

# HyDRA:

## Hydrogen Demand and Resource Analysis Tool

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May 17, 2007

Project ID #AN4



This presentation does not contain any proprietary, confidential, or otherwise restricted information

# Overview

## Timeline

Project start date – September 2006

Project end date – September 2007

Percent complete – 50% complete

## Budget

Total project funding – 100% DOE share

Funding received in FY 2006 – \$0 (new project)

Funding for FY 2007 – \$305k

## Barriers

### Systems Analysis Barriers

Stove-piped/siloed analytical capability

Inconsistent data, assumptions, and guidelines

Suite of models and tools

## Partners

NREL project with support from *A Mountain Top, LLC* for programming expertise

# Objectives

Develop a web-based GIS tool to allow analysts, decision makers, and general users to view, download, and analyze hydrogen demand, resource, and infrastructure data spatially and dynamically.

Why spatial analysis for hydrogen?

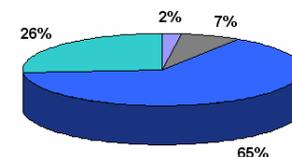
An energy carrier, similar to electricity

Produced from various feedstocks

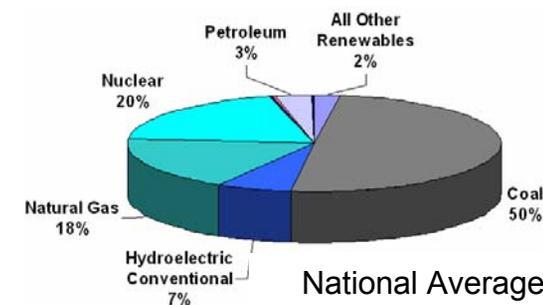
Resource, demand, and infrastructure will vary regionally

- Analyses tend to use national averages
- Price and availability are not the national average
- Need a tool to facilitate regional analyses

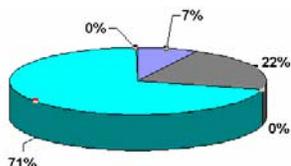
**Does not replace other analysis efforts**



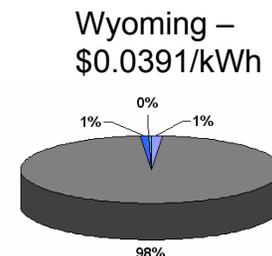
Oregon –  
\$0.0443/kWh



National Average  
Industrial Electricity  
Rate = \$0.0525/kWh



Vermont –  
\$0.0796/kWh



Wyoming –  
\$0.0391/kWh

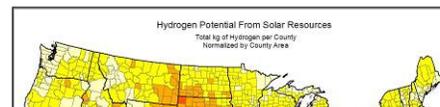
# Approach

Builds on existing NREL efforts

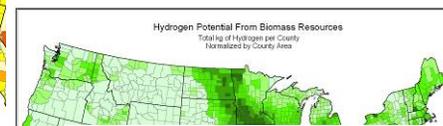
GIS Resource Analysis

Hydrogen Demand Scenario Analysis

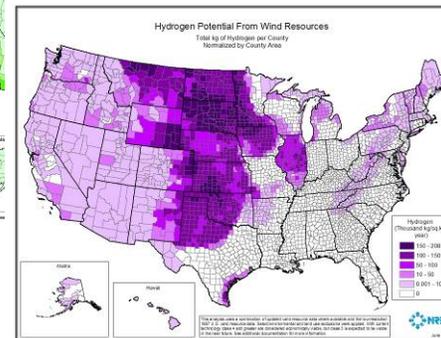
Renewable Planning Model (RPM)



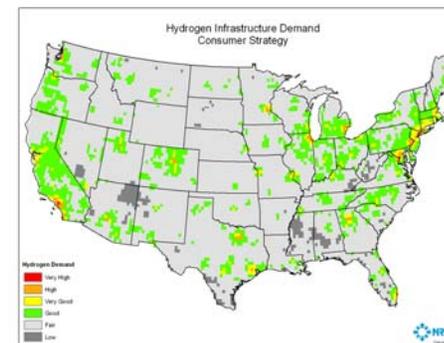
*Solar*



*Biomass*

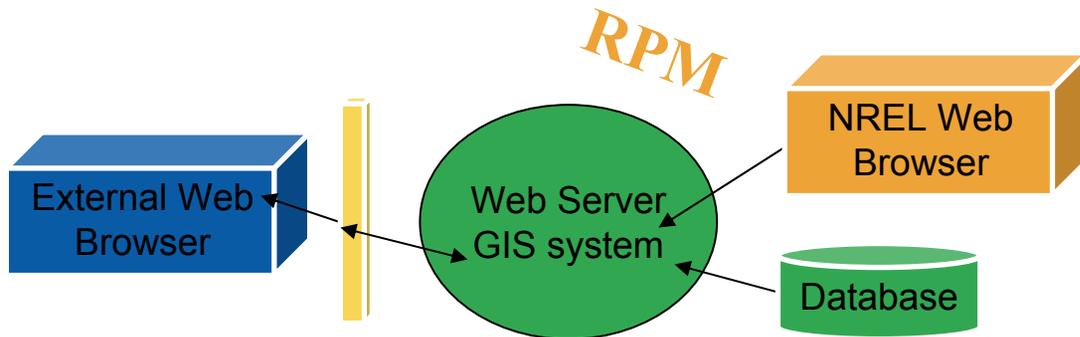


*Wind*



*Demand*

*RPM*



Functional Requirements

Data Requirements

Application Build and Test

Release  
6/2007 (beta)  
9/2007

# Accomplishments – Functional Requirements

1. Generic viewing maps
2. Resource maps
3. Infrastructure maps
4. Demand maps
5. Layer control
6. Change underlying assumptions
7. Build hydrogen system
8. Buffer layers
9. Security
10. Import data
11. Export data
12. Selecting data
13. Print map
14. Emissions
15. Temporal functionality
16. Interaction with other applications

# Progress – Resource Data

Renewable

Wind

Solar

Biomass

Offshore wind

Hydro

Geothermal

Coal

Natural gas

Uranium

Water

Geologic features

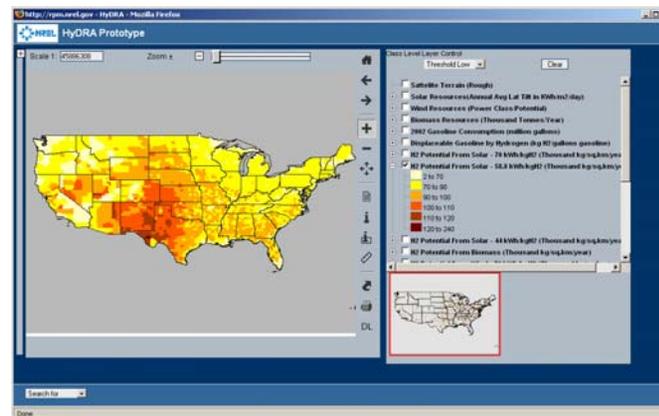
Sequestration locations

Hydrogen storage

Oil/gasoline

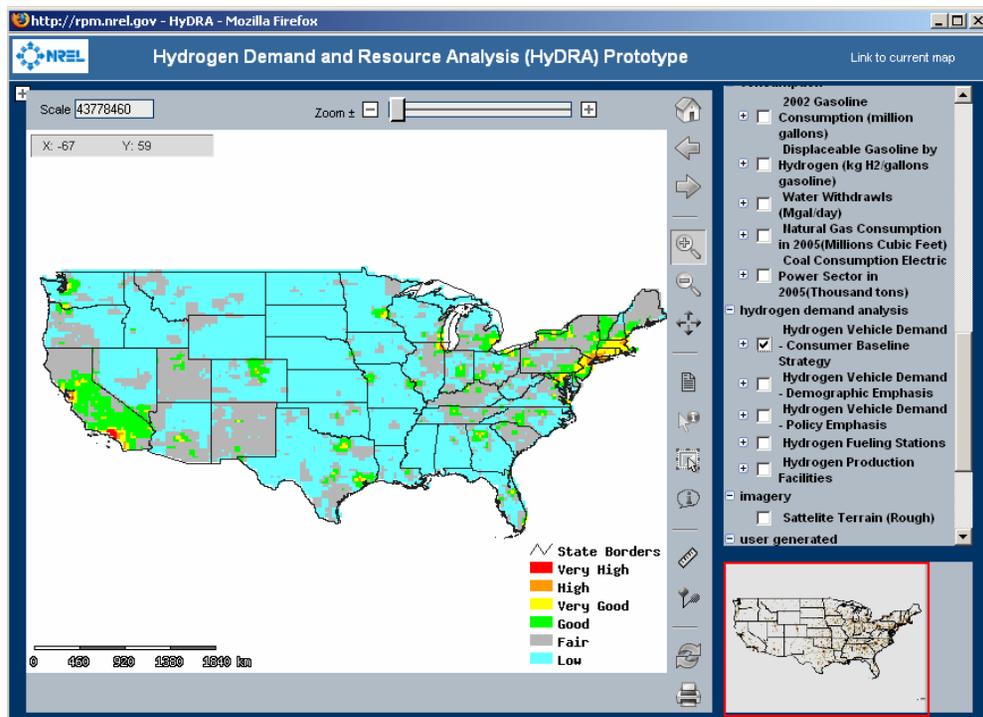
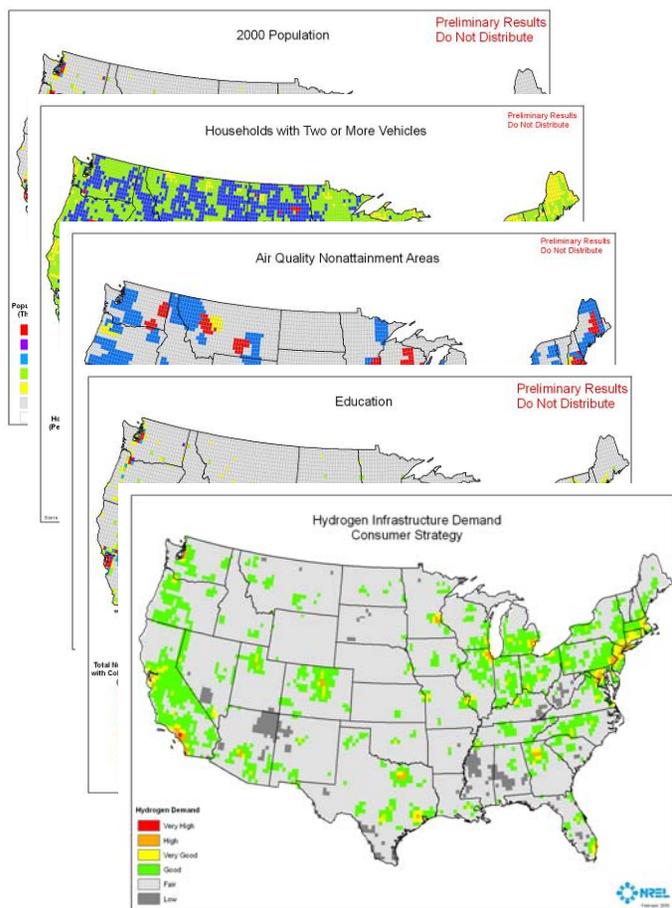


Need energy production potential  
 Hydrogen production potential  
 Usage of utilities and feedstocks  
 Competition



# Progress – Demand Data

Identifies key attributes for hydrogen vehicle adoption based on demographics and policy



# Progress – Infrastructure Data

Electricity

Natural gas

Water



Capacity

Location

Availability

Consumption

Rates



Water treatment plants

Transportation sector

Roads

Rail

Ports



Hydrogen infrastructure

Power plants

Renewable installations

Gas stations

# Accomplishments - Application

Incorporate existing analysis work in application

General mapping functionality

- Zoom
- Pan
- Print
- Scale
- Legend



- general
  - +  Cities
  - +  Roads
  - +  StateBorders
- regions
  - +  WinDS regions
  - +  NEMS Regions
  - +  Counties

Thresholds

- Single out
- Floor
- Ceiling

Hide/emphasize

Layer maps

Identify/select

Search

Dynamically change assumptions

Security

**Display**

hide

emphasize

**Threshold**

single out

set as floor

set as ceiling

Reset Layer

[Close](#)



Search for

**Create H2 Layer**

Electrolyzer efficiency 70

LayerName

Calculate Layer

[Close](#)

# Accomplishments – Case Study

Where should a biomass-to-hydrogen demonstration project be built?

Requirements:

- Good biomass resource

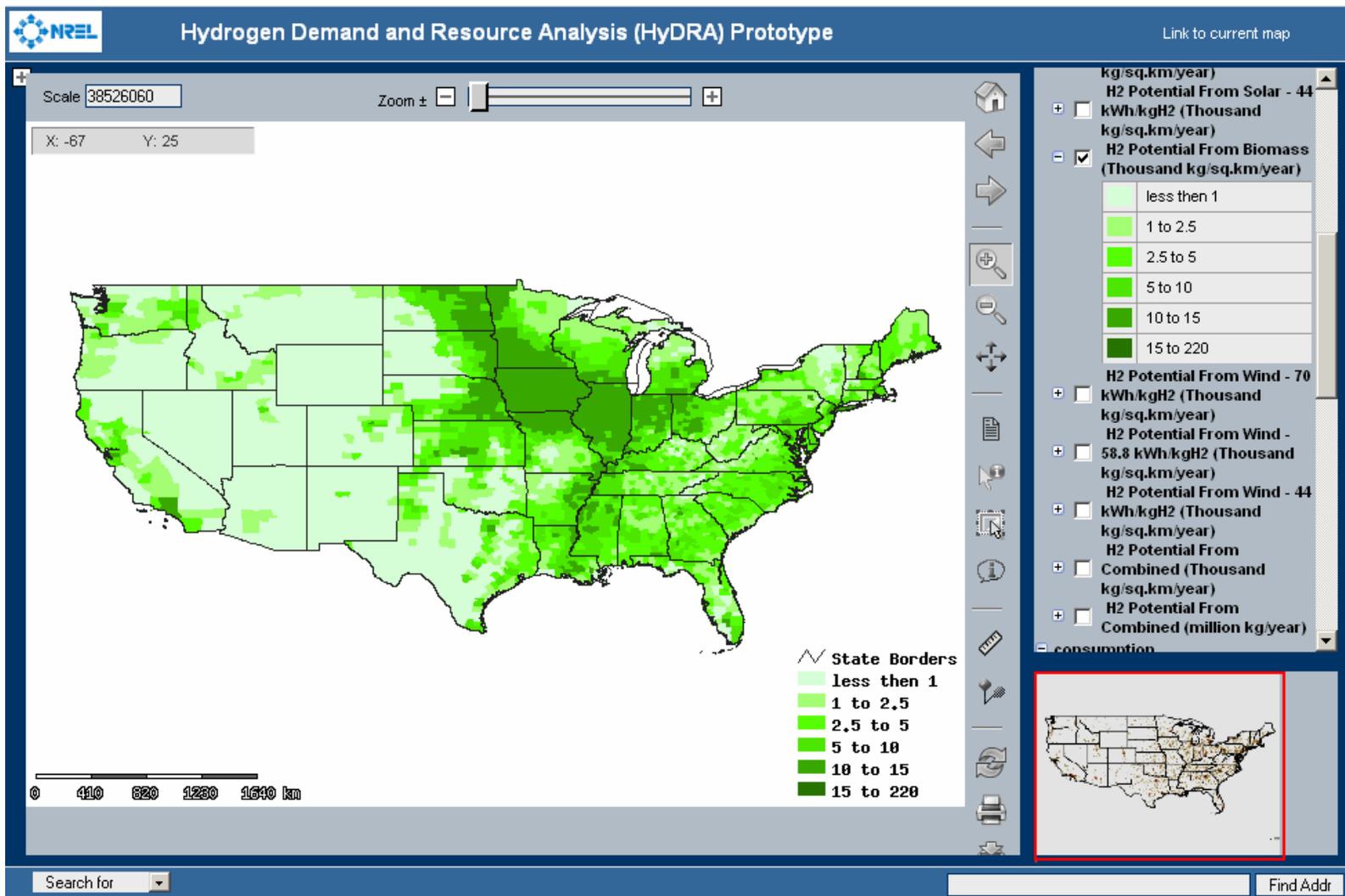
- Good early demand

- Build first hydrogen refueling station in region

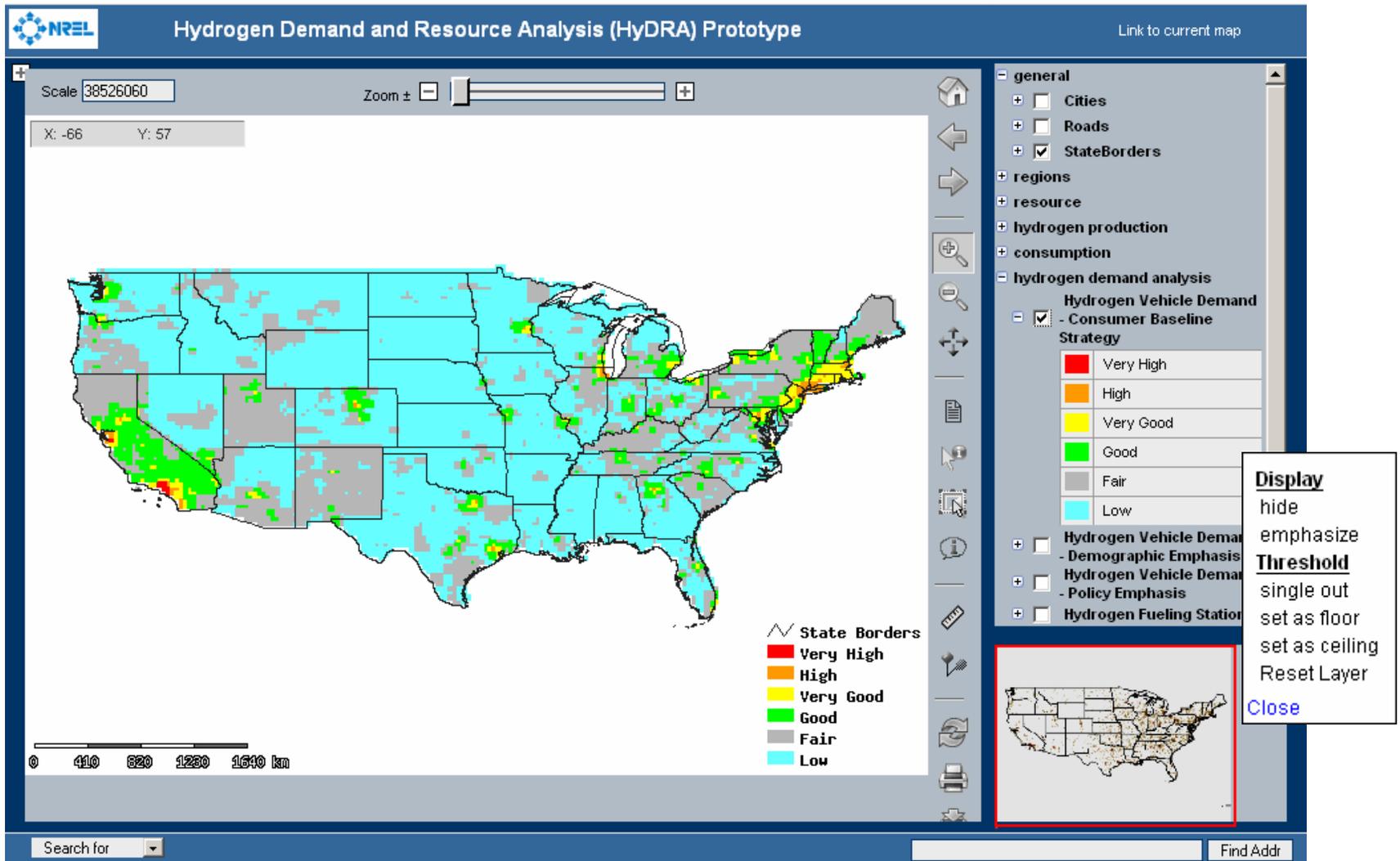
- Near existing hydrogen production locations

- Near a major metropolitan area

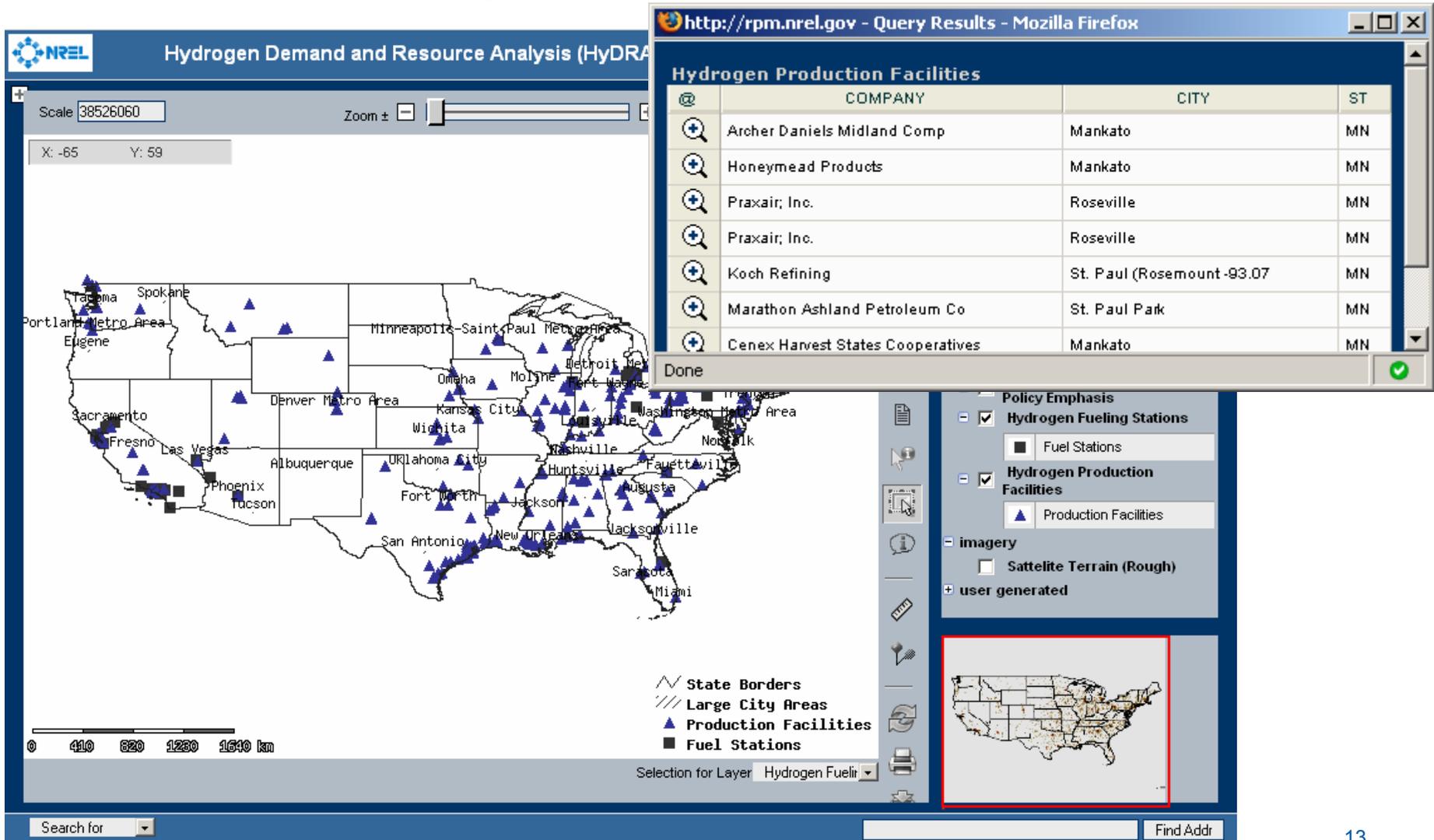
# Accomplishments – Good Biomass Resource



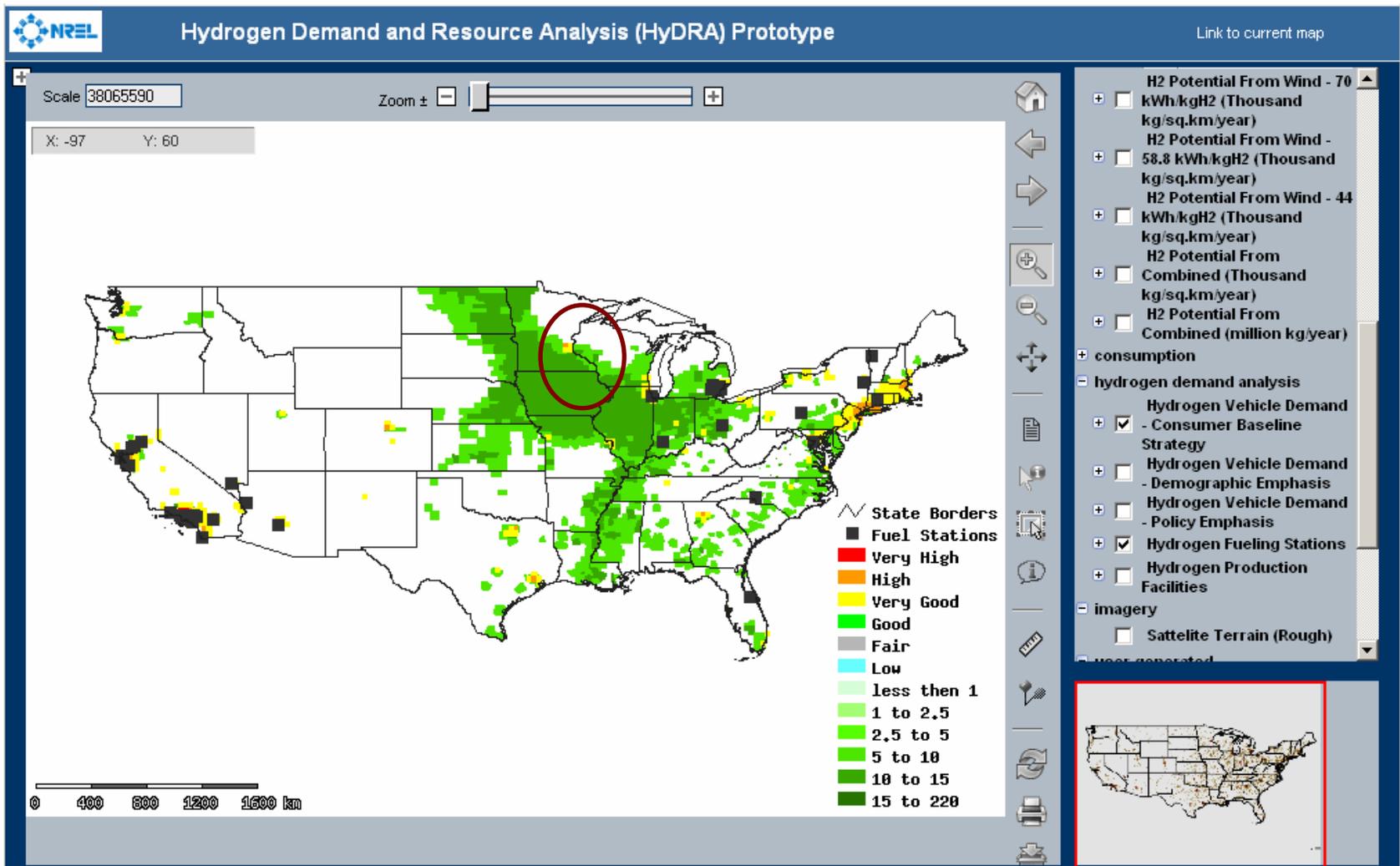
# Accomplishments - Good Early Demand



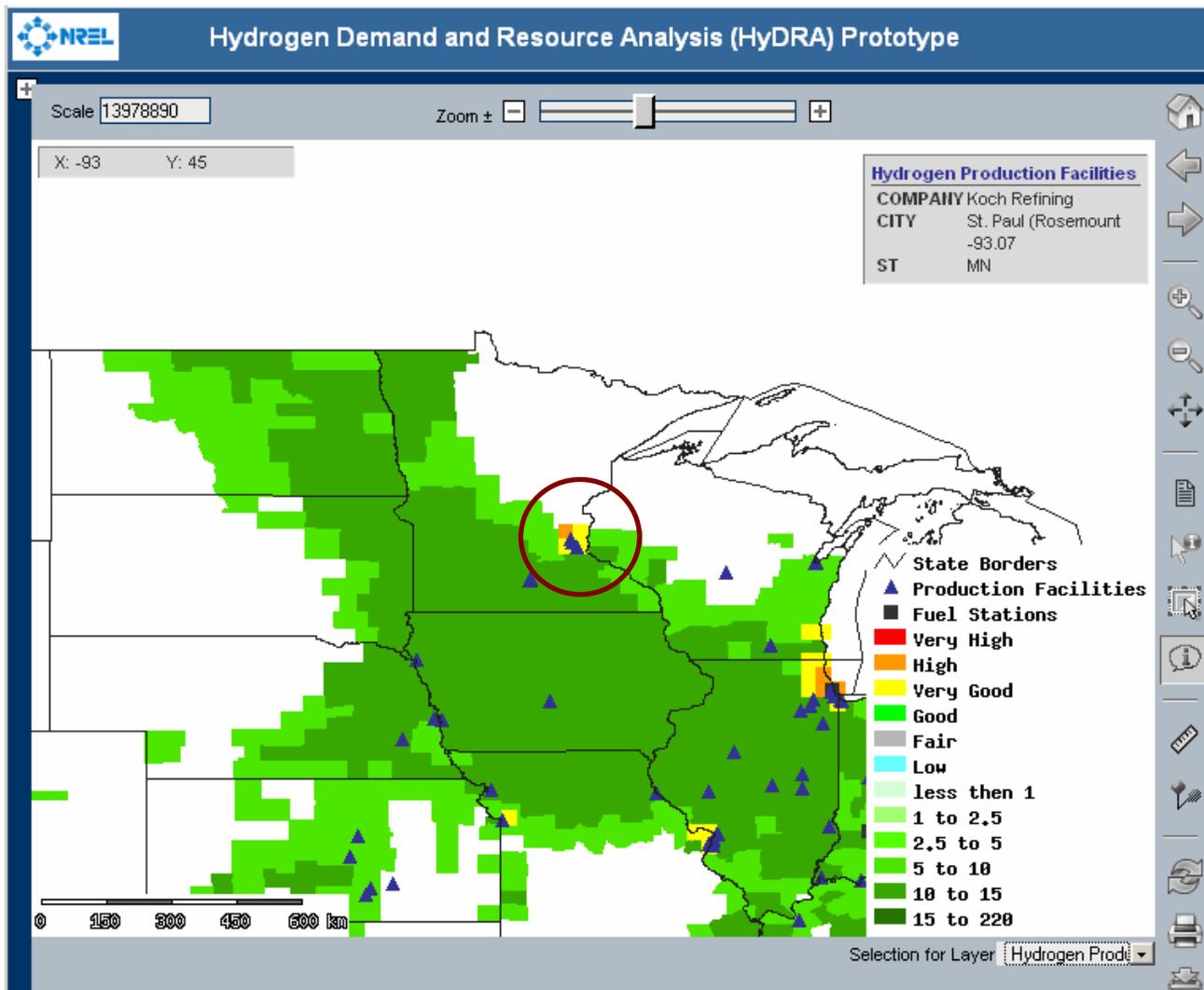
# Accomplishments – Refueling Stations and Production Facilities



# Accomplishments – Layering Data



# Accomplishments – Case Study Findings



## Future Work

June 2007: beta release

June – August 2007: Develop release 2

- Additional resource layers

- Infrastructure layers

- Application functionality enhanced

  - e.g. upload/download data

September 2007: test and release

FY 2008 and beyond: temporal functionality, interfaces with other applications (MSM, HyDS, HyTrans), additional resource and infrastructure layers, emissions

# Summary

HyDRA concept is a Web-based, dynamic, highly interactive demand and resource tool

- View, download, and report on resource, demand, and infrastructure data
- Spatially represent analysis results
- Provides a tool for regional analysis

Current DOE resource and demand analysis is static

Existing DOE models need or could use consistent demand and resource data and regional capabilities

- HyDS, HyTrans, MSM, others

Hydra is built on existing work at NREL

- GIS resource analysis
- Hydrogen demand scenario analysis
- Renewable planning model