

# Critical Infrastructure Data R&D: LandScan USA, HIFLD Support, & Foundation Energy Data

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ORNL is managed by UT-Battelle, LLC for the US Department of Energy

# Critical Infrastructure (CI) Data Development

- Leverage existing internally developed spatial databases to create accurate & authoritative national critical infrastructure data layers
  - ✓ Schools: Public/Private K12; Higher Education (2009 - Present)
  - ✓ Prisons/Correctional Institutions (2009 - Present)
  - ✓ Rail: Network (routable), Rail Yards, Rail Tunnels (2009 – 2016)
  - ✓ Day care point database (2010 – Present)
  - ✓ Solid Waste Facilities (2012 - Present)
  - ✓ Mobile Home Parks (2012 - Present)
  - ✓ Hospitals (2013 - Present)
  - ✓ Energy Infrastructure Data (2013 - Present)
  - ✓ Major Sports Venues (2014 - Present)
  - ✓ National Shelters (2015)
  - ✓ Nursing Homes/Assisted Living (2015 - Present)
  - ✓ Fixed Rail Transit (2015)
  - ✓ Law Enforcement (2017 - Present)
  - ✓ Colleges & Universities Polys (2017 - Present)
  - ✓ Convention Centers (New in 2018)



Homeland Infrastructure Foundation-  
Level Data Subcommittee



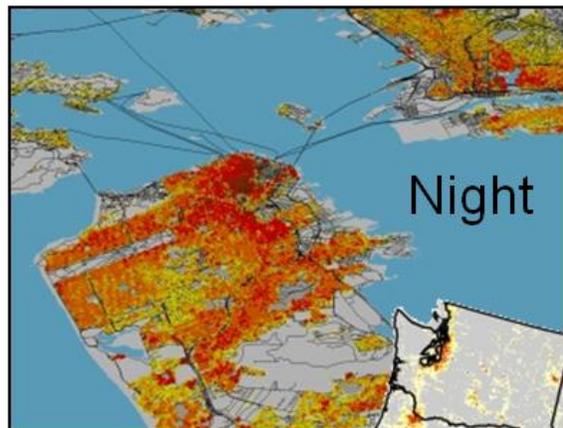
DHS Geospatial Management Office



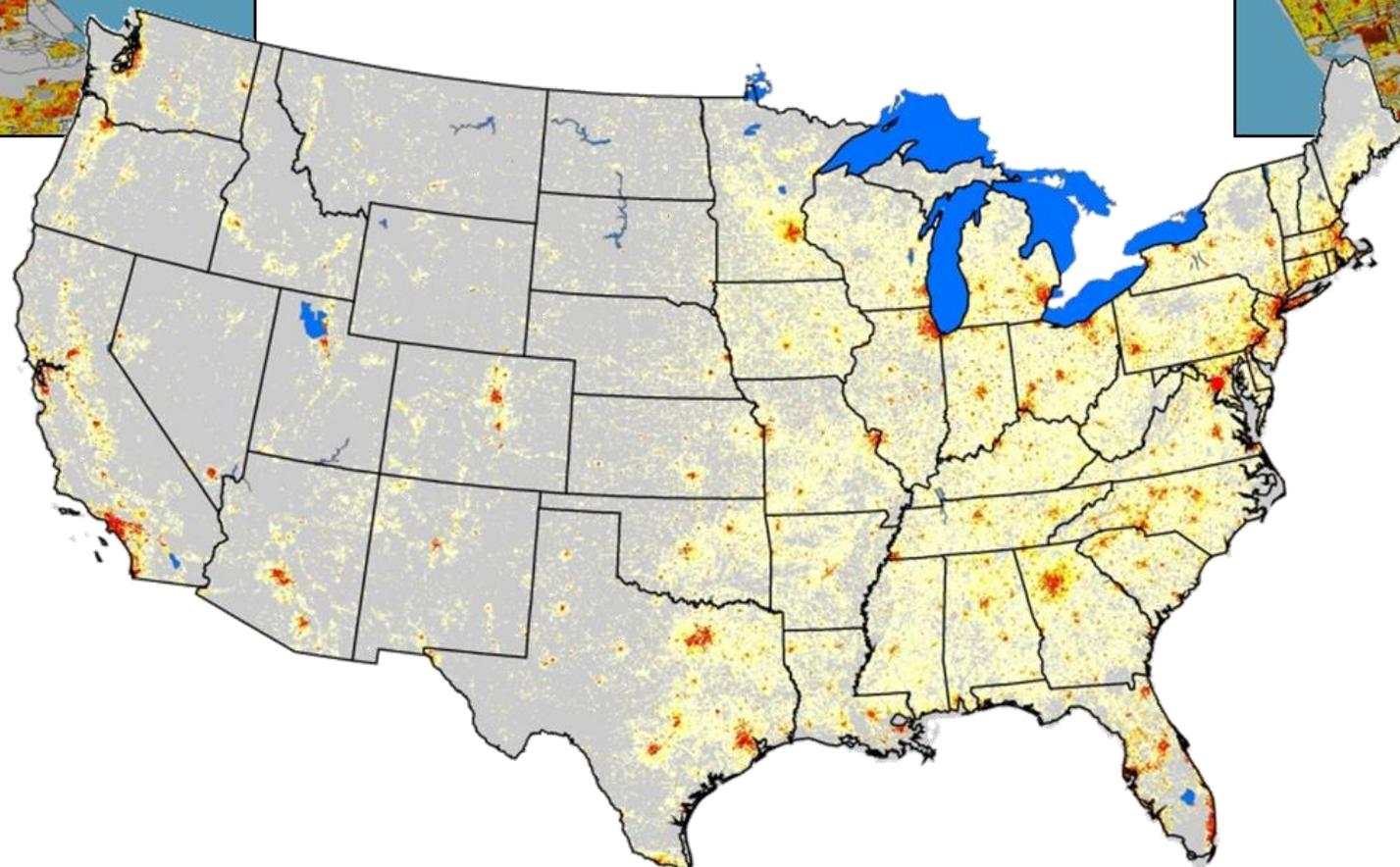
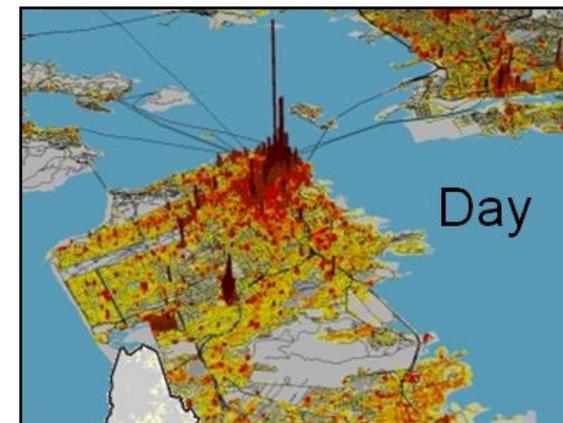
Office of Geography for the  
North American Geography Branch (SFGAH)



# Why ...



## LandScan USA





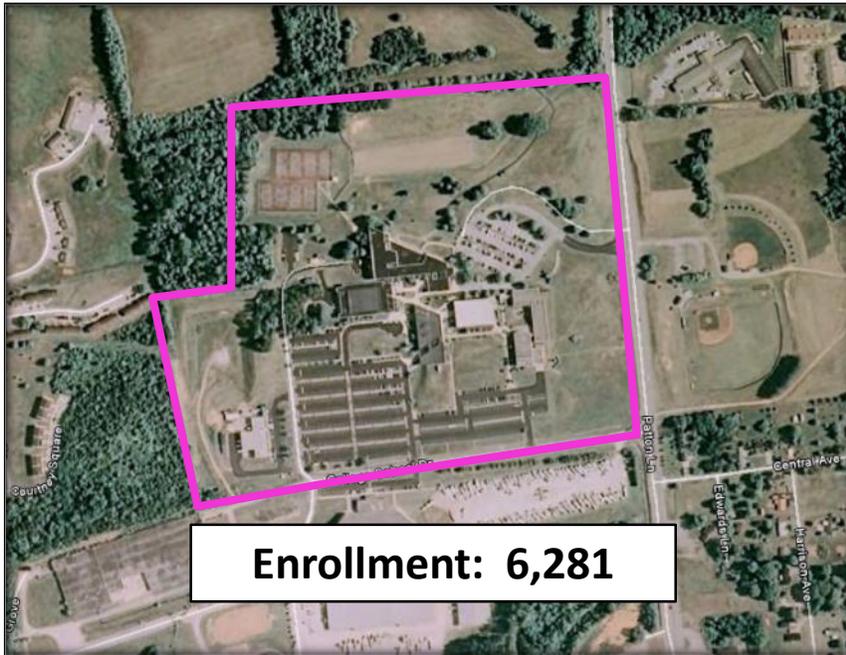
# Schools: K-12 and Higher Education

- Three National Schools Layers: Public (K-12), Private (K-12) and Colleges & Universities
- US Department of Education, NCES is the authoritative data source updated annually:
  - CCD: *Common Core Data* for Public (K-12)
  - PSS: *Private School Survey* for Private (K-12)
  - IPEDS: *Integrated Postsecondary Education Data System* for Colleges and Universities
- School point geo-located on building
- American Red Cross/FEMA NSS shelter ids conflated to respective school layer
- Selected DCIP, BEI, and IICD attributes included in school layers

# Colleges and Universities

## Multiple Campuses – One Enrollment

NCES & HIFLD College & University Layer  
One record for  
Roane State Community College:



Roane State Community College website navigation menu:

- Our Programs
- Student Resources
- Why Roane State
- Locations**
- Apply Now!
- Faculty/Staff
- Alumni/Community
- Workforce Connections

- Roane State Has Campuses In:**
- » [Roane County \(Main Campus\)](#)
  - » [Oak Ridge](#)
  - » [Campbell County](#)
  - » [Cumberland County](#)
  - » [Fentress County](#)
  - » [Knox County \(Center for Health Sciences\)](#)
  - » [Loudon County](#)
  - » [Morgan County](#)
  - » [Scott County](#)



# Day Care Centers: MOTIVATION

- No National Level Day Care Database exists
- Day Care Centers house one of the most vulnerable population (6 weeks - 5+ years)
- Around 9% of the total population are in Day Care at a given point of time

# Day Care Centers: DATA SOURCES

- Over 53 Data Sources
- Data for 35 States Publically Available

State of Alaska > Health & Social Services



PA.GOV



The Official Website of the Executive Office of Education (EDU)

Education

Mass.Gov Home State Agencies State Online Services



Supporting Hawaii's Child Care Needs



WYOMING DEPARTMENT of



Family Services

*Make a Difference*

# Day Care Centers: DATA FORMATS

**ABC Learning Center Lic. #753**  
 Wanona Phillips, Owner/Director  
 Kimbly Phillips, Owner/Infant/Toddler Director  
 151 East Park Street, Carson City, 89706  
 Telephone: (775) 841-7223  
 Center/Nursery: 75 Children  
 20 children Birth-2yrs  
 55 children 2-5

**Capital Christian Child Development Center South Lic. #728**  
 Capital Christian Child Development Center Owner  
 1600 Snyder Avenue, Carson City, 89701  
 Telephone: (775) 883-1478  
 Preschool: (775) 883-3355  
 Kristi Callahan, Center Director  
 Capital Christian Child Development Center  
 Capacity: 110 Children

● **PDFs, Text, Documents, Spreadsheets, WebPages**

● **CIS Format – 4 States – DC, LA, FL, WA**

M	ALL STARS PRESCHOOL	PRE8966	301 N 27th St	Capacity: 11	Days of Week Open: MTWTFH
A	ANGELA KONEN	Preschool	Ashland NE 68003	Ages: 2 YRS To 6 YRS	Hours: 0800 To 1500
Li	(402) 944-2078	01/31/2008		If a "N" appears or the space is blank after the question, the licensee does not have a contract, or is not accredited. Accepts Child Care Subsidy through DHHS? Accredited?	
16	BRIGHT BEGINNINGS	FII7061	1218 CLAY ST	Capacity: 12	Days of Week Open: MTWTF
Te	JULIE JUDY	Family Child Care Home II	ASHLAND NE 68003	Ages: 6 WKS To 12 YRS	Hours: 0700 To 1800
M	(402) 944-3295	03/27/2003		If a "N" appears or the space is blank after the question, the licensee does not have a contract, or is not accredited. Accepts Child Care Subsidy through DHHS? Y Accredited?	
C	Thurlow Rowe	White Mountains Community College Child Care Center	CCCB-02137 Center Based Program License	09/30/2012	45 0 3 0 Low High
N	15 Twichell Lane Berlin NH 03570 (603) 752-5550	Director Jane Leblanc			Days of Week Open: MTWTFHS To 12 YRS To 1800
	Thurlow Rowe	White Pine Montessori	CCCB-05915 Center Based Program License	08/31/2011	15 0 32 0 Low High
	2445 Main Street Bethlehem NH 03574 (603) 869-2468	Director Susan Blais			Days of Week Open: MTWTF To 13 YRS To 1800
		Director Erin Woo			Accepts Child Care Subsidy through DHHS? Accredited?

# Day Care Centers: CLASSIFICATION

- What types of Day Care Centers to include/exclude?
- Over 100 'Types' of Day Care Centers
- Can be Grouped into 5 major types:
  - Day Care Centers
  - School Child Care
  - Church Based
  - Group Home Child Care
  - Family Home Child Care

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  - ✓ Day care point database
  - ✓ Solid Waste Facilities
  - ✓ Hospitals
  - ✓ Major Sports Venues
  - ✓ Nursing Homes/Assisted Living
  - ✓ Law Enforcement
  - ✓ Colleges & Universities Polys
  - ✓ Convention Centers

# Mobile Home Parks

- Population residing in Mobile Homes are the most vulnerable to hurricanes, flooding, tornadoes, and other natural disasters
- National Mobile Homes was a gap in HIFLD data holdings (and the LSUSA model)
- Data Fusion Approach:
  - Open Source Knowledge Discovery to target geolocations
  - Existing government ancillary datasets
  - Novel and evolving image processing using NGA HR Ortho collection

# Mobile Home Parks

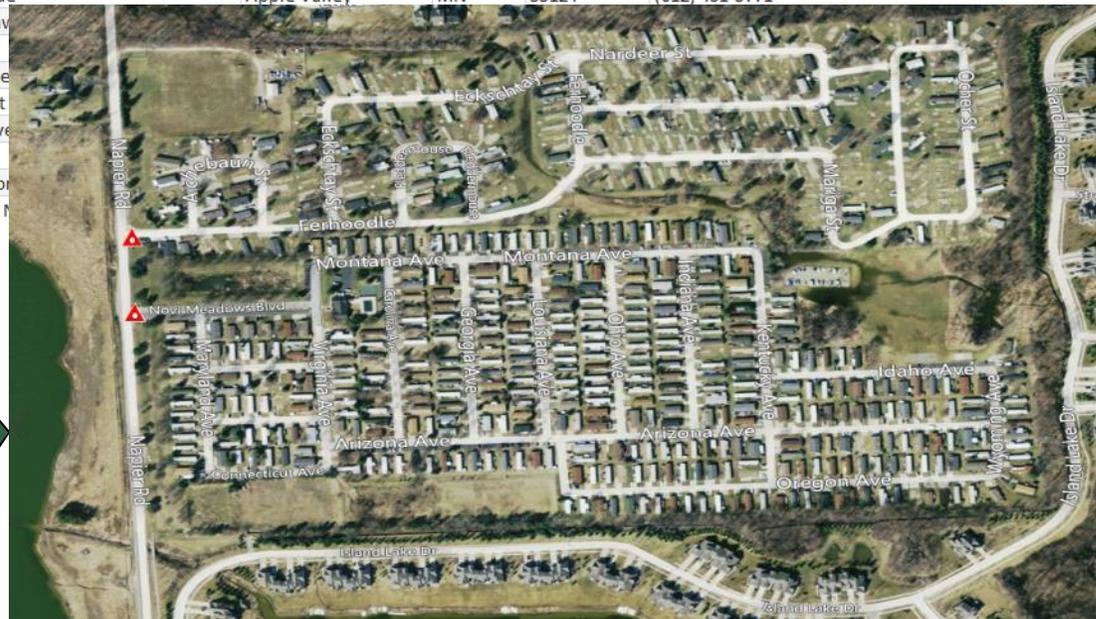
## Open Source Data Collection:

File Edit Format View Help  
 Name, Address, City, State, Zip, Phone, Fax, Misc  
 Thompson Mobile Home Park, 39625 Deer Street, PO Box 174, Aitkin, MN, 56431, (218) 927-3320, Fax: (218) 927-1866  
 Rainbow Terrace Mobile Home, 1714 Margaretha Avenue, Albert Lea, MN, 56007, (507) 373-8017  
 Oak Terrace Estates, 6545 Highway 10 Northwest, Anoka, MN, 55303, (612) 421-6540  
 Apple Valley Estates, 13001 Pennock Avenue, Apple Valley, MN, 55124, (612) 454-2727  
 Cedar Knolls, 12571 Garland Avenue, Apple Valley, MN, 55124, (612) 431-5771  
 Wheel Estates Inc, 3700 3rd Place Southwest, Austin, MN, 55912, (507) 433-3134  
 Stinar's Whispering Pines, Highway 2 west, Bagley, MN, 56621, (218) 694-2481  
 Birchlane Mobile Home Park, 507 Jefferson Avenue Northwest, Bemidji, MN, 56601, (218) 751-8869  
 Elpine Mobile Home Court, 5901 Highway 2 west, Bemidji, MN, 56601, (218) 751-8184  
 Hillcrest Manor, 755 Paul Bunyan Drive Northwest, Bemidji, MN, 56601, (218) 751-5699  
 Mississippi Mobile Home Park, RR 2 Box 149A, Bemidji, MN, 56601, (218) 751-7891  
 North 71 Mobile Home Park, 11430 Highway 71 North, Bemidji, MN, 56601, (218) 751-2789  
 Skyline Village Mobile Park, 2601 Delton Avenue Northwest, Bemidji, MN, 56601, (218) 751-1419  
 Southview Mobile Home Park, 1018 Washington Avenue southeast, Bemidji, MN, 56601, (218) 751-5699  
 Westwood Acres, 755 Paul Bunyan Drive Northwest, Bemidji, MN, 56601, (218) 751-5699  
 Castle Towers Inc, 24355 Highway 65 Northeast, Bethel, MN, 55005, (612) 434-5656  
 Blaine International Village, LLC, 10454 Central Ave NE, Blaine, MN, 55424, 763-784-2566, Fax: 763-785-9464, http://www.mhville.com

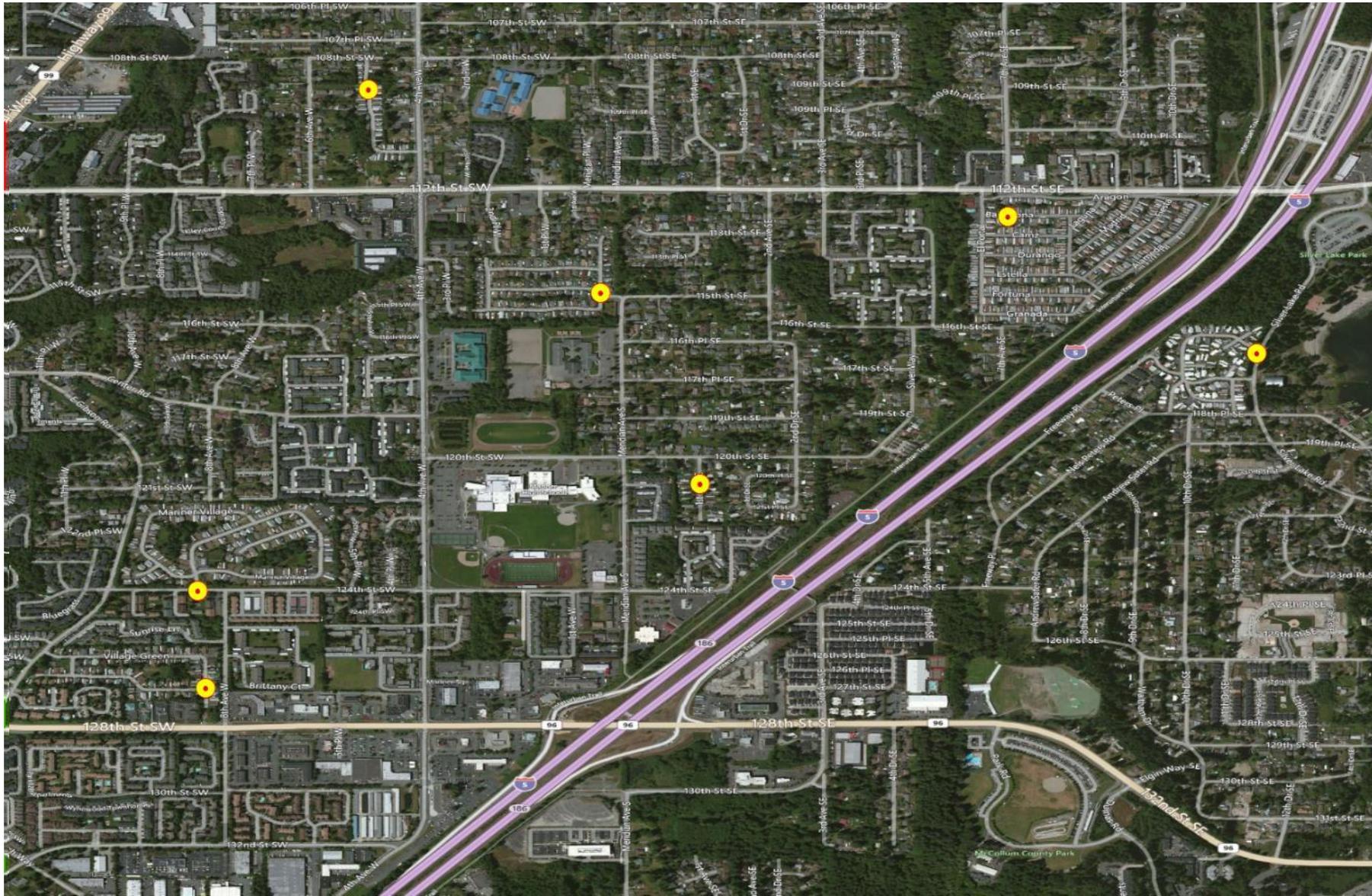
Transform

Name	Address	City	State	Zip	Phone
Thompson Mobile Home Park	39625 Deer Street	Aitkin	MN	56431	(218) 927-3320
Rainbow Terrace Mobile Home	1714 Margaretha Avenue	Albert Lea	MN	56007	(507) 373-8017
Oak Terrace Estates	6545 Highway 10 Northwest	Anoka	MN	55303	(612) 421-6540
Apple Valley Estates	13001 Pennock Avenue	Apple Valley	MN	55124	(612) 454-2727
Cedar Knolls	12571 Garland Avenue	Apple Valley	MN	55124	(612) 431-5771
Wheel Estates Inc	3700 3rd Place South				
Stinar's Whispering Pines	Highway 2 West				
Birchlane Mobile Home Park	507 Jefferson Avenue				
Elpine Mobile Home Court	5901 Highway 2 West				
Hillcrest Manor	755 Paul Bunyan Drive				
Mississippi Mobile Home Park	RR 2 Box 149A				
North 71 Mobile Home Park	11430 Highway 71 North				
Skyline Village Mobile Park	2601 Delton Avenue North				

Geolocate

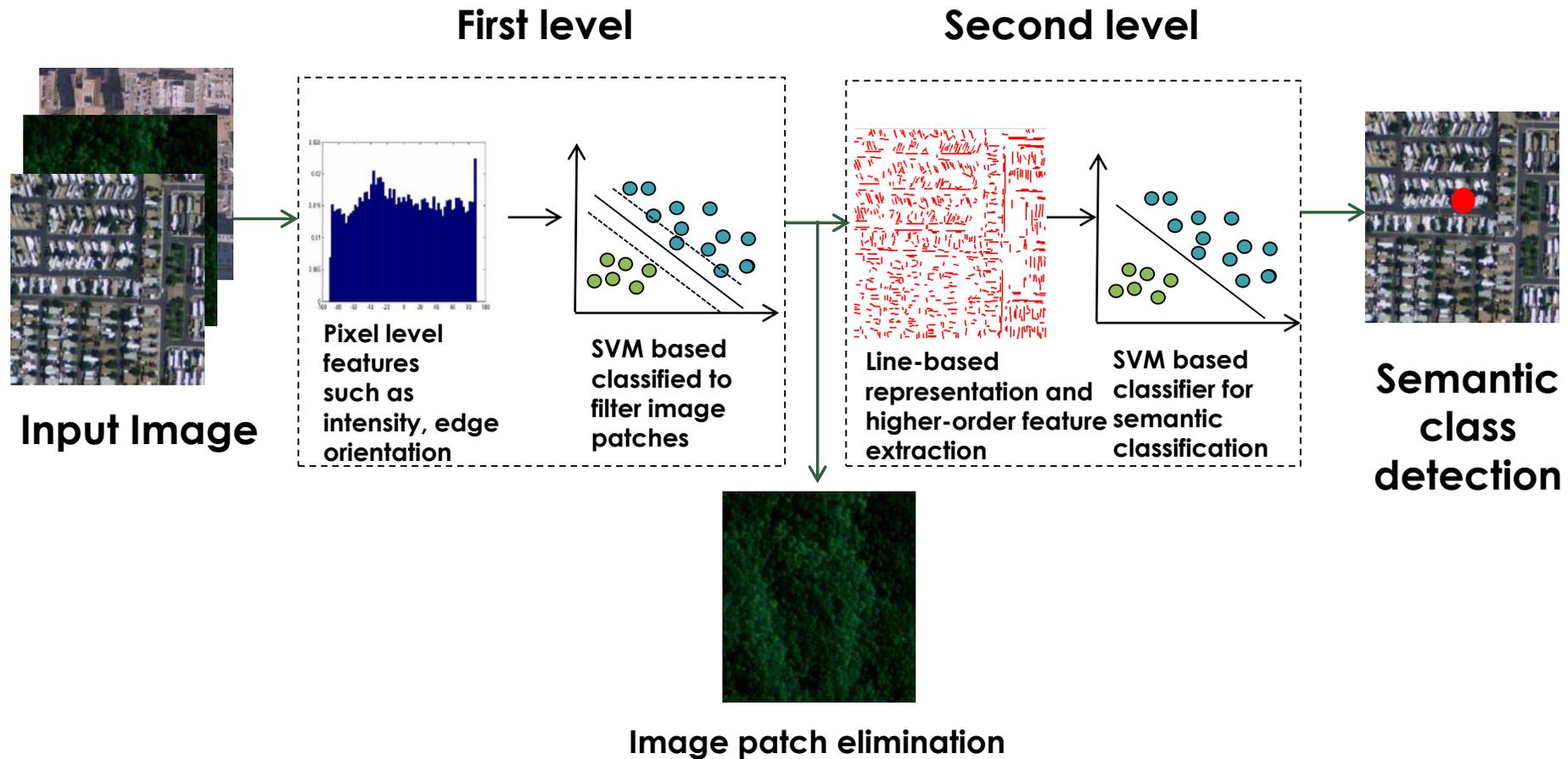


# Mobile Home Parks

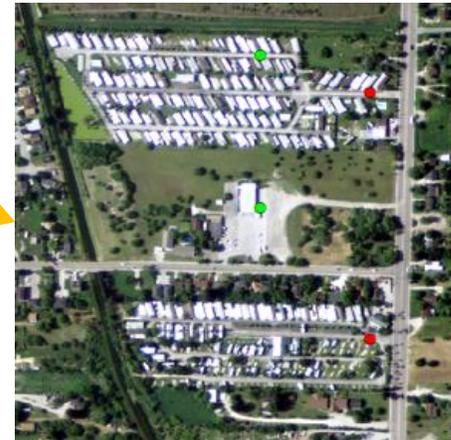
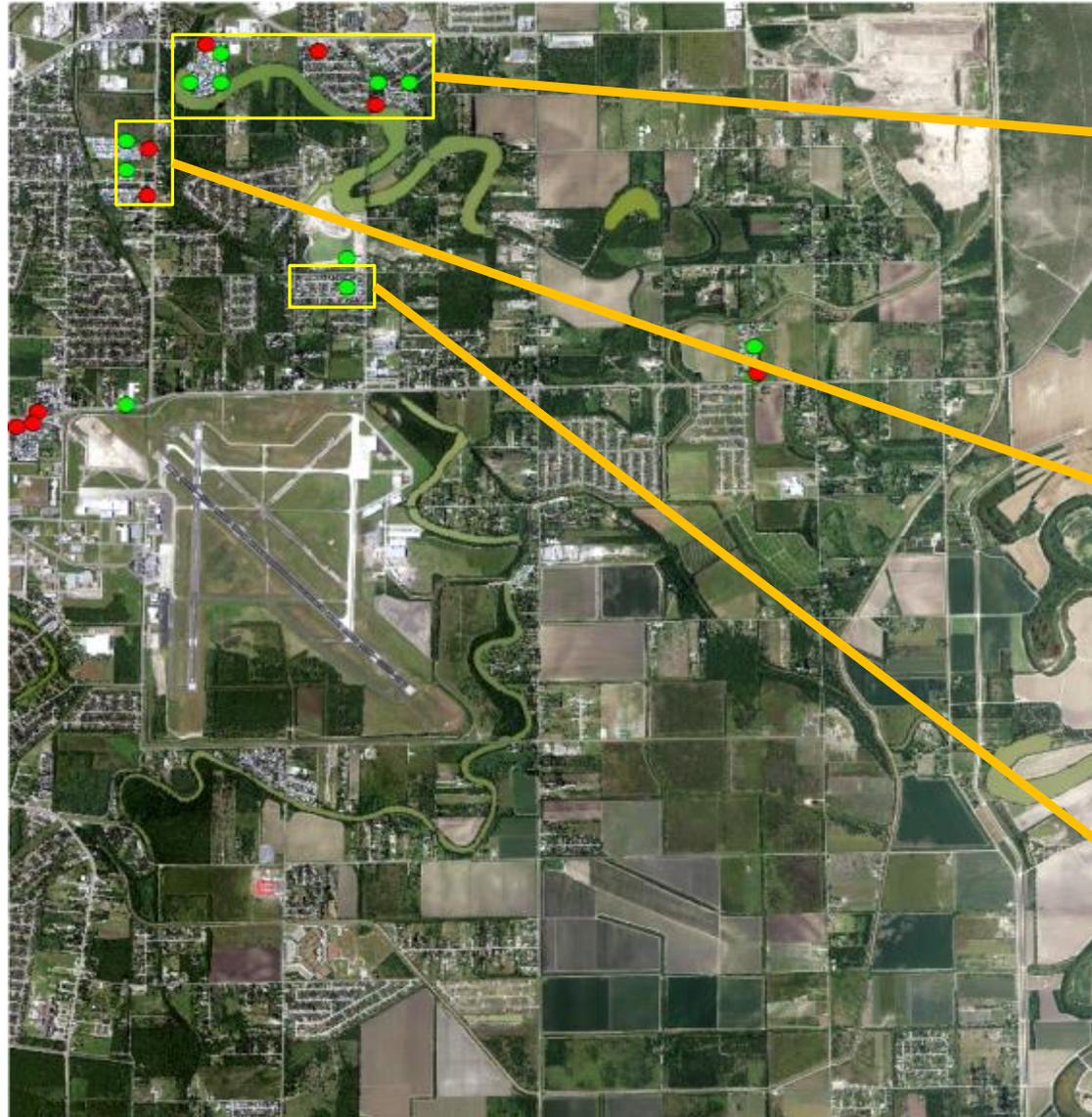


# Mobile Home Parks

## Image Processing: Multi-level Analysis



# Mobile Home Parks



● Database point

● Detected point



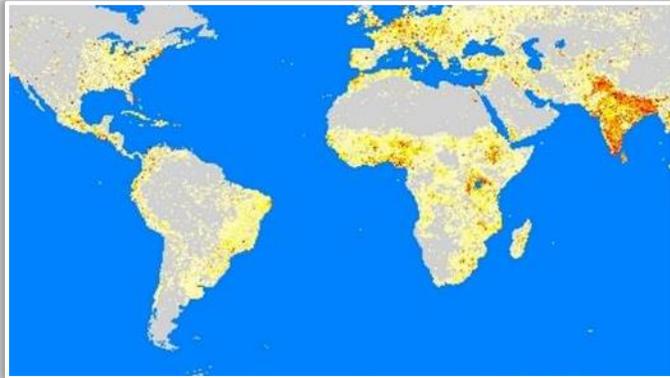
# LandScan: Global, USA, HD

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# LandScan Population Project

Improving Knowledge of Population Distribution and Dynamics Around the World

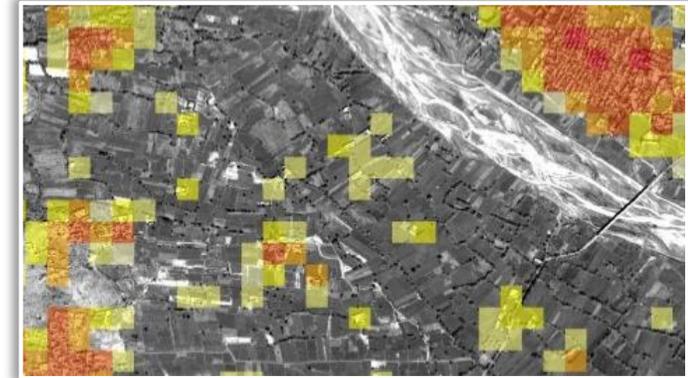
LandScan Global



LandScan USA



LandScan HD



**Spatial Resolution**

30 arc-seconds (~1km)

**Temporal Resolution**

Ambient (24 hour average)

**Modeling Framework**

Top-down (census dependent)

**Approach**

Remote sensing-based global data modeling and mapping

3 arc-seconds (~90m)

Daytime and nighttime

Hybrid top-down/bottom-up

Integration of infrastructure and activity databases

3 arc-seconds (~90m)

Ambient; daytime and residential distributions on request

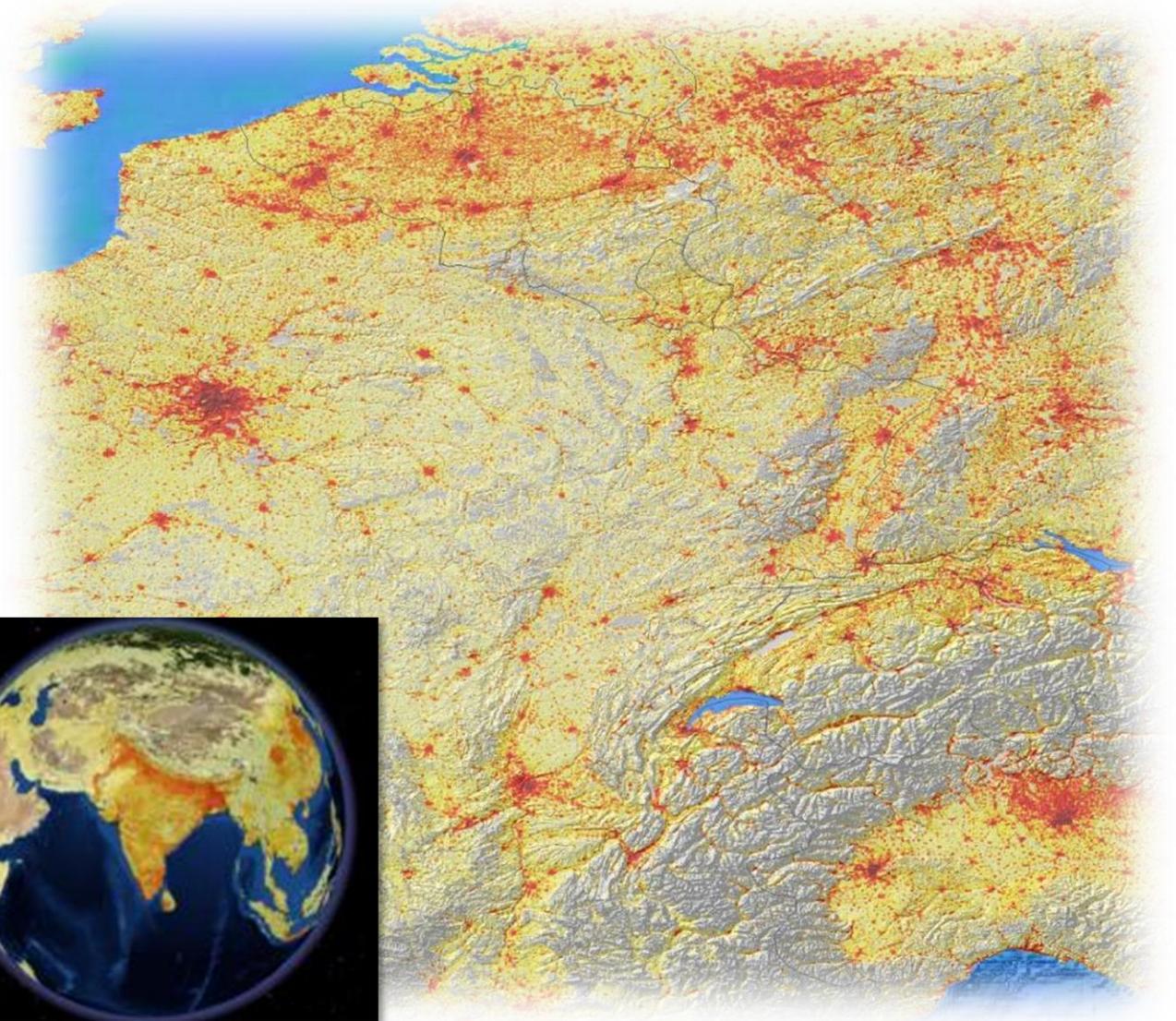
Bottom-up (census independent)

Data fusion: High resolution building extraction, occupancy data, land use, and POI

# LandScan Global

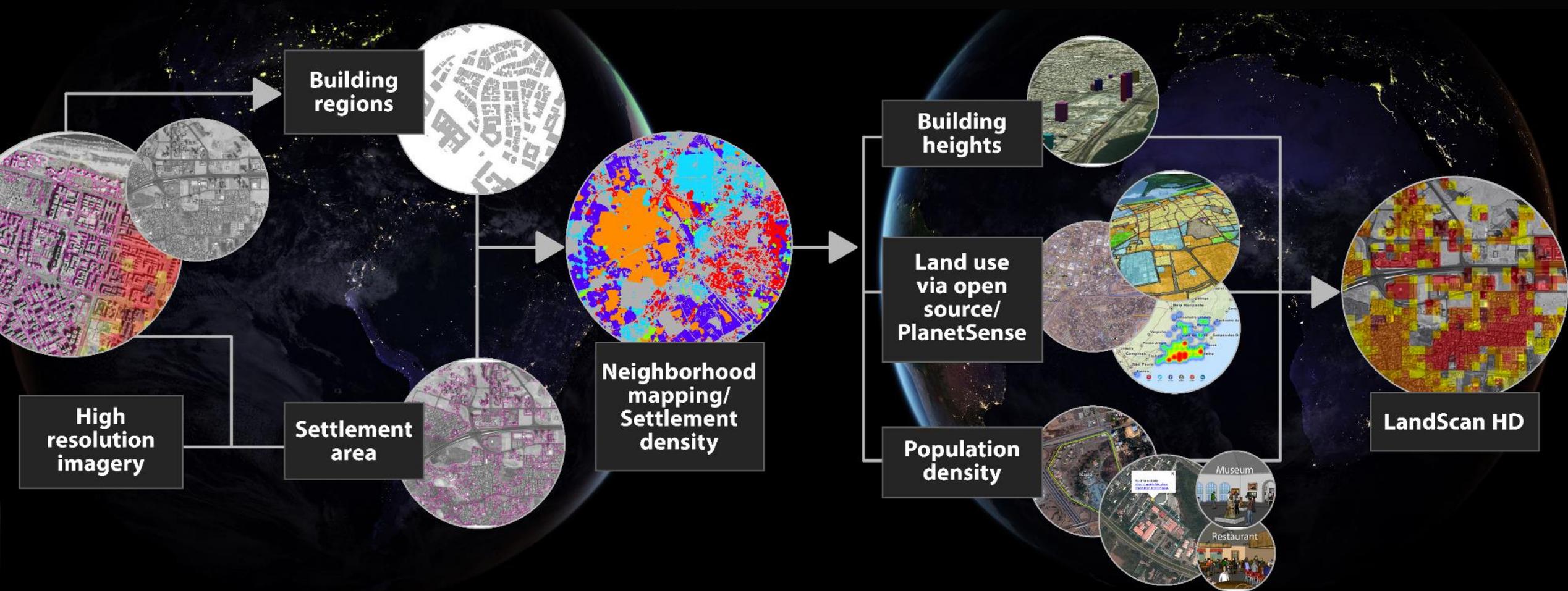
More realistic population distribution for consequence assessment

- “Unwarned population”
  - Spatial resolution of 30 arc seconds (~1km)
  - Ambient population (average over 24 hours)
  - Remote sensing based global data modeling and mapping
- Annual Improvements
  - New census information and mid-year population estimates
  - Exploit new spatial data and imagery



# LandScan HD: High Resolution Population Distribution and Dynamics

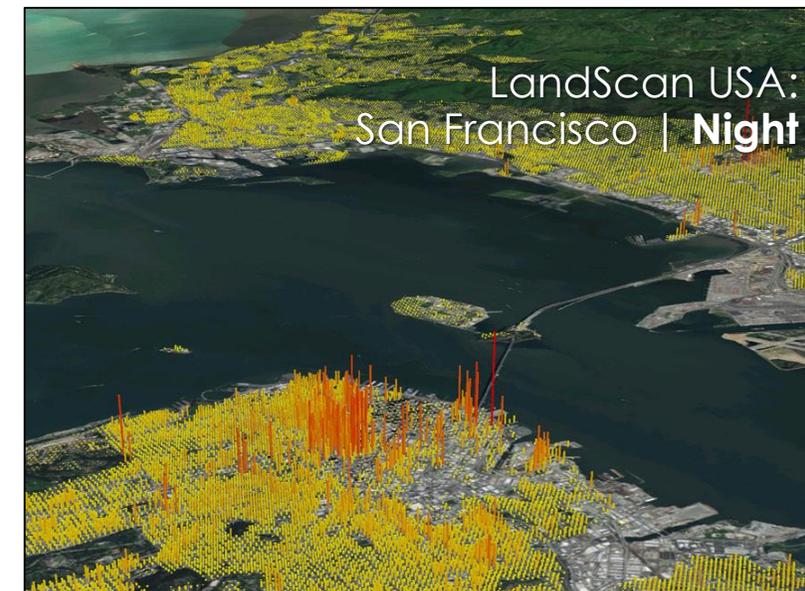
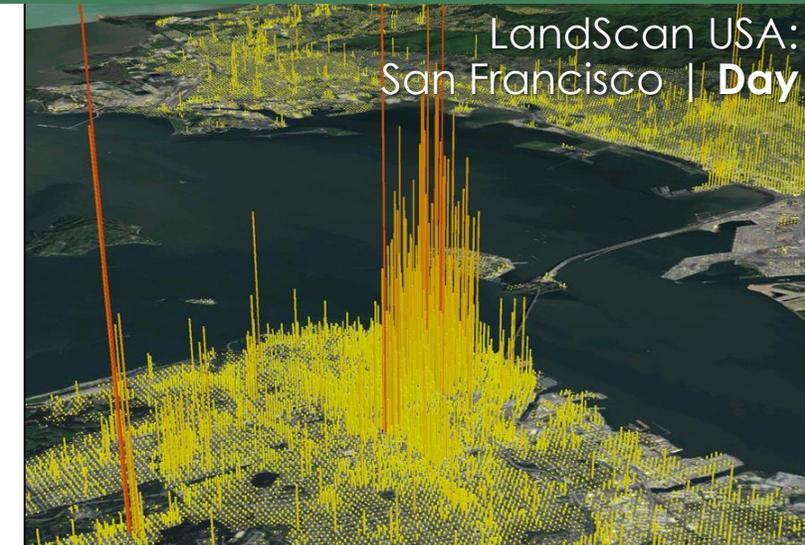
*Big Data Fusion*



# LandScan USA

## High Resolution Spatiotemporal Population Distribution for the U.S.

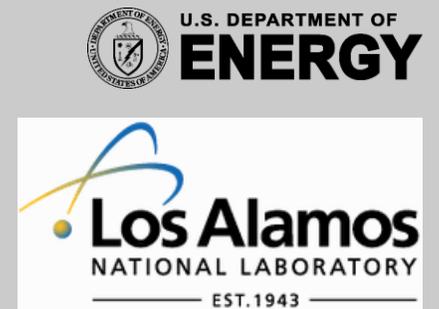
- Captures diurnal variations of population:
  - Nighttime baseline includes residential and prisoner populations
  - Sub-models for daytime population components:
    - Workers, Students, Daycare, Prisoners, Shoppers, Stay-at-home, Socioeconomic/Demographic Data
- Extensible for special events and tourist location scenarios
- U.S. Govt. foundation-level data: distributed via HIFLD Secure; for use by govt. agencies, primarily for emergency preparedness and response
- **New release:** LandScan USA 2017 (rel. July 2018)



# Foundation Energy Data NGA, DOE, ORNL, INL, LANL, and ANL Partnership



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# Foundation Energy Data Partnership

## Foundation Energy Data

### Objective:

The overall objective of this effort is to develop Government Off-The-Shelf (GOTS) FOUNDATION ENERGY DATA layers composed of electric grid, natural gas and petroleum infrastructure that will be shareable across all levels of government for:

- Homeland Security
- Homeland Defense
- Emergency Preparedness, Protection, Prevention, Mitigation, Response and Recovery
- Energy modeling and simulation community.





# Foundation Energy Data Partnership

## ASSESSMENT OF THE FEASIBILITY OF A GOVERNMENT ENERGY DATA LAYER

Submitted by

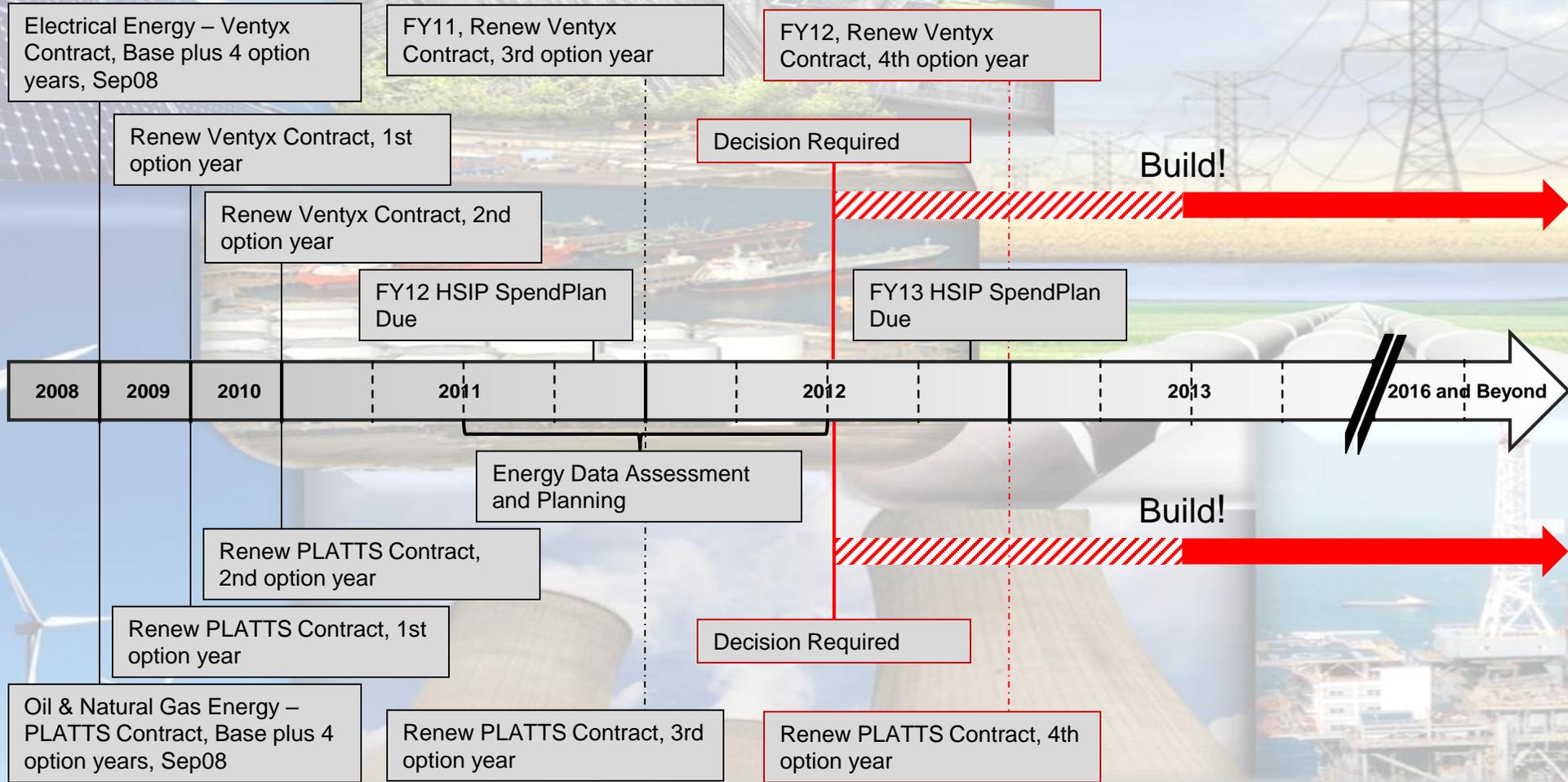
Oak Ridge National Laboratory  
Idaho National Laboratory  
Argonne National Laboratory

December 10, 2012





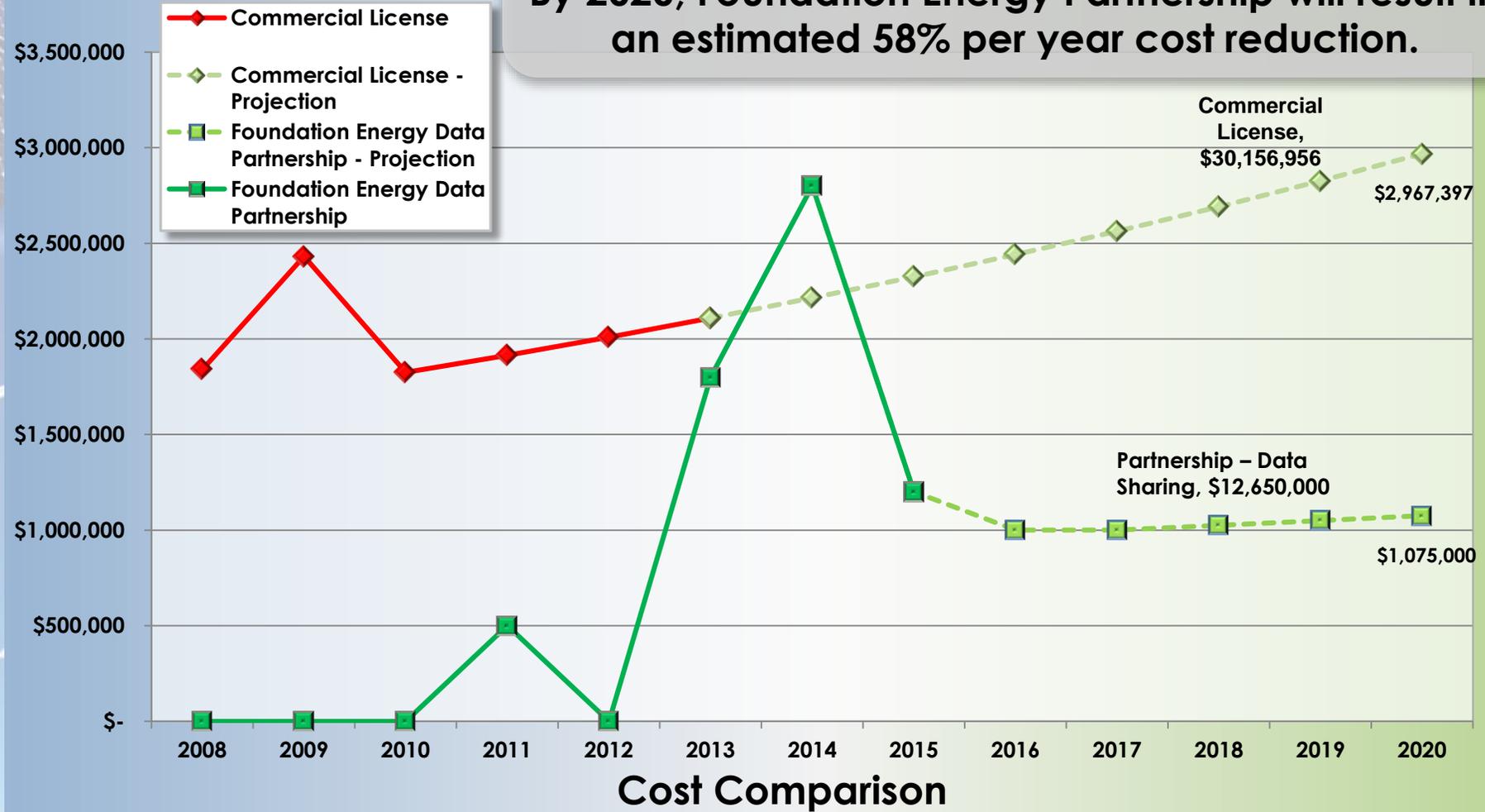
# Foundation Energy Data Partnership





# Foundation Energy Data Partnership

By 2020, Foundation Energy Partnership will result in an estimated 58% per year cost reduction.





# Foundation Energy Data Partnership



**Model and Processes**  
 Power Flow  
 Pipeline Flow  
 Smart Grid  
 ...

**Data Sources**  
 OpenStreetMap  
 NPMS  
 Open Source  
 ...

Predictions/  
Forecasts

**Decision Support**  
 ...  
 ...  
 ...

Infrastructure /  
Mapping

**Values and Benefits**

Situational Awareness

EA Analysis

Smart Grid M&S Base

Partnerships

Inputs

Infrastructure / Mapping

Outcomes

Impacts

*Enabling the Mission*



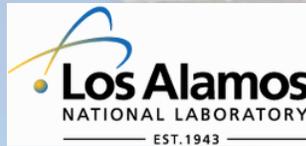


# Foundation Energy Data Partnership

## Content - Electric

Feature Layer	Geometry
Power Plant	Point
Transmission Lines	Line
Substation Points	Point
<del>Flowgate Lines</del>	<del>Line</del>
<del>Flowgate Points</del>	<del>Point</del>
FERC Regions	Polygon
NERC Regions	Polygon
NERC Reliability Coordinators	Polygon
Holding Company Areas	Polygon
Control Areas	Polygon
Distribution Control Facilities	Polygon
Planning Areas	Polygon
Retail Service Territories	Polygon
Independent System Operators	Polygon

**Delivered  
30 Sep 2015**





# Foundation Energy Data Partnership

## Content – Natural Gas/Petro

**Delivered  
30 Jun 2016**



Feature Layer	Geometry
Natural Gas Compressor Stations	Point
Oil Refineries	Point
POL Terminals	Point
Oil-Gas Platforms	Point
US Shipping Fairways	Polygon
NG Imports – Exports	Point
Strategic Petroleum Reserves	Point
NG/POL Pipelines	Line
Ethanol Transloading Facilities	Point
Petroleum Ports	Point

	Geometry
NG Processing Plants	Point
NG Receipt - Deliveries	Point
NG Storage Facilities	Point
NG Service Territories	Polygon
Biodiesel Plants	Point
Ethanol Plants	Point
NG-LNG Import Terminals	Point
Gas Meter Stations	Point
Oil-Gas-Wells	Point
POL Pump Stations	Point
Oil-Gas Fields	Polygon
Oil-Gas Interconnects	Point



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