PVMapper and SAM Integration: Web-Based Solar Project Siting Analysis

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BOISE STATE UNIVERSITY | Idaho National Laboratory INL | Idaho State UNIVERSITY | University of Idaho

Project Personnel

- Overall Project/Scientific Direction: David Solan, PI, Boise State University
- Technical Subgroup Led by Randy Lee, Co-PI, Idaho National Laboratory
  - INL: Brant Peery, Sam Alessi, Kurt Myers, Dave McGrath
  - ISU: Dan Ames (Co-PI), Matthew Klein
  - ANL: Jim Kuiper, Andy Ayers, Andy Orr, Pam Richmond
- Social Risk/Perception Subgroup led by Juliet Carslile, ISU
  - INL: Jeffrey Joe, Kurt Myers
  - ISU: Madelaine Bowman (GRA)
  - BSU: Yao Yin, Christian Samples (GRA)
  - U of I: Stephanie Kane
- Project Management: Dave Koehler, BSU

Steering Committee Personnel

- Amber Smith, GIS Administrator, juwi Solar
- Mike Belikoff, Vice President, Systems Development, First Solar
- Dusty Friedman, Manager, Tenaska Solar
- Pascal Storck, Chief Operating Officer, 3Tier
- Alain Gallet, Senior Vice President, Energy, Terracon
- Laurie Hietter, Founding Principal, Panorama Environmental Inc.
- Chip Koch, Manager, Environmental Planning and Permitting, Pacific Gas & Electric
- Jim Kuiper, GIS Projects Developer/Analyst, Argonne National Laboratory
- Ted Quinby, Project Manager and Developer, Data Analysis & Visualization Group, National Renewable Energy Laboratory
- Venkat Banunarayanan, Systems Integration, SunShot Initiative, U.S. DOE; Senior Manager, ICF International

Project Overview

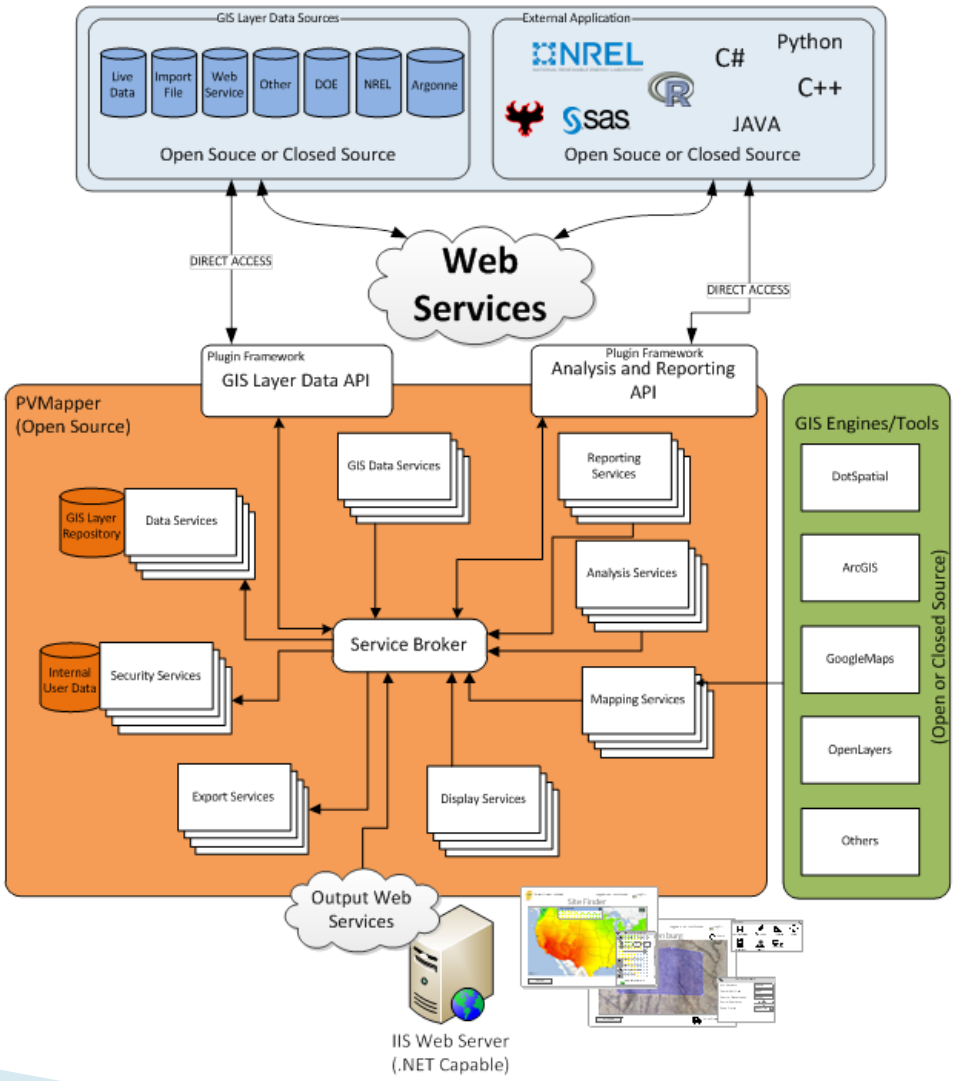
- SunShot Initiative's goals: 1) solar energy to be cost competitive without subsidy; 2) 75% cost reduction by 2020.
- Our Project is Funded under a Program to Reduce the *Non-Hardware* Balance of Systems Costs.
- Project Goal: Develop an Open-Source Geographic Information Systems (GIS) Tool to Optimize Siting for Utility-Scale Solar PV Projects.

Project Objectives

- Develop a GIS-based project planning tool to identify optimal utility-scale solar PV sites;
- Develop the tool on an open-source platform;
- Integrate the appropriate data sets/layers;
- Include a measure of social risk and public acceptance;
- Provide site comparison analysis / weights
- Provide a free and accessible platform to download the tool; and
- Provide a sustainability plan to ensure future relevance of the tool.

Plug-In Architecture

- Provide API for adding modules
- Commercial or Open Source integration possible

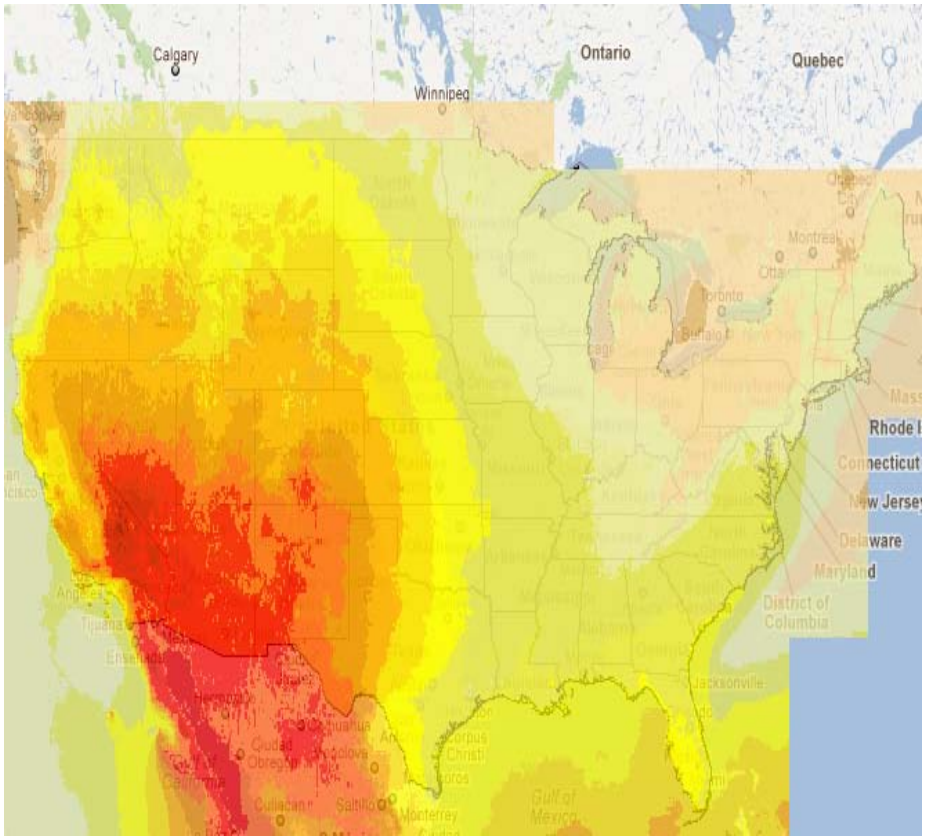


Features & Functional Requirements

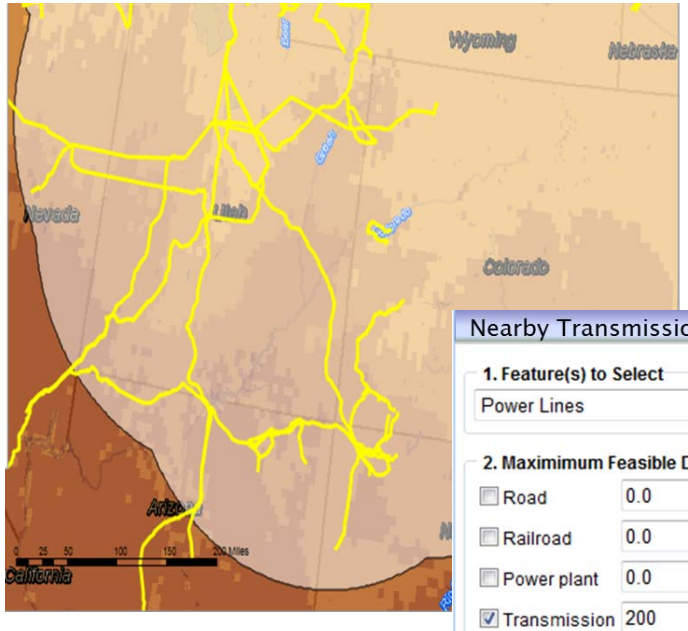
- Site Finder
- Potential Power Purchaser
  - Power company service territories
  - Power purchaser demographics
  - Properties of nearby transmission
- Cost of Energy
  - Local offsets
  - Cost to deliver power to transmission line
  - Incentives
  - Energy forecast
- Site Comparisons
- Site Suitability
  - Social, political, and environmental factors

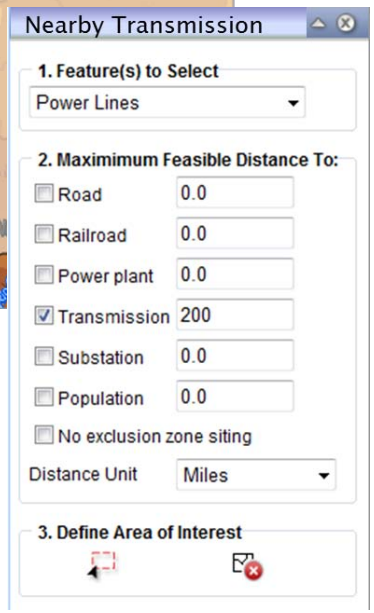
Site Finder

- Large-scale map of US for identifying "hot spots"
  - National-level solar insolation, slope, public lands
  - Highlights areas with highest solar potential
  - Provides first level cut for from which detailed areas can be selected



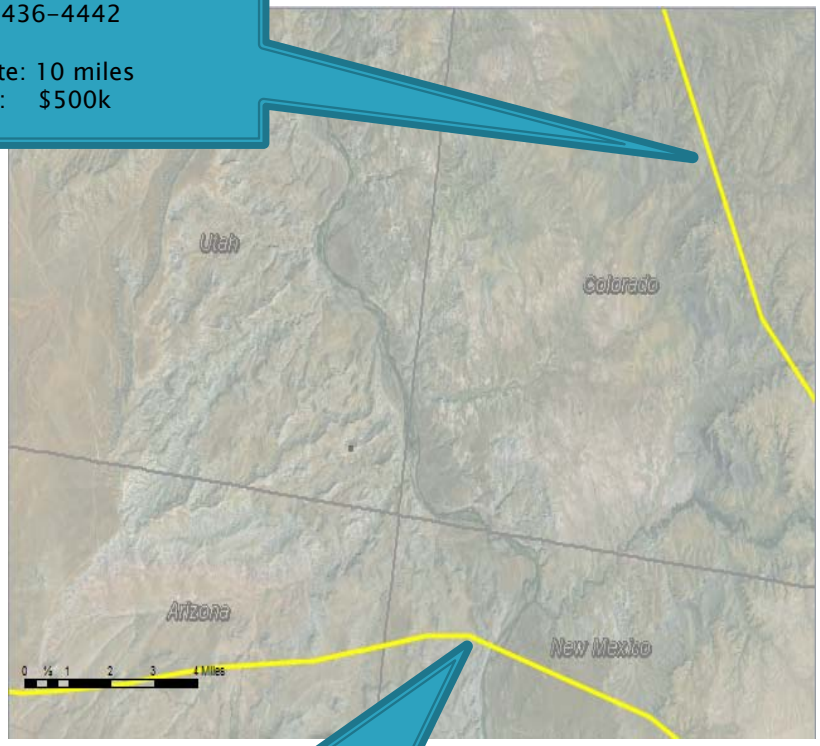
Potential Power Producers





Company: Tucson Electric Power Co.
Voltage: 345 kV
Capacity:
Telephone: xxx-436-4442

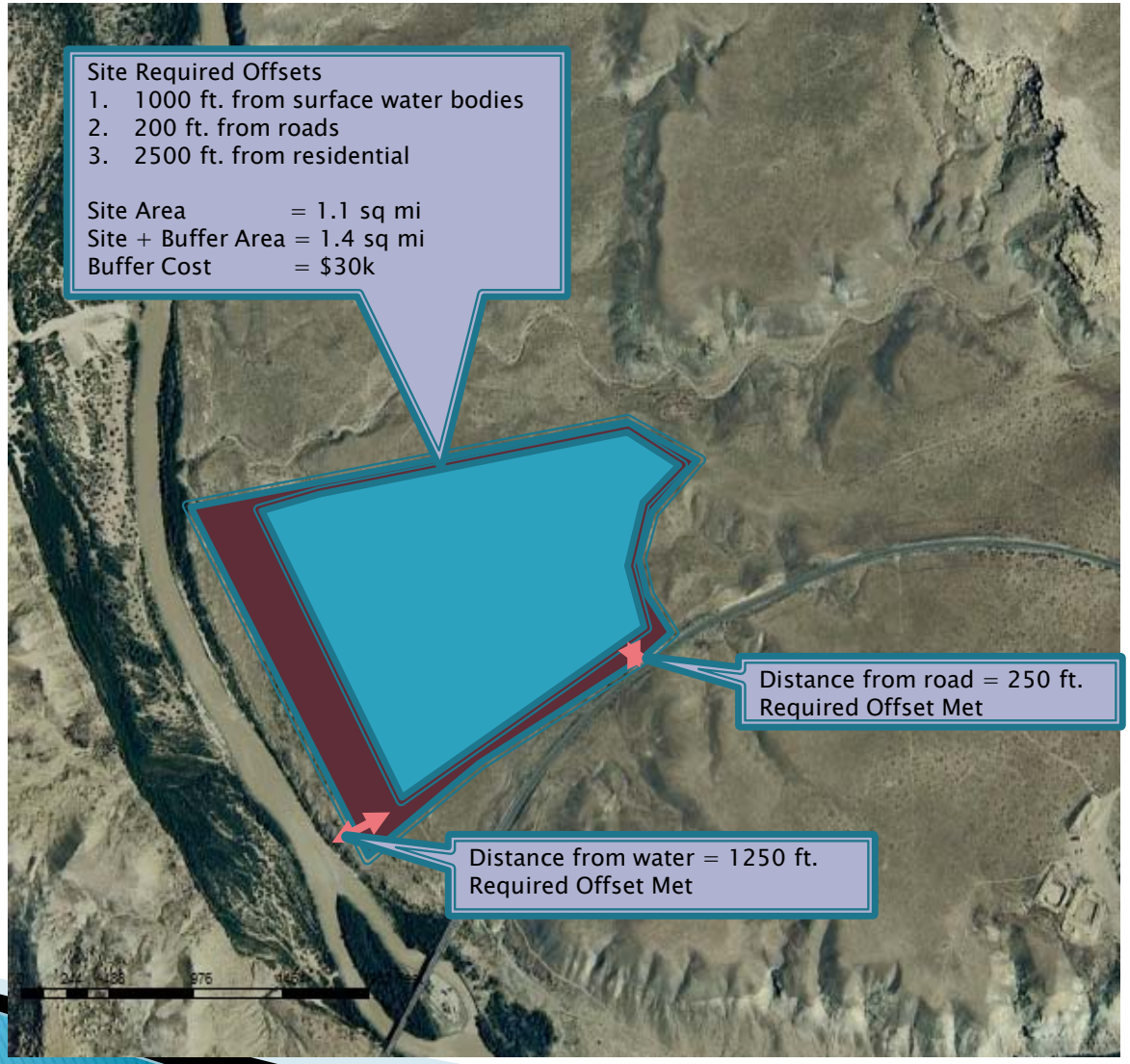
Distance from Site: 10 miles
Connection Cost: $500k



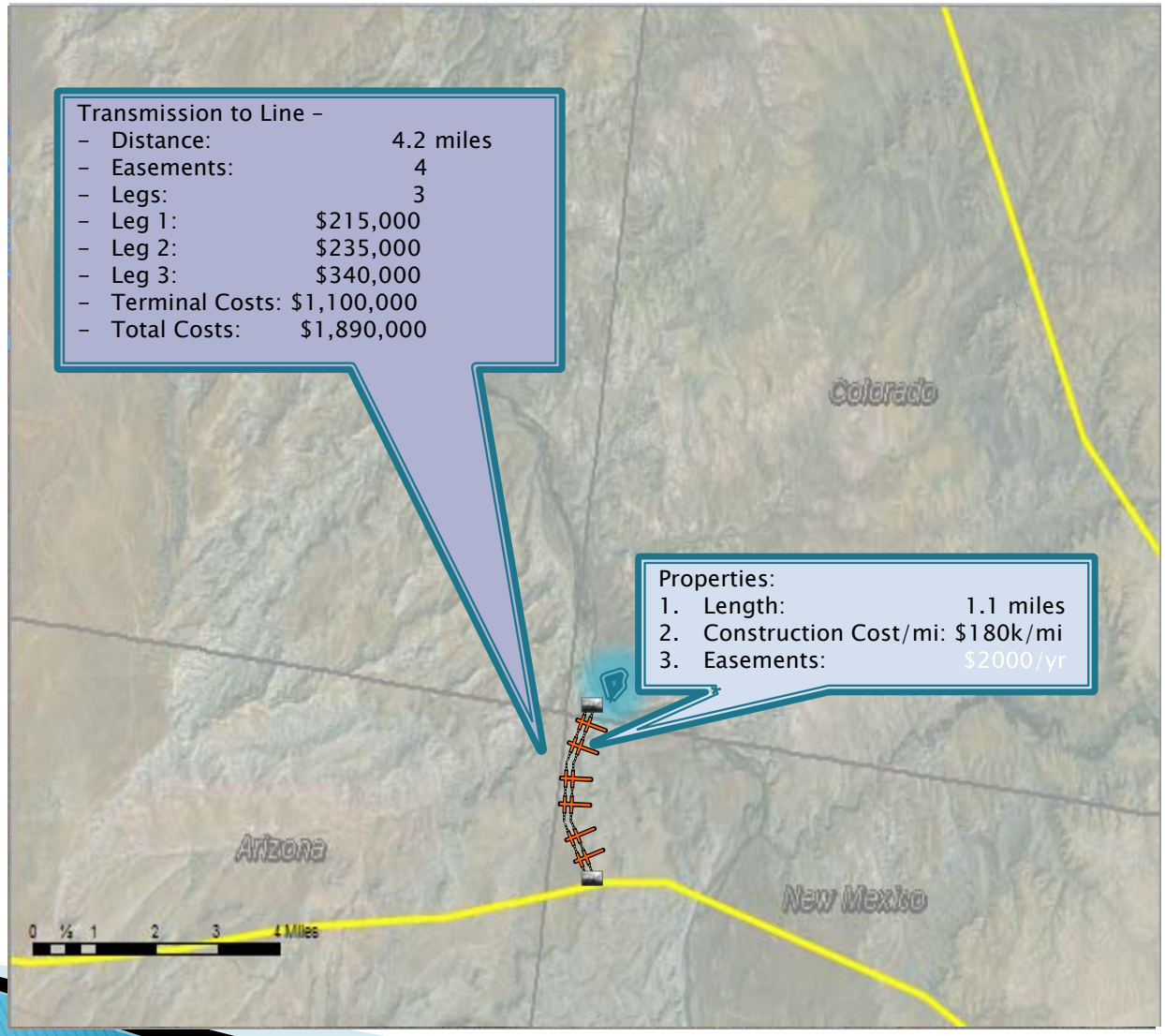
Company: Tucson Electric Power Co.
Voltage: 500 kV
Capacity:
Telephone: xxx-436-4442

Distance from Site: 3.5 miles
Connection Cost: $300k

Cost of Energy: Local Offsets



Cost of Energy: Cost to Connect



Site Suitability

- Socio-Political and Environmental Factors
  - From a selected site(s), user can evaluate suitability from layers:
    - Public perceptions regarding siting proximity to specific land features
    - Threatened/endangered species
    - Cultural resource areas
    - Zoning types
    - Soil/geology
    - Water availability
  - Results will be areas to avoid based on feasibility score of overlapping layers above represented as a heat map

Site Comparison

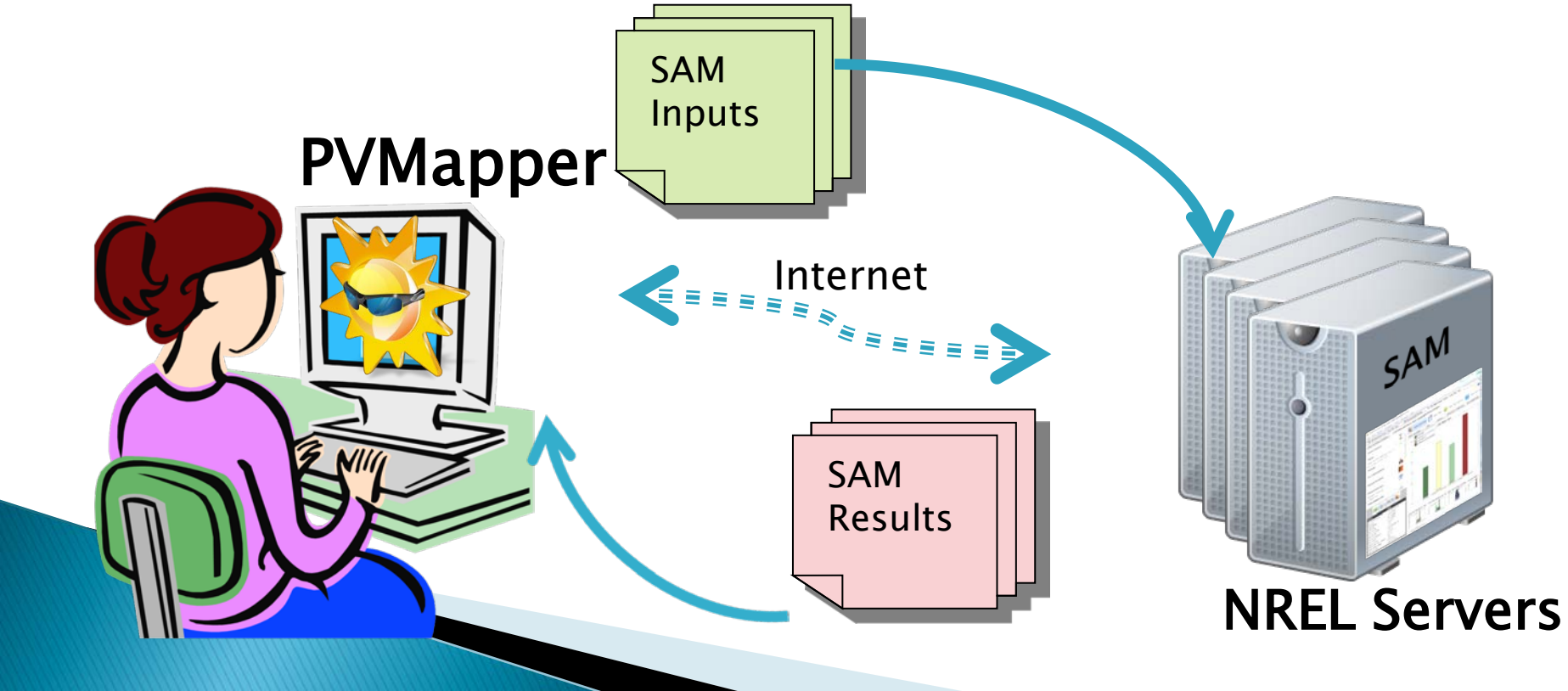
- Side-by-side comparison of costs and benefits for selected sites
  - User selects from a list of cost items
  - User can define weights for each cost item
  - Comparison tool will scale comparisons and present data in a user defined table
  - Tool calculates and overall site score

Use SAM for Site Performance & Financial Calculations

- In addition to soft costs, PVMapper will use SAM to provide estimates of main system cost comparisons
- SAM results will then be incorporated into the site comparison tool
- Overall
  - PVMapper will help the user collect SAM input
  - SAM results will be linked to PVMapper site information
- Technical Options
  - SAM as a web service
  - SAM api

Our preferred interface to SAM

- The user provides SAM inputs to PVMapper
- PVMapper sends inputs to NREL
- NREL runs the calculations and returns results
- PVMapper stores and presents results to User



Questions?

Sam Alessi has a Ph.D. in Soil Physics, which he has applied to numerous fields including, environmental simulation and modeling, software architectures, statistical forecasting, and a wide variety of engineering project areas, ranging from nuclear power and hybrid energy systems to enterprise business intelligence. Sam led the University of Idaho Systems Engineering program where he develop and taught classes in traditional Systems and Software Design, Requirements Analysis, and created new engineering courses in Naturalistic Inquiry and Technology Ethics. He is current the Generalized Environment for Modeling Systems (GEMS) engineering infrastructure lead and the Optimization Analysis for Strategic Integrated Energy Systems (OASIES) program lead at the INL. Sam is a member of the American Statistical Association, a prior director with the International Council on Systems Engineering and currently involved with the INCOSE systems science working group.

Randy Lee – Technical Lead for Geospatial Science and Engineering and Remote Sensing. Randy has over twenty years of progressively responsible experience in program development and project management of geospatial science projects at the Department of Energy's Idaho National Laboratory (INL). Instrumental in designing, building and operating INL's geographic information systems. Responsible for growing the INL Geospatial Science and Engineering and Remote Sensing Programs.

He provides expertise in digital cartography, spatial data analysis, image processing, web-enabled map application development, global positioning system (GPS) data collection, and spatial data acquisition, conversion and management.

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Potential Power Producers

- Power Company Service Territories
  - Helps determine potential buyers in a region
  - User gets marketer's contact information from the map
  - If data is missing, user will get information on local economic develop agencies
  - Map will display a map of utility service areas
  - User will be able to load site specific information they may already have

Potential Power Producers

- Power Purchaser Demographics
  - Performs a search of nearby power companies
  - Provides company names, addresses, contact names, phone numbers, and URLs
  - User will define search radius

Potential Power Producers

- Properties of Nearby Transmission
  - Provides users with search of nearby transmission lines
  - Returns a list of attributes associated with nearby lines including:
    - Company & contact information
    - Transmission capacity & availability
    - Distance to line
    - Development cost to reach line

Cost of Energy

- Incentives
  - From a selected site, user is provided access to the DSIRE database
  - Tool returns records from DSIRE for selected site including:
    - Financial incentives
    - Rules & regulations
    - Polices

Cost of Energy

- Energy Forecast
  - From a selected site, user is provided with a tool for forecasting:
    - Solar radiation
    - Electrical energy demand and price
    - Construction costs
  - Tool forecasts future estimated balance sheets for the selected site