

BioFuels Atlas



**2011 Infrastructure
Platform Review,
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Goal Statement

- **BioFuels Atlas is a first-pass visualization tool that allows users to explore the potential of biomass-to-biofuels conversions at different locations and scales**
- **NREL's Biofuels Atlas applies to OBP's Program Goals and Mission:**
 - Tool highlights areas for biofuels production and infrastructure deployment
 - Identifies proximity of biomass to oil refineries for co-processing
 - OBP supports geospatial evaluation of biofuels distribution
 - Tool meets strategic communication goal of deploying web-based tools to increase public awareness of bioenergy

Timeline, Budget, Barriers, & Partners

Timeline

Project start date: January 2010
Project end date: September 2010
Percent complete: 100%

Budget

Total project funding

- DOE share: 100%
- Funding of other OpenCarto tools and data sources by other EERE programs benefited Biofuels Atlas

Funding for FY10: \$250,000

Barriers Addressed

- Dt-F Limited Understanding of Downstream Infrastructure Needs
- Mm-A. Level of Industry & Consumer Acceptance & Awareness

Project Participants

NREL

Project Overview

History

- FY07– NREL developed the State Assessment for Biomass Resources (SABRE); static and aggregated data for EPA
- FY08– NREL develops OpenCarto—a web-based GIS platform with shared code, updates, maintenance; components funded by seven agencies (DOE & EPA)
- FY10– SABRE is moved into OpenCarto platform with numerous data layers; query; download; and analysis functionality added

Context

- Provide bioenergy related data in one mapping application
- To meet RFS requirements; multiple feedstocks will need to be converted to biofuels
- Fueling infrastructure is limited; tool highlights opportunities

Objectives

- **A biofuels visualization tool that allows users to see and download data and perform simple analysis**

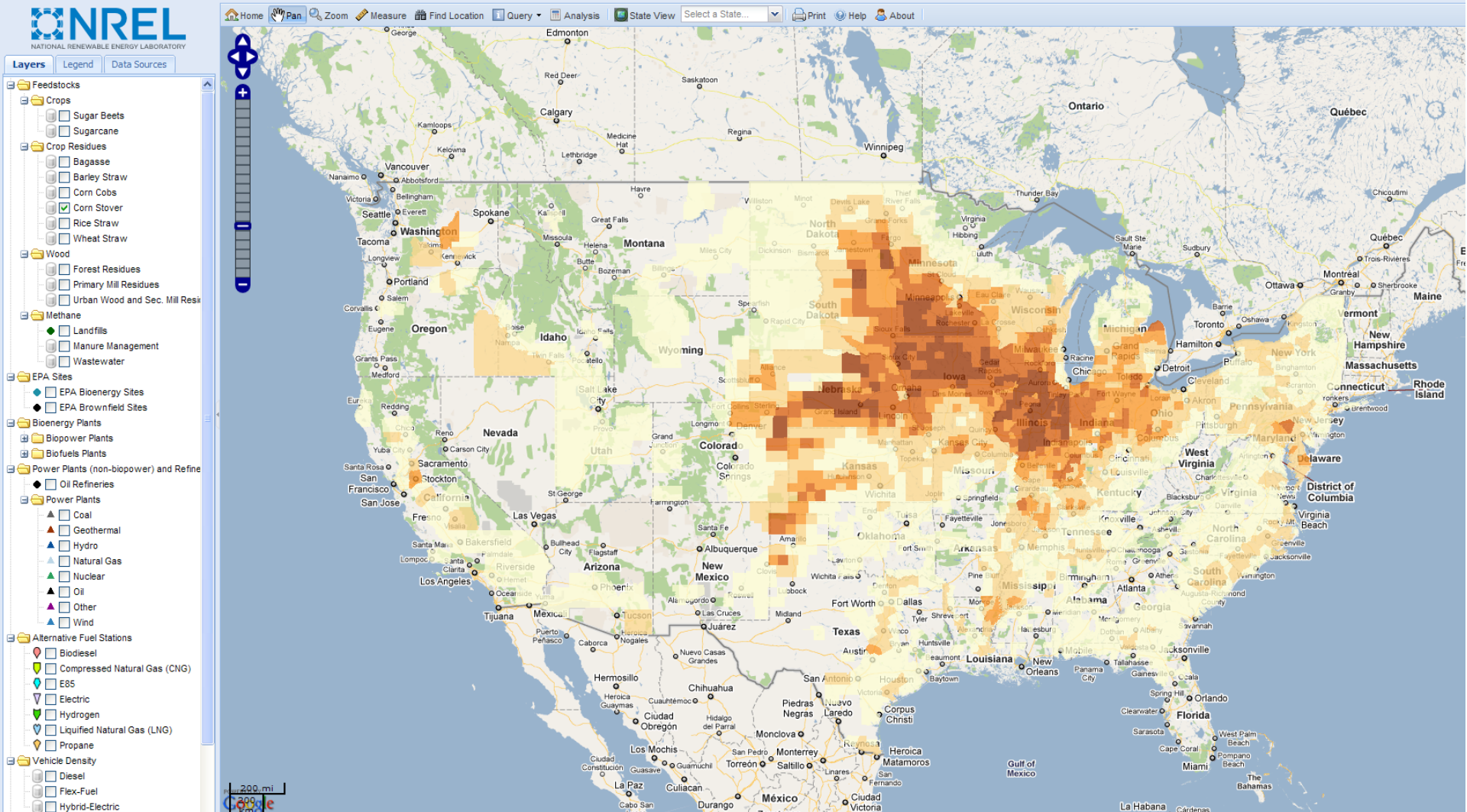
Approach

- **Web-based platform**
 - OpenCarto-NREL developed this platform for multiple geospatial tools of shared code, updates, maintenance, and consistent functionality
 - Seven tools share the platform reducing development, maintenance, and updating costs (a potential 7:1 return for every dollar invested)
- **Data Layers**
 - Consistent and reliable data sources: DOE, EPA, USDA
 - Crop residues, methane, secondary mill and urban residues were calculated based on logical assumptions and methodologies
- **Analysis**
 - Biofuels potential based on user selected feedstocks and collection radius
 - Calculation based on feedstock chemistry (EERE Biomass Composition and Property Database) and yield (70% of EERE Theoretical Ethanol Yield Calculator)
 - User can change inputs and recalculate potential biofuels yields
- **State Summary View & Tables**-Traditional & Bioenergy data included
- **Extensive testing** was conducted to ensure consistency and accuracy of data, queries, and analysis and overall performance of the tool

Technical Accomplishments/ Progress/Results

- **The accomplishment is the public release of BioFuels Atlas**
- **Released late September 2010**
- **BioFuels Atlas Google Analytics since launch**
 - 6,534 users
 - Access-51% Referring Sites; 44% Direct; 5% Search Engines
 - Users from 86 nations
- **Extensive positive feedback from users**
- **AFDC Fuels pages updates:** blends, feedstock, ASTM standards, infrastructure development, production/consumptions/trade data & information
 - **Fuels pages receive over 900,000 view per year**

Technical Accomplishments/ Progress/Results 2



Technical Accomplishments-Query

**Regional Query-
blue highlights
counties in region
selected**

**Tabs for each data
layer queried**

Site Name	City	State	Mapped Acreage	Dist to Powerlines	Distance to Highways	Distance to Rail	Latitude	Longitude
PHELPS DODGE CORP NEW CORNELIA BRANCH	AJO	AZ	1,800.00	0.84	0.00	1.10	32.3800000000000	-111.1610000000000
Usaf Davis Monthan Air Force Base	Marana	AZ	10,763.00	0.00	0.00	0.00	32.1640020000000	-110.8389970000000
Tangerine Road MSW Landfill	Marana	AZ	52.00	2.38	0.79	0.88	32.4194450000000	-111.1833340000000
Harrison City Landfill	Tucson	AZ	70.00	0.48	0.00	1.93	32.1627000000000	-110.7902000000000
Los Reales Landfill	Tucson	AZ	375.00	0.33	0.00	0.00	32.2140000000000	-110.9698000000000
TUCSON INTERNATIONAL AIRPORT AREA	TUCSON	AZ	1,902.00	0.17	0.00	0.00	32.1055600000000	-110.9333000000000

**Detailed data for each data
layer; including infrastructure
info; can download to excel**

Technical Accomplishments-Analysis

The screenshot shows the NREL Bioenergy Resource Analysis tool interface. On the left, a legend titled "Feedstocks - Crop Residues - Corn Stover (tonnes/yr)" lists five categories with checkboxes: 1 to 10,000, 10,000 to 50,000, 50,000 to 100,000, 100,000 to 200,000, and Greater Than 200,000. A "Select Layers" dialog box is open, showing a list of available layers with checkboxes: Bagasse, Barley Straw, Forest Residues (checked), Urban Wood and Sec. Mill Residues, Primary Mill Residues, Corn Cobs, Corn Stover (checked), Rice Straw, Sugar Beets, Sugarcane, and Wheat Straw. Below this, a "Buffer Distance" section has a "Distance (miles)" input field set to 30 and a "Run" button. A large green circular area on the map represents the analysis radius. On the right, two "Bioenergy Resource Analysis Results" windows are shown. The top window has tabs for "Forest Residues", "Corn Stover", and "Summary". The "Summary" tab is active, displaying a table of results. The bottom window has tabs for "Forest Residues", "Corn Stover", and "Summary". The "Forest Residues" tab is active, showing "Conversion Inputs" and "Outputs".

Potential biofuels production from selected feedstocks

Residue Type	Dry Amount	Gallons
Forest Residues	809,775.00	25,467,423.75
Corn Stover	372,126.00	16,224,680.08
Totals	1,181,900.69	41,692,103.83

User selects feedstocks for analysis

User enter radius

Input assumptions; user can change and re-calculate

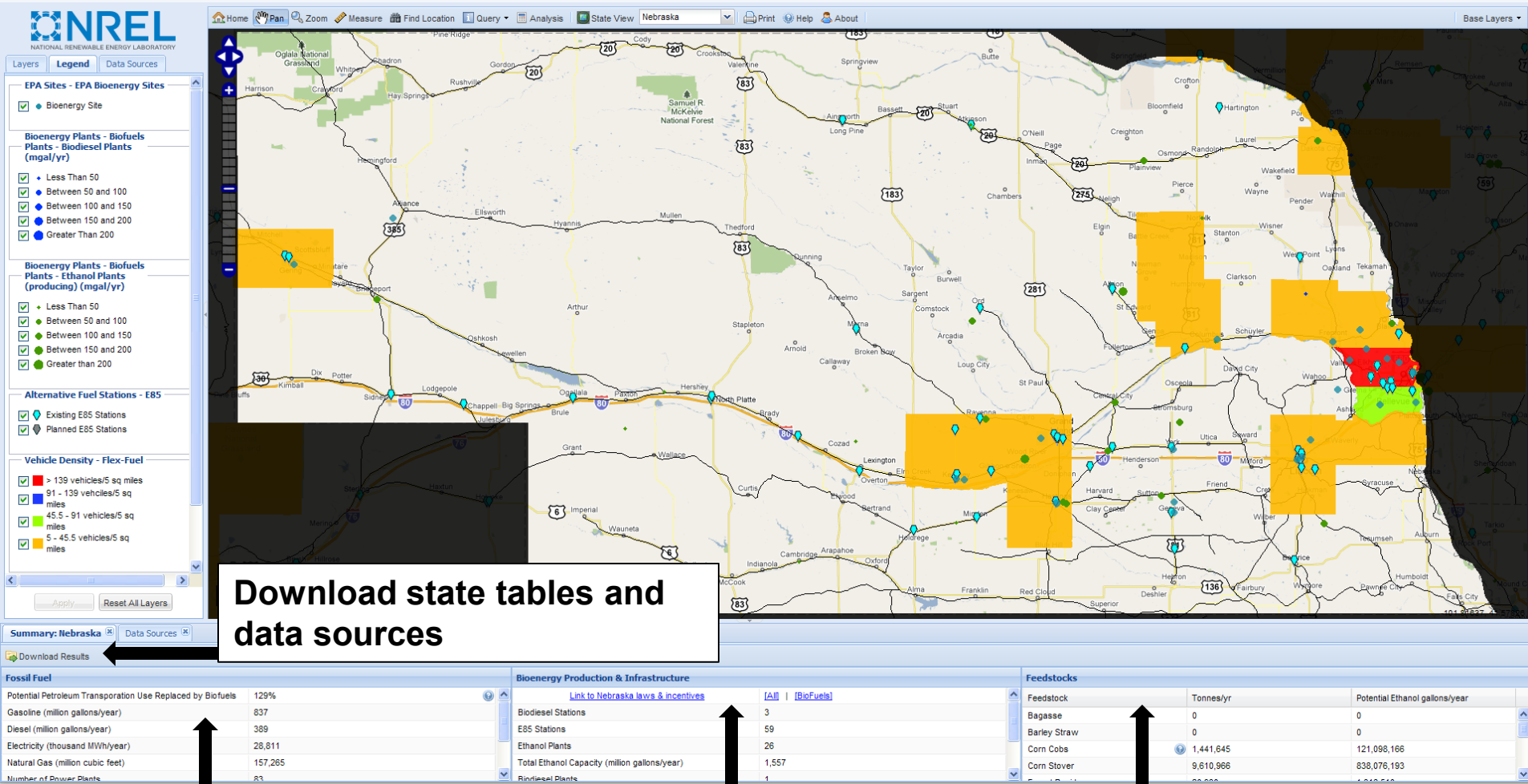
Conversion Inputs	
Available resource (tonnes/year):	809,775.00
Expected Biofuel Yield (gallons/tonne):	62.90
% of Resource Obtainable:	50

Outputs

Potential Biofuel Production (gallons):	25,467,423.75
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Tool sums each feedstock total for each county in radius

Technical Accomplishments-State View



Summary of state fossil fuel use & infrastructure

Summary of state bioenergy production, use & infrastructure

Summary totals for each feedstock and biofuels potential

Relevance

Meeting OBP Missions and Goals of contributing to volumetric targets in RFS

- Provides users the ability to view biomass related data layers; query and download data; analysis for potential biofuels production; and state summaries
- Highlights geographic diversity of feedstock
- Enables users to identify target areas for biofuels project development
- Biofuels Atlas is conducive to maximizing production and use of biofuels
- Tool contributes to OBP goal of strategic communication through web-based tools to increase public awareness of bioenergy

Benefits and Expected Outcomes

- **Low development, updates, and maintenance costs on shared OpenCarto platform**
- **Provide biomass data on an interactive map in an easy to understand format**
- **Assist decision makers on locations of biofuels production facilities and fueling infrastructure to meet RFS**
- **Strong synergy with other EERE program (ex. Vehicle Technologies) due to shared data**
- **Exceptional response from stakeholders (other government agencies, technology owners, project developers, investors, private corporations, universities, state governments, associations)**

Summary

Relevance

- RFS necessitated a need to determine ideal locations for biofuels production and infrastructure; BioFuels Atlas makes these decisions easier

Approach

- Shared Opencarto platform; data from reliable sources and shared with other tools; dynamic updates; feedstock data layers calculated based on logical assumptions and methodologies

Technical Accomplishments

- BioFuels Atlas is live

Success Factors and Challenges

- Over 6,000 users in 3 months; positive stakeholder response

Technology Transfer and Future Work

- Webinars to demonstrate the tool to multiple users groups; future work will add novel bio/renewable diesel data layers; GHG data; Biomass thermal plants; interoperability with KDF; annual data updates and maintenance

Demonstration of BioFuels Atlas

<http://maps.nrel.gov/biomass>

Biofuels Information Center Task

- Biofuels Atlas is part of a larger overall task of Biofuels Information Center
- FY10 funding of \$250,000
- Task Updates EERE' Alternative Fuels and Vehicles Data Center fuels information
 - Blends
 - Feedstock
 - ASTM standards
 - Infrastructure development
 - Production, Consumption, Trade data & information
 - Emissions data
- **AFDC fuels pages receive over 900,000 view per year; it is essential to keep EERE's site populated with current biofuels fuels data and information**
- <http://www.afdc.energy.gov/afdc/fuels/index.html>

Additional Slides-Analysis Calculations

Feedstock	Expected Yield-use this (gallons per tonne)
Sugar beets	27.3
Sugar cane	21.5
Barley Straw	82.7
Corn Cobs	84.0
Corn Stover	87.2
Rice Straw	84.8
Bagasse	86.0
Wheat Straw	74.4
Primary Mill Residues	82.2
Secondary Mill Residues and Urban Wood	82.2
Forest Residues	62.9

- Yields are 70% of EERE Theoretical Ethanol Calculator Yields
- Potential Biofuels Yield (million gallons) = available resource (tons of feedstock in counties in selected radius) x expected yield x % obtainable (defaults to 50%--assumes project can obtain half the available resource)
- User can change all inputs to see how yield and % obtainable impact potential biofuels production

Additional Slides-Feedstock Calculations

Crop Residues

- Crop production (tons) x residue ratio x % dry matter x 0.35 (% removed)

Methane

- *Manure Equation 1:* Volatile Solids per animal type=animal population x animal weight x volatile solids for animal type
- *Manure Equation 2:* Methane production = Equation 1 x max methane producing capacity (ft³/lbs volatile solids) x methane conversion factor x % of animal types manure management system
- *Wastewater:* Methane=county population x BOD per capita per year x % BOD anaerobically digested per year x methane generation potential

Secondary Mill Residues

- *For Pallet/Lumber:* Residues=# of companies in country x 300 (avg wood waste per year) x 0.9072 (conversion to metric tons)
- *Woodworking Co's:* Residues=# of companies in country x avg wood waste (based on # of employees) x 0.9072 (conversion to metric tons)

Urban Wood Waste

- *Utility/Tree Co's:* Single tree crew harvest 1,000 tons per year
- *Construction/Demolition:* Residues=0.09 (tons/yr/person) x population

Publications and Presentations

BioFuels Atlas Access

- <http://maps.nrel.gov/biomass>
- <http://maps.nrel.gov/bioenergyatlas>
- <http://maps.nrel.gov>
- Press release: <http://www.nrel.gov/news/press/2010/891.html>

Presentations

- International Biomass Conference, May 2010
- USDA Biofuels Committee, July 2010
- DOE/UL/EPA Networking Group, September 2010
- EPA Region 10 Biofuels Tools Workshop, September 2010