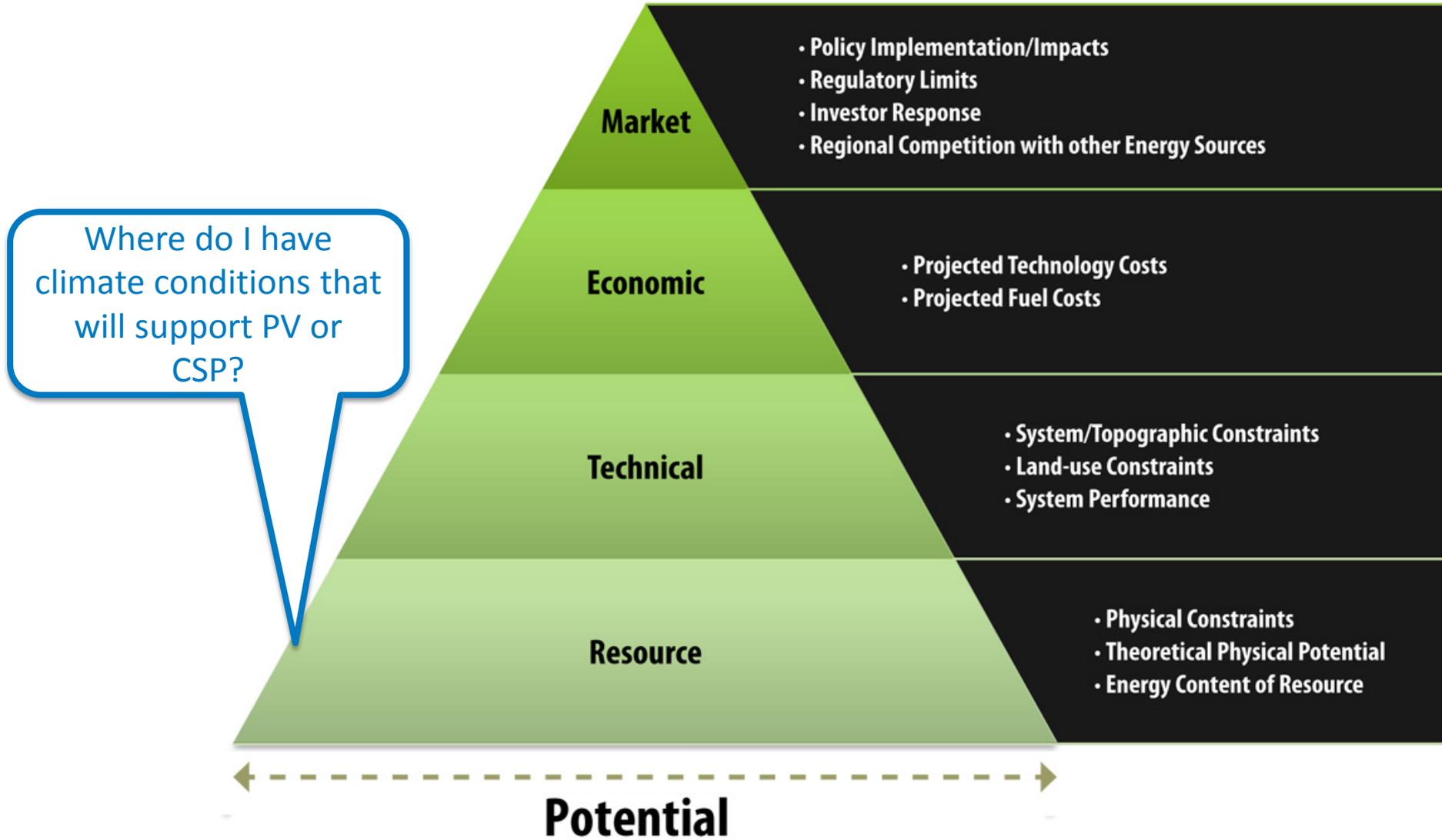


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Levels of Potential

Key Assumptions

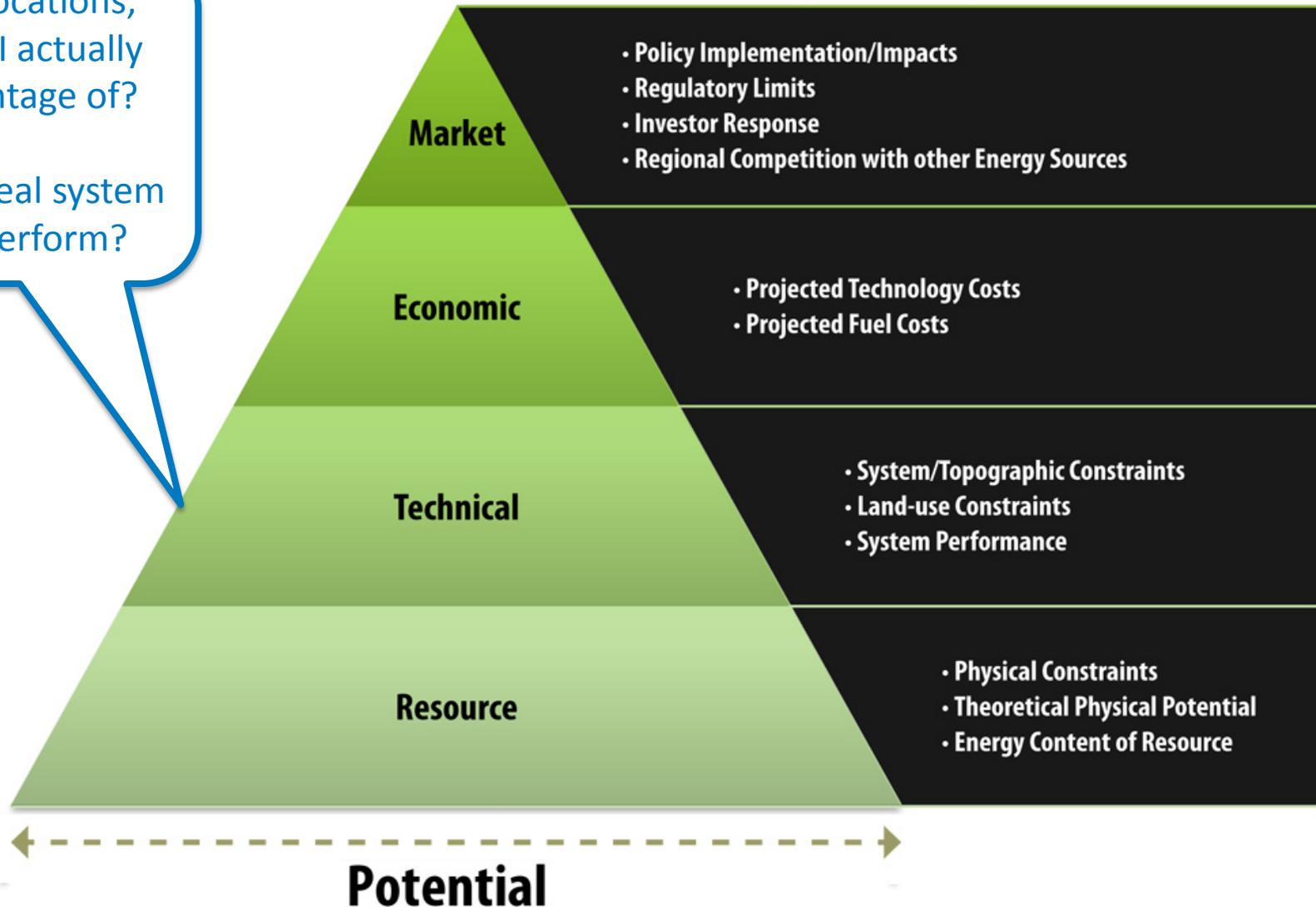


Levels of Potential

Key Assumptions

Of those locations,
which can I actually
take advantage of?

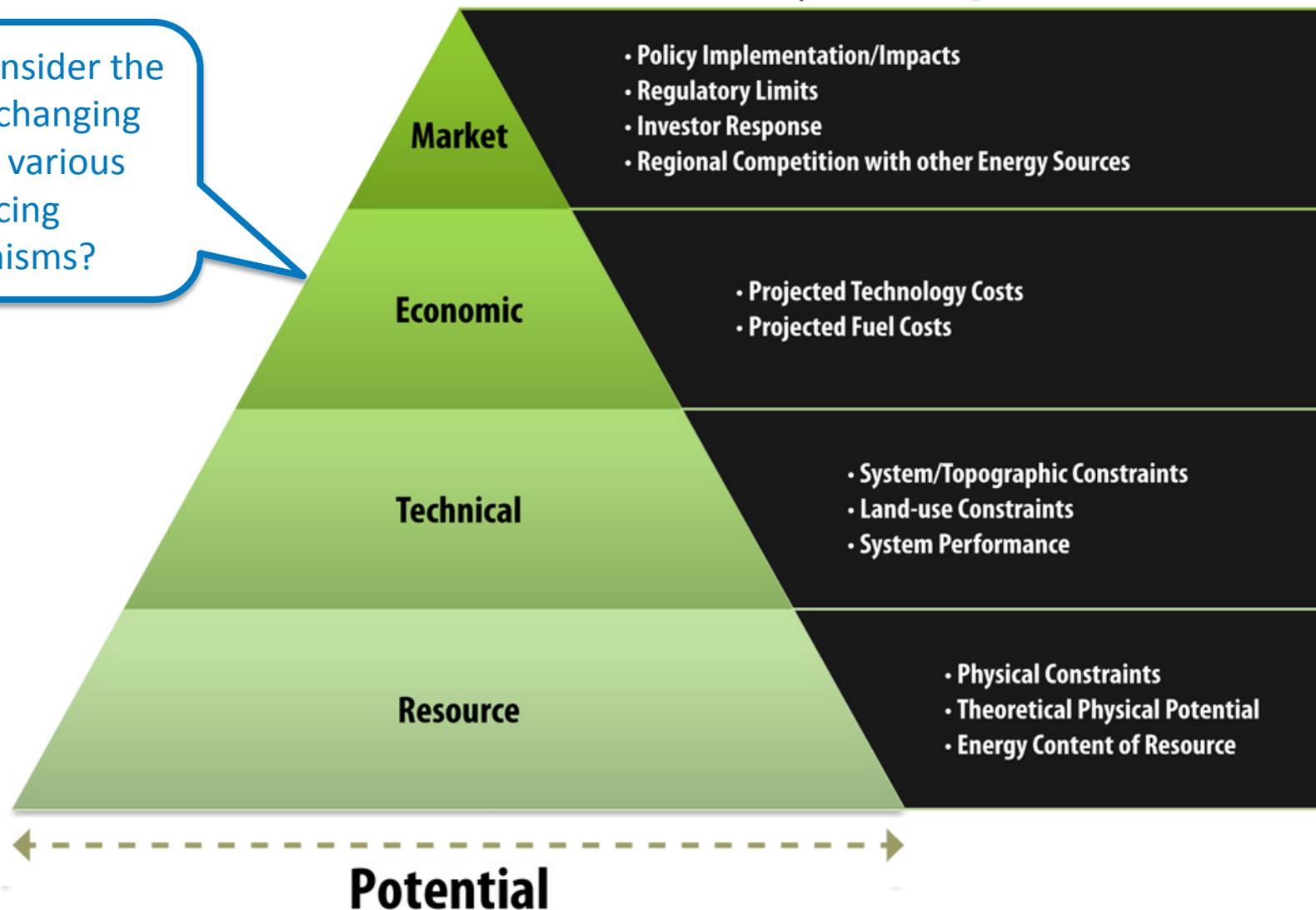
How will a real system
actually perform?



Levels of Potential

Key Assumptions

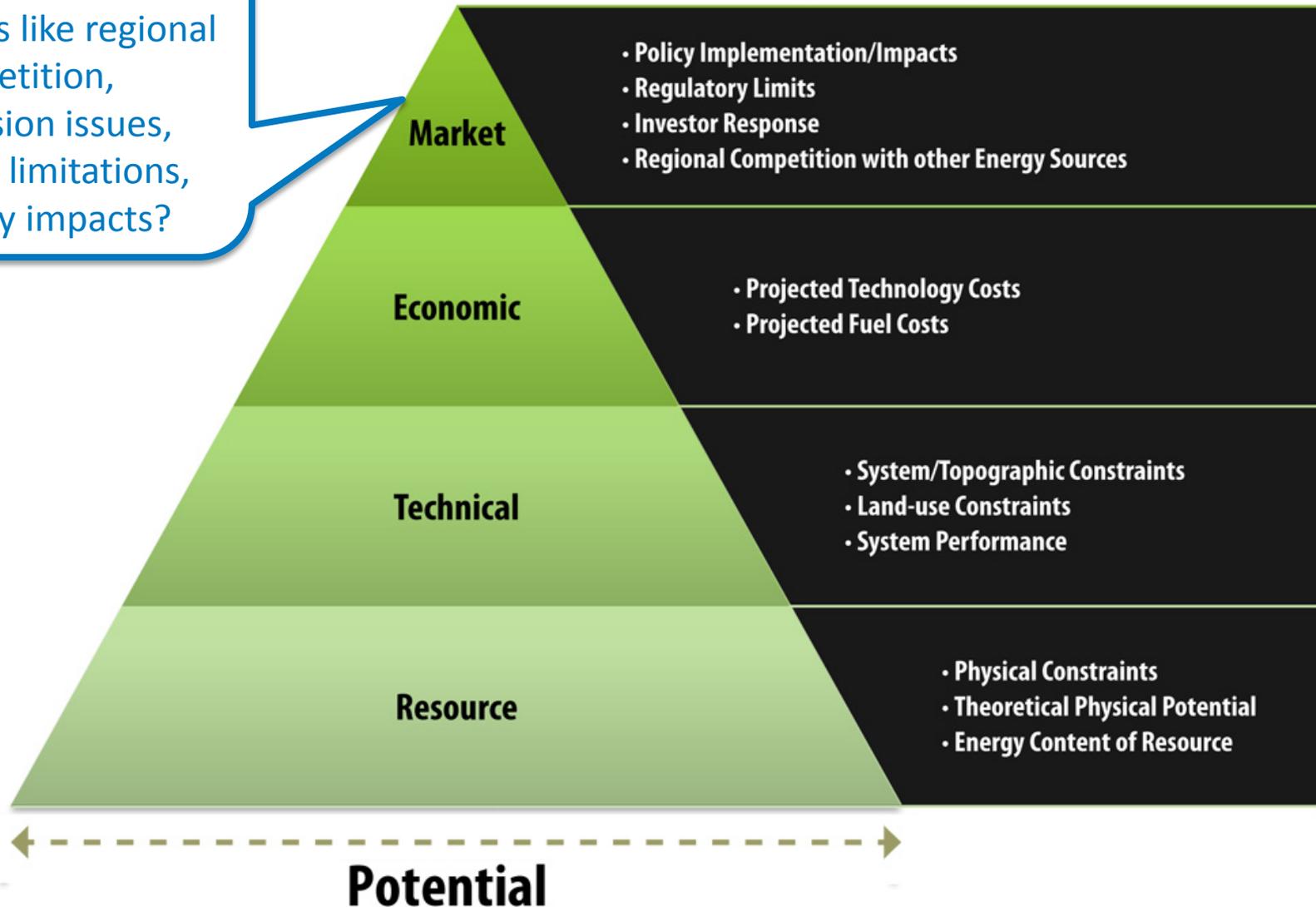
How do I consider the impact of changing costs and various financing mechanisms?



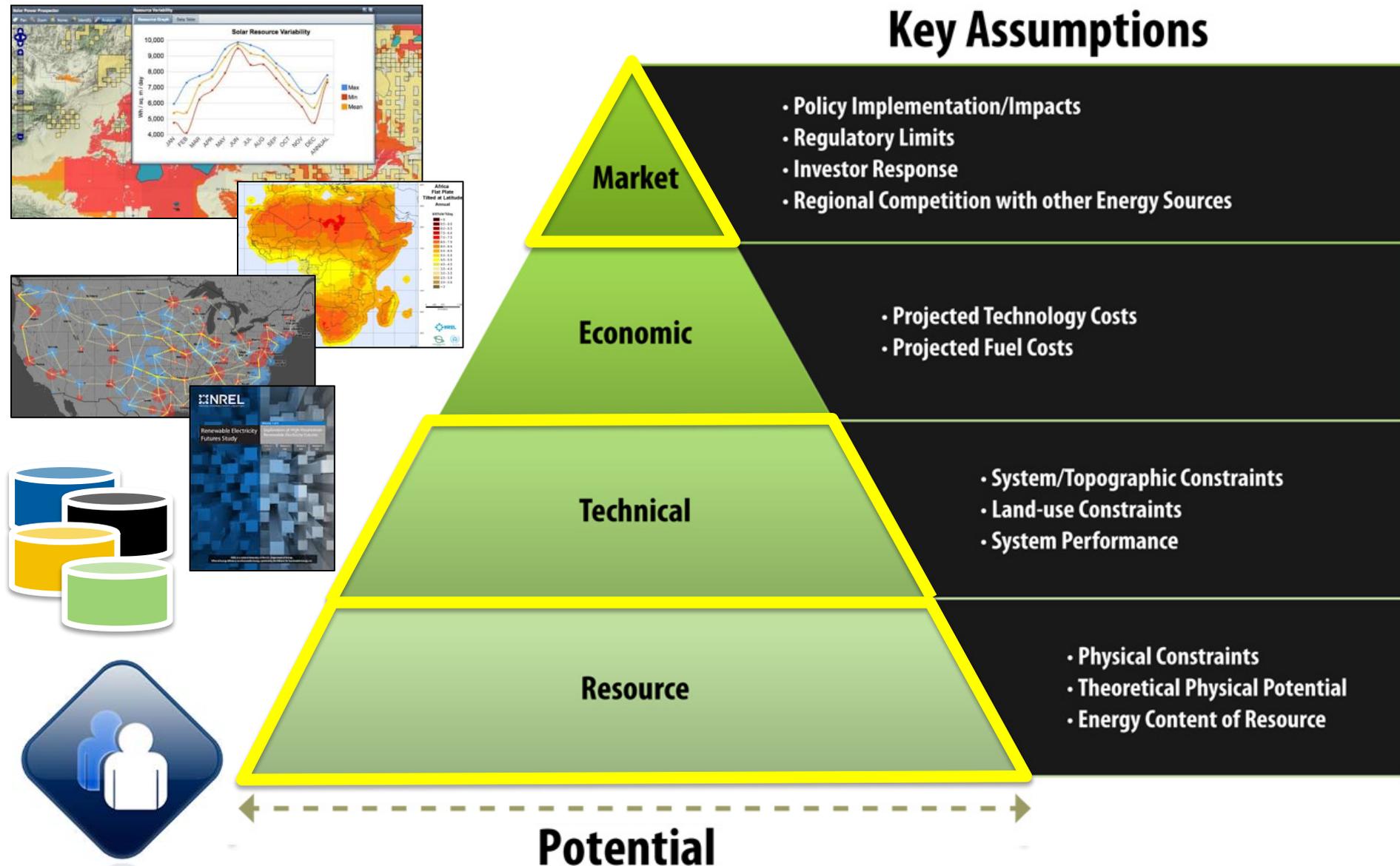
Levels of Potential

What about all of the other details like regional competition, transmission issues, regulatory limitations, and policy impacts?

Key Assumptions



Data, Tools, and Reports to Leverage Levels of Potential in Decision Making



General Resource: Data and Tools

- **Energy Analysis at NREL (*)**
 - Publications and information about analysis at NREL
 - <http://www.nrel.gov/analysis/>
- **Publications**
 - Easily search publications on solar energy at NREL
 - <http://nrelpubs.nrel.gov/WebtopSecure/ws/nich/int/nrel/SearchForm>
- **Maps (*)**
 - Access thousands of maps related to RE and EE
 - <http://www.nrel.gov/gis/mapsearch/>
- **NREL Solar Resource Pages**
 - Information specific to solar resource data generation
 - http://www.nrel.gov/rredc/solar_resource.html

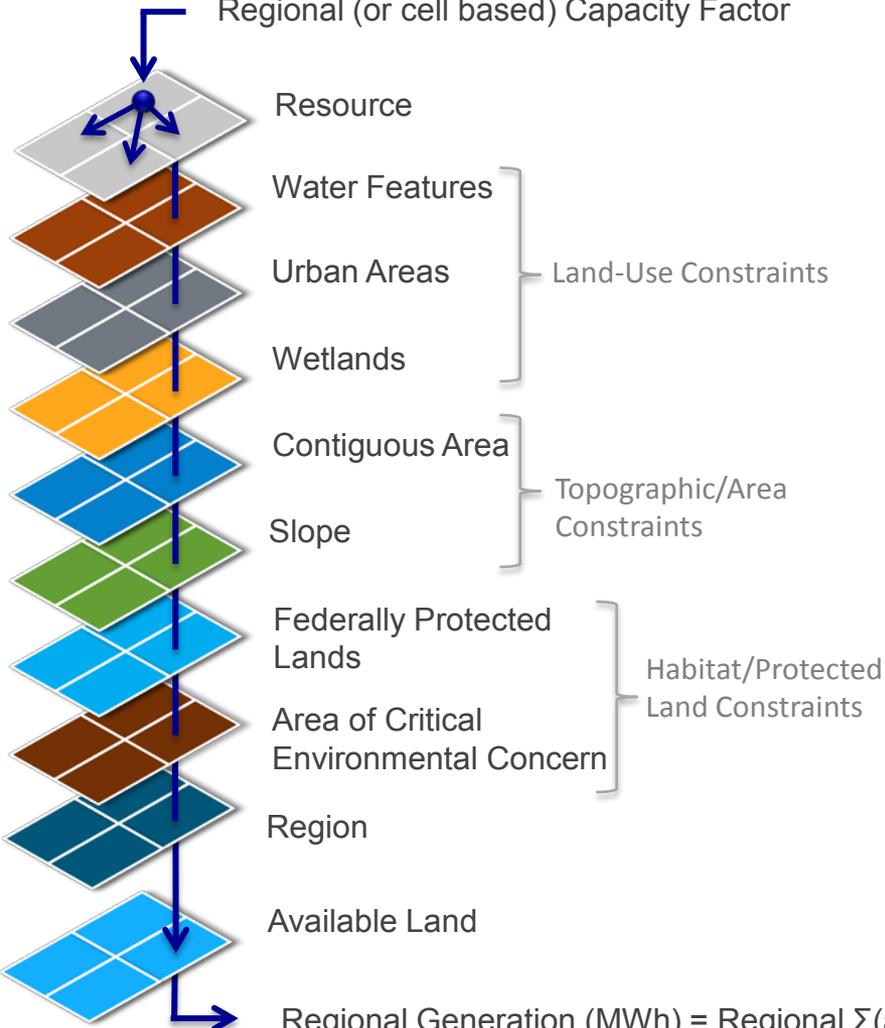
Resource Assessment: Data and Tools

- **National Solar Radiation Database**
 - 50 years of solar and meteorological data for the US
 - http://rredc.nrel.gov/solar/old_data/nsrdb/
- **Solar Prospector (*)**
 - Access and download solar and meteorological data for the US through a map based interface
 - <http://maps.nrel.gov/prospector>
- **PXS and PXS Prospector**
 - New modeled solar resource and meteorological dataset from NREL
 - 4 meter spatial resolution (max)
 - ½ hour temporal resolution (max)
 - Coming Soon!
- **RE Atlas (*)**
 - Compare resource data from several domains of renewable energy
 - http://maps.nrel.gov/re_atlas

Renewable Resource Characterization and Technical Potential

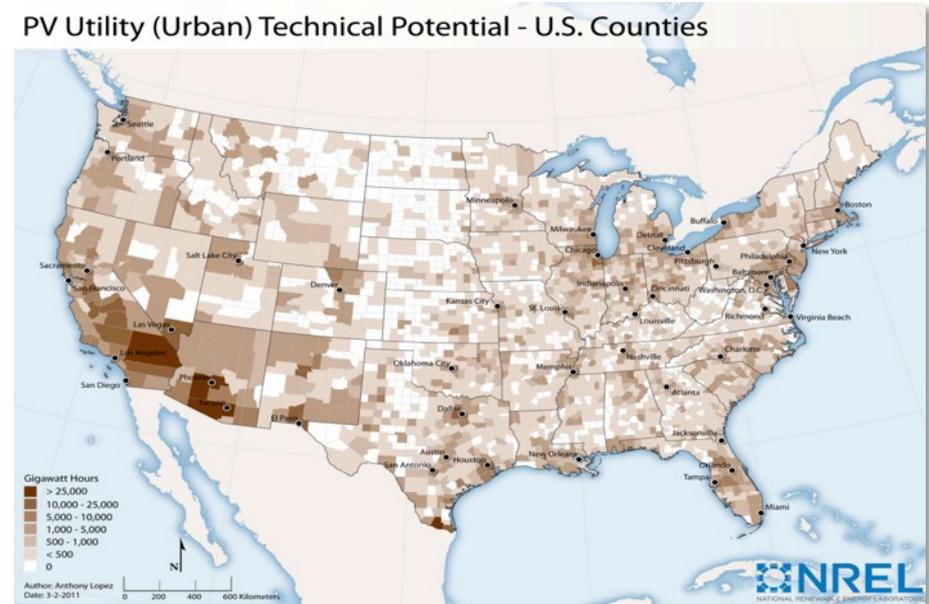
Layers in this Analysis

Regional (or cell based) Capacity Factor



$$\text{Regional Generation (MWh)} = \text{Regional } \Sigma(\text{available land (km}^2) * \text{power density (MW/km}^2) * \text{capacity factor (\%)} * 8760 \text{ (hours/year)})$$

PV Utility (Urban) Technical Potential - U.S. Counties



2012 NREL REPORT:

U.S. Renewable Energy Technical Potentials: A GIS-Based Analysis

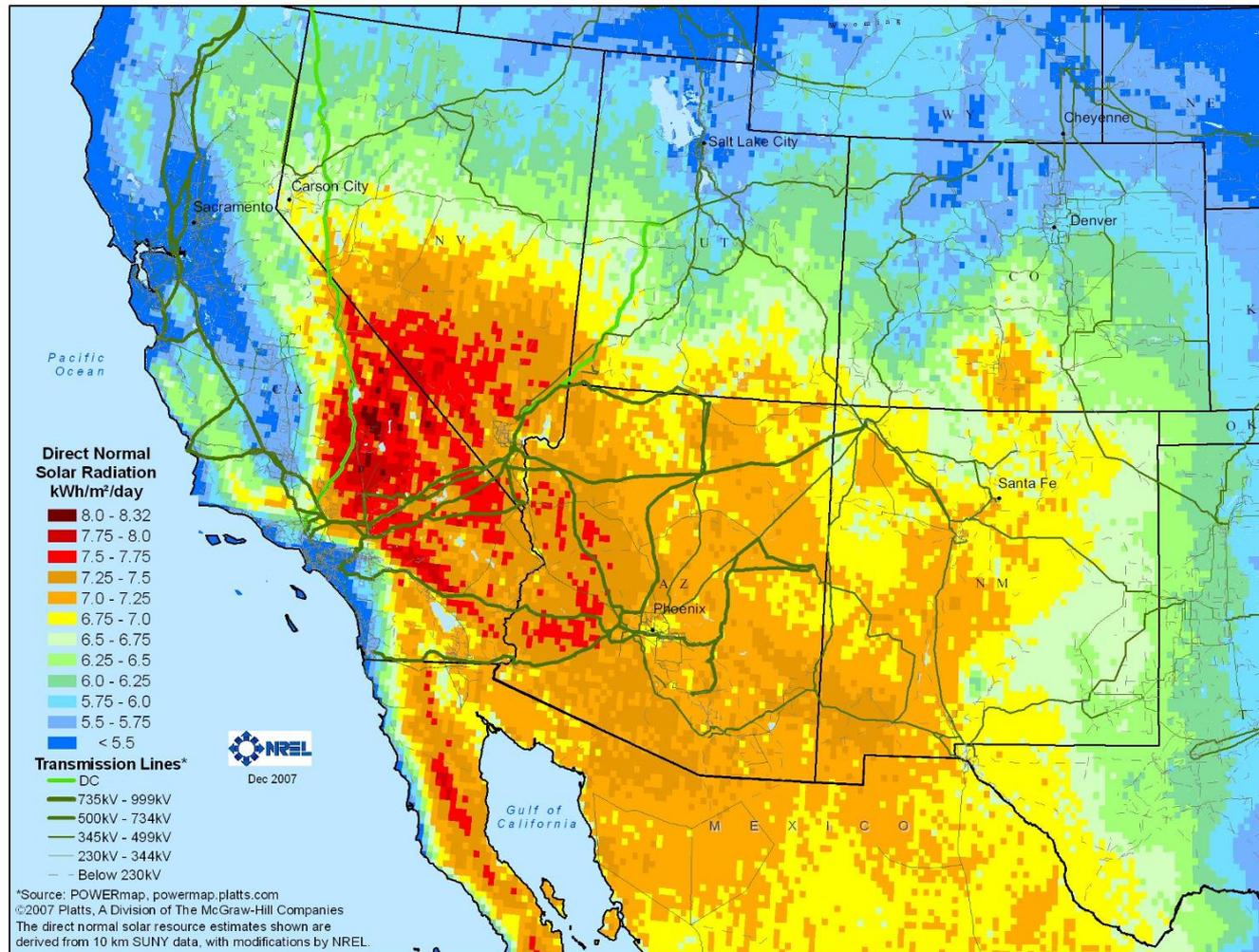
Anthony Lopez, Billy Roberts, Donna Heimiller, Nate Blair, and Gian Porro

- Offshore Wind
- Hydropower

* See Technical Potential Worksheet for data sources, descriptions, and

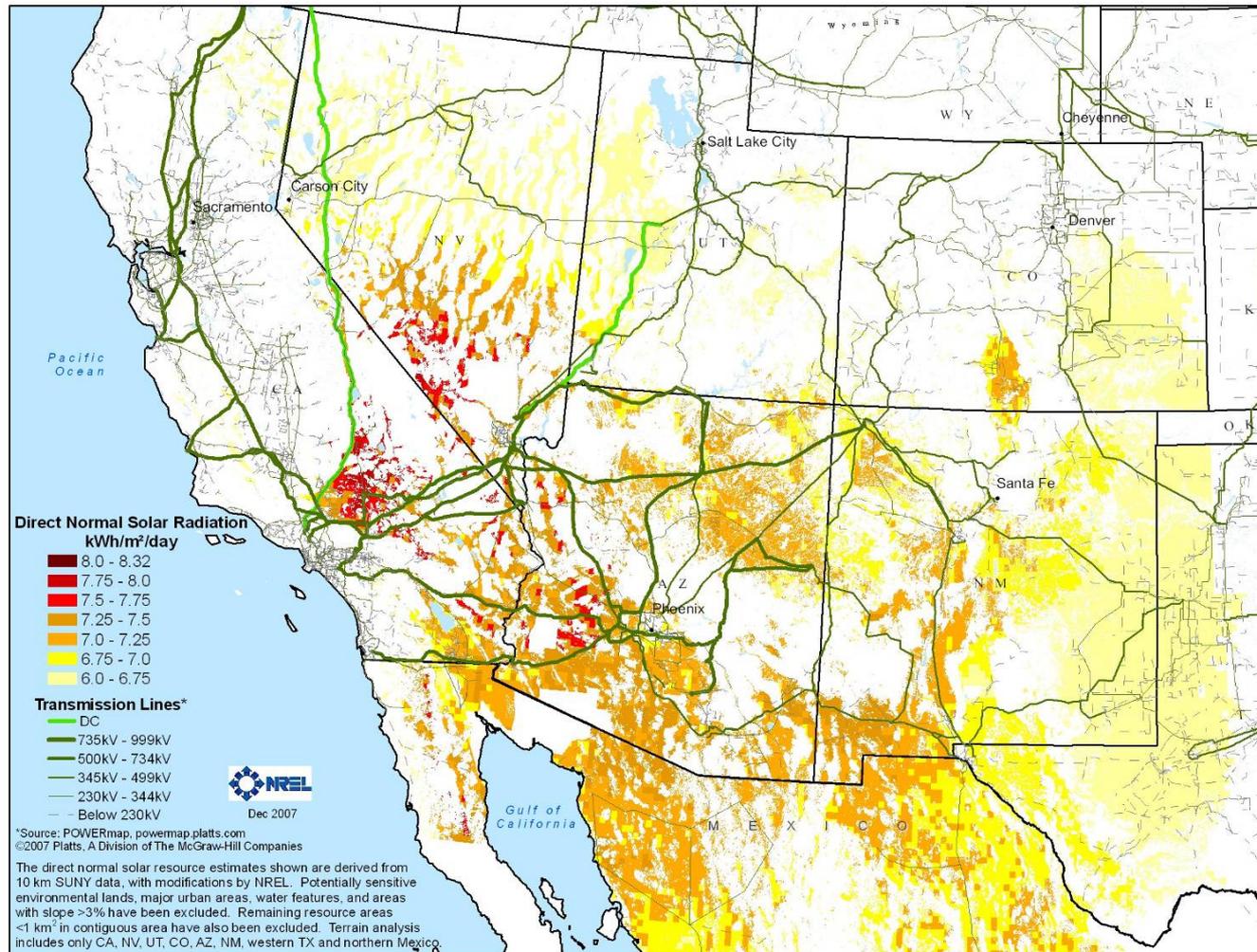
GIS Analysis - CSP Site Suitability Example

Southwest Solar Resources – Base Data



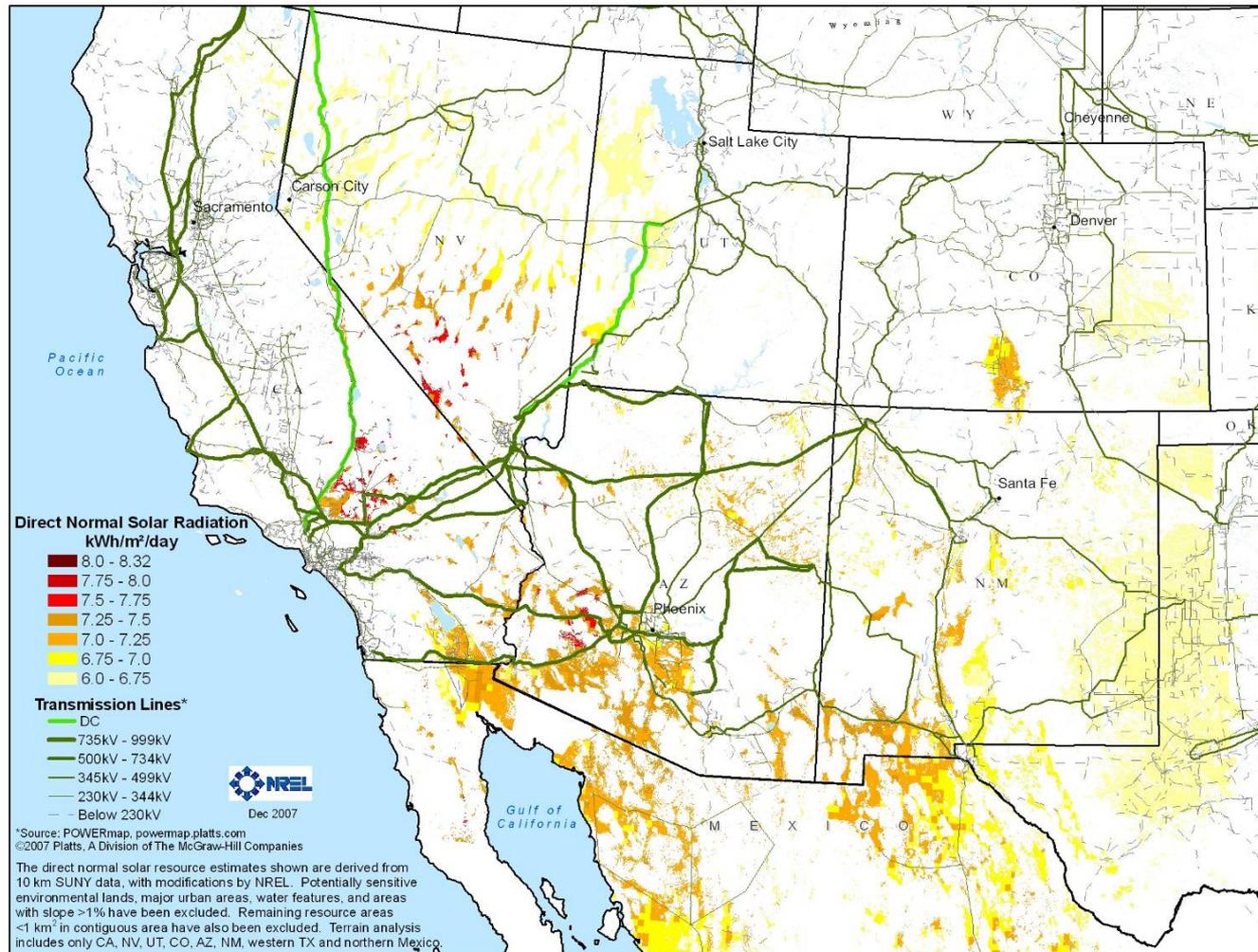
GIS Analysis - CSP Site Suitability Example

Southwest Solar Resources with Slope < 3%



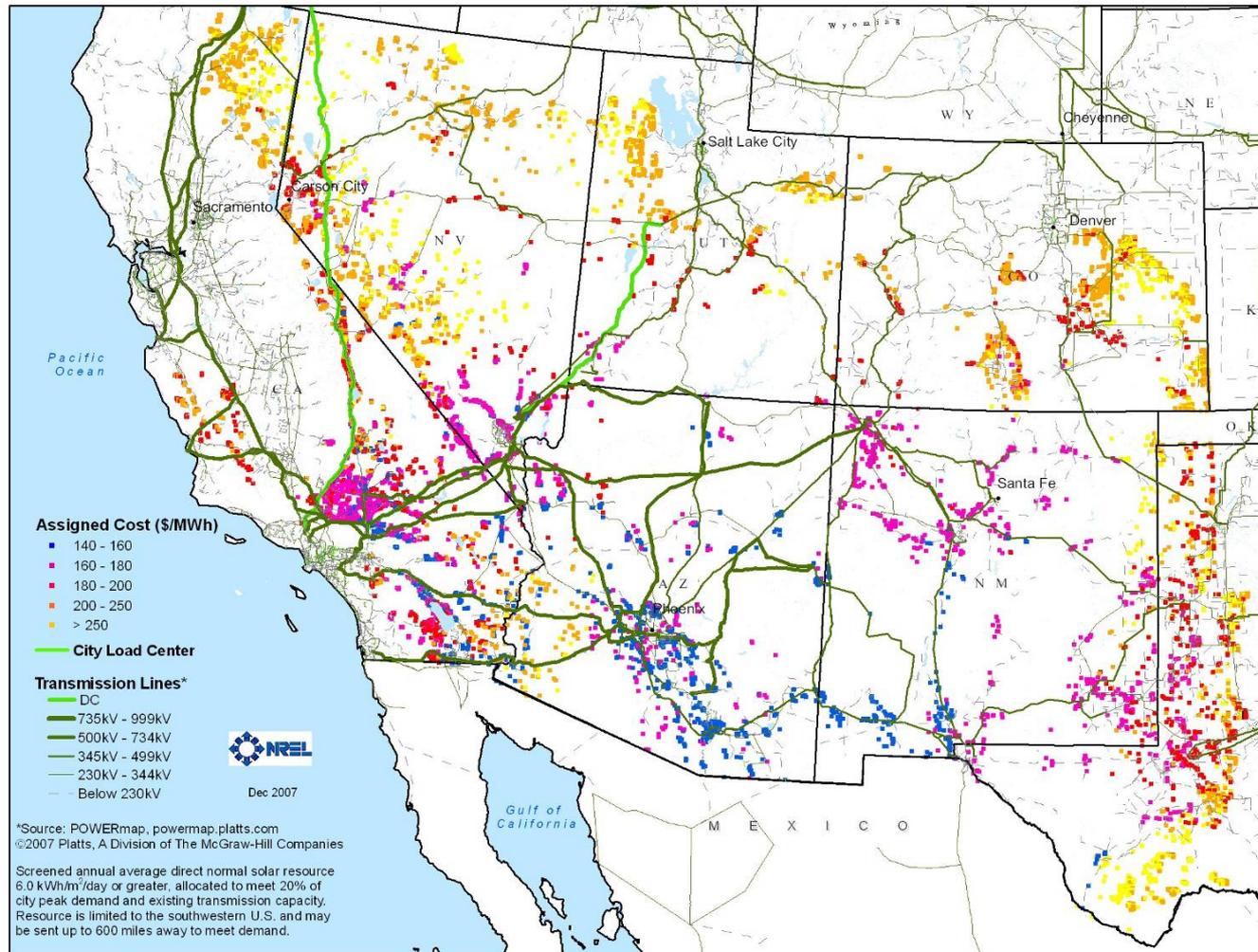
GIS Analysis - CSP Site Suitability Example

Southwest Solar Resources with Slope < 1%



GIS Analysis - CSP Site Suitability Example

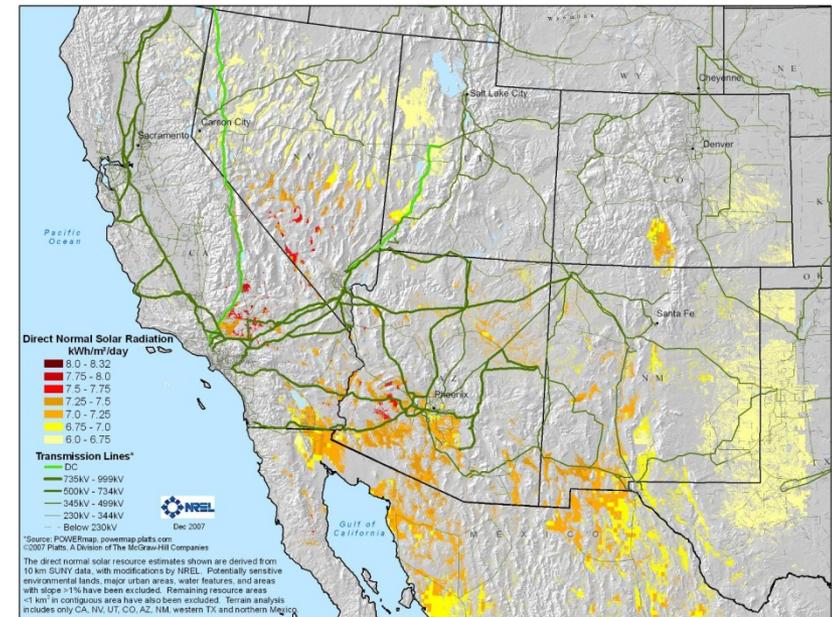
Optimal CSP Sites from CSP Capacity Supply Curves



GIS Analysis - CSP Site Suitability Example

Resulting CSP Resource Potential

State	Land Area (mi ²)	Solar Capacity (MW)	Solar Generation Capacity GWh
AZ	13,613	1,742,461	4,121,268
CA	6,278	803,647	1,900,786
CO	6,232	797,758	1,886,858
NV	11,090	1,419,480	3,357,355
NM	20,356	2,605,585	6,162,729
TX	6,374	815,880	1,929,719
UT	23,288	2,980,823	7,050,242
Total	87,232	11,165,633	26,408,956



The table and map represent land that has no primary use today, exclude land with slope > 1%, and do not count sensitive lands.

Solar Energy Resource ≥ 6.0

Capacity assumes 5 acres/MW

Generation assumes 27% annual capacity factor

Current total nameplate capacity in the U.S. is 1,000GW w/ resulting annual generation of 4,000,000 GWh

Technical Potential: Data and Tools

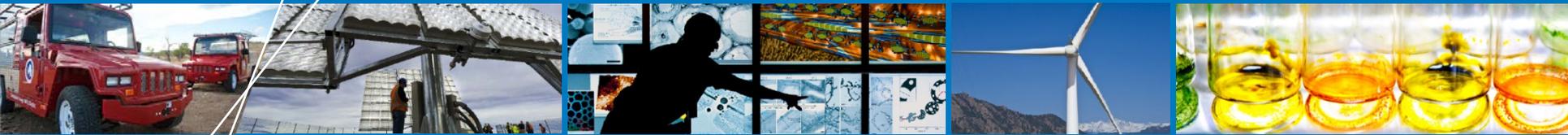
- **Renewable Energy Technical Potential Paper**
 - Technical potential for the continental US
 - http://www.nrel.gov/gis/re_potential.html
- **Solar Prospector (*)**
 - Investigate solar resource data, land use restrictions, transmission, topography, and other data related to solar siting
 - <http://maps.nrel.gov/prospector>
- **PVDAQ (*)**
 - Investigate actual PV performance for systems across the US
 - <http://maps.nrel.gov/pvdaq>
- **PVWatts (*)**
 - Calculates a PV system's hourly energy output over a single year
 - <http://pvwatts.nrel.gov/>
- **System Advisor Model (SAM)**
 - Calculates a renewable energy system's hourly energy output over a single year, and calculates the cost of energy for a renewable energy project over the life of the project.
 - <https://sam.nrel.gov/>

Economic Potential: Data and Tools

- **Transparent Cost Database**
 - Collects program cost and performance estimates for EERE technologies in a public forum where they can be viewed and compared to other published estimates
 - http://en.openei.org/wiki/Transparent_Cost_Database
- **Cost of Renewable Energy Spreadsheet Tool (CREST)**
 - An economic cash flow model designed to assess projects, design cost-based incentives (e.g., feed-in tariffs), and evaluate the impact of tax incentives or other support structures
 - <http://financere.nrel.gov/finance/content/CREST-model>
- **PV Jobs and Economic Development Impact (JEDI)**
 - Estimate the economic impacts of constructing and operating power generation and biofuel plants at the local (usually state) level
 - http://www.nrel.gov/analysis/jedi/about_jedi.html

Market Potential: Data and Tools

- **Renewable Energy Futures Report and Visualization (*)**
 - An initial investigation of the extent to which renewable energy supply can meet the electricity demands of the continental United States over the next several decades
 - http://www.nrel.gov/analysis/re_futures
 - http://www.nrel.gov/analysis/re_futures/data_viewer
 - <http://rpm.nrel.gov/refhighre/dispatch/dispatch.html>
- **DSIRE Incentives**
 - Comprehensive listing of federal, state, and local RE and EE incentives
 - <http://www.dsireusa.org/solar>
- **Developer.nrel.gov (*)**
 - Access utility rates, incentives, and other data and analysis related to RE systems
 - <http://developer.nrel.gov/docs/electricity>
- **OpenPV (*)**
 - Actual PV installs summarized nationally, by state, and by county
 - <https://openpv.nrel.gov>



Discussion

Contact:

dan.getman@nrel.gov