

Unleashing climate and energy knowledge with Linked Open Data

Clean Energy Solution Center Webinar, 12.03.2013

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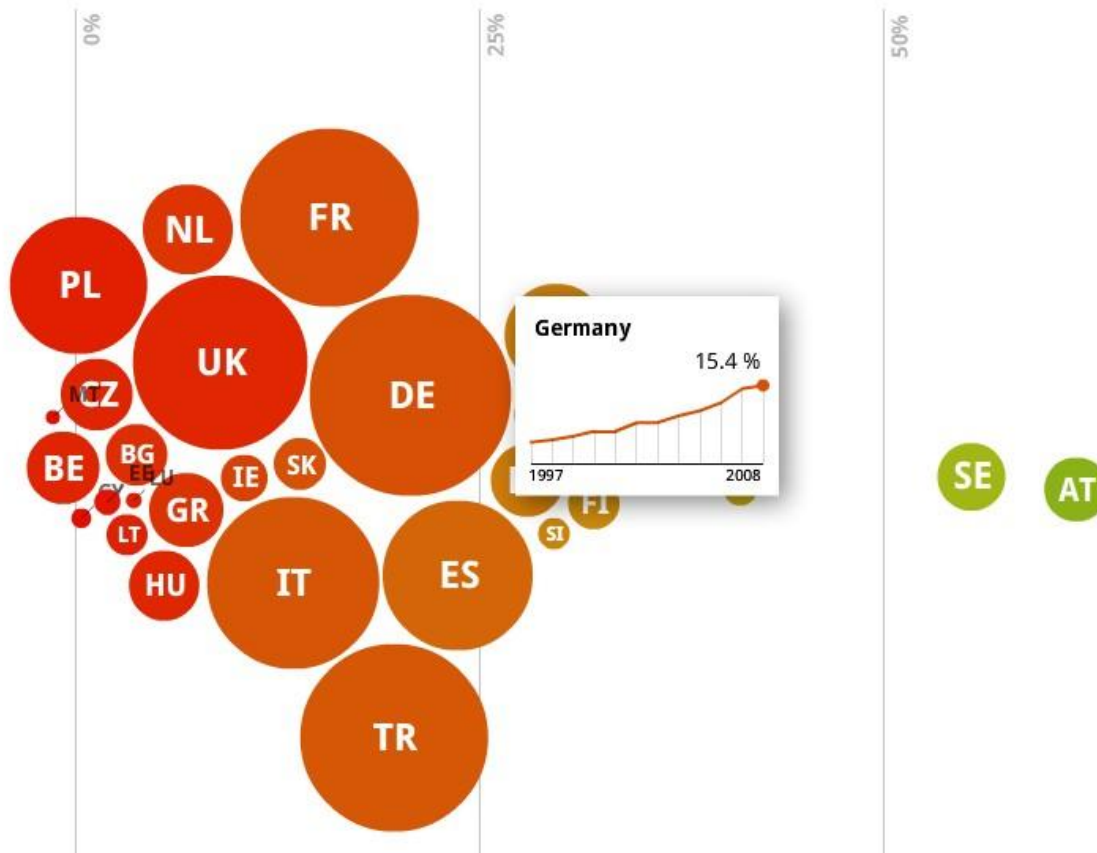


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<http://creativecommons.org/licenses/by/3.0>

We use data for ...

Electricity Generated from Renewable Sources

Percent of gross electricity consumption



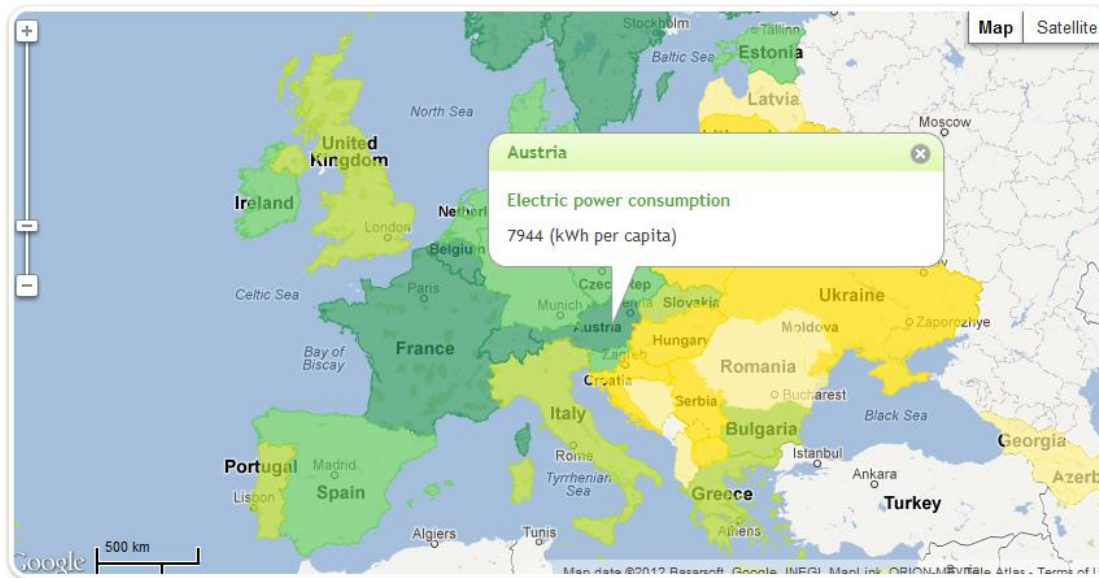
We use data for ...

Energy Statistics

Europe

Electric power consumption (kWh per capita)

2009

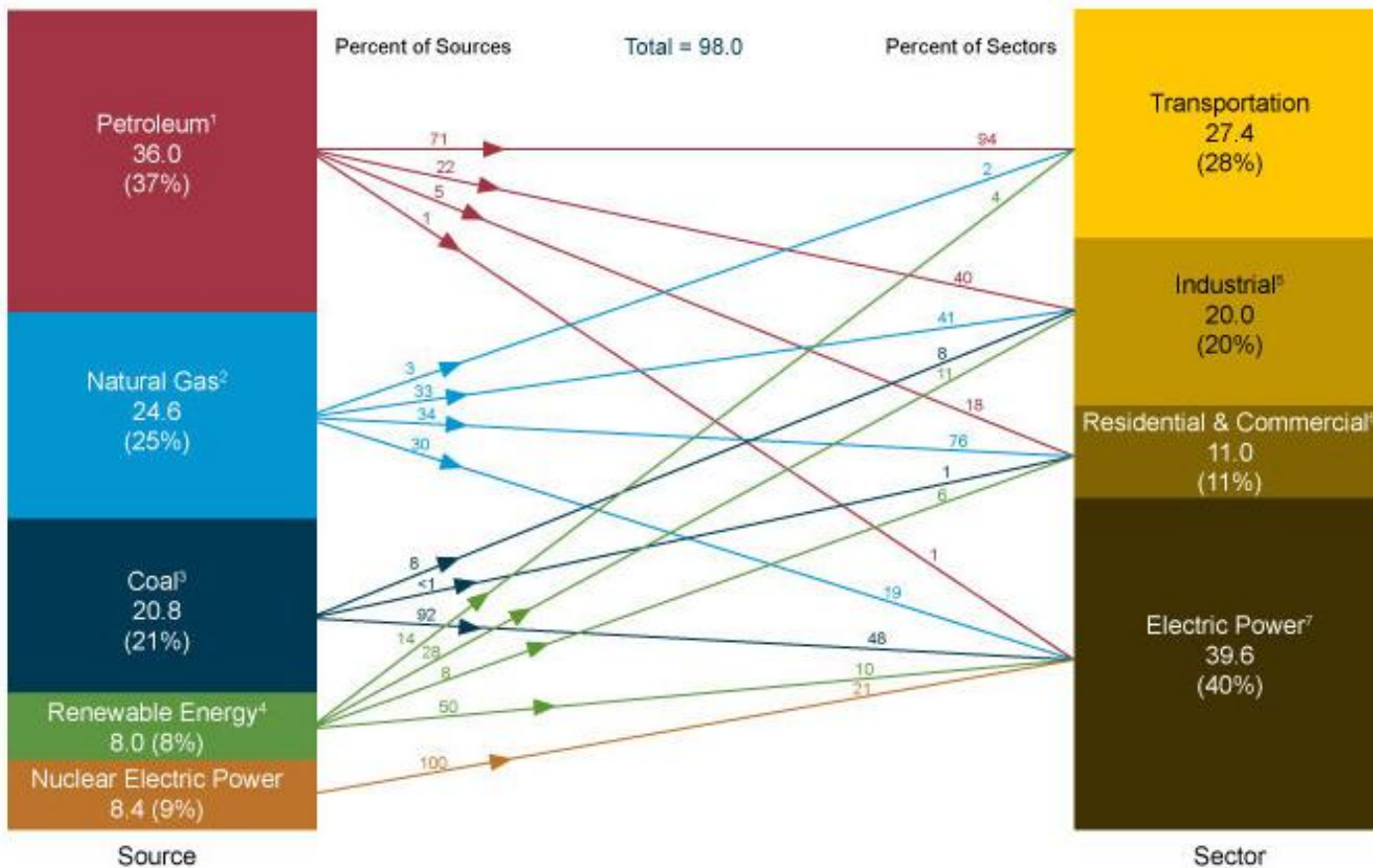


Source: Statistics - Worldbank

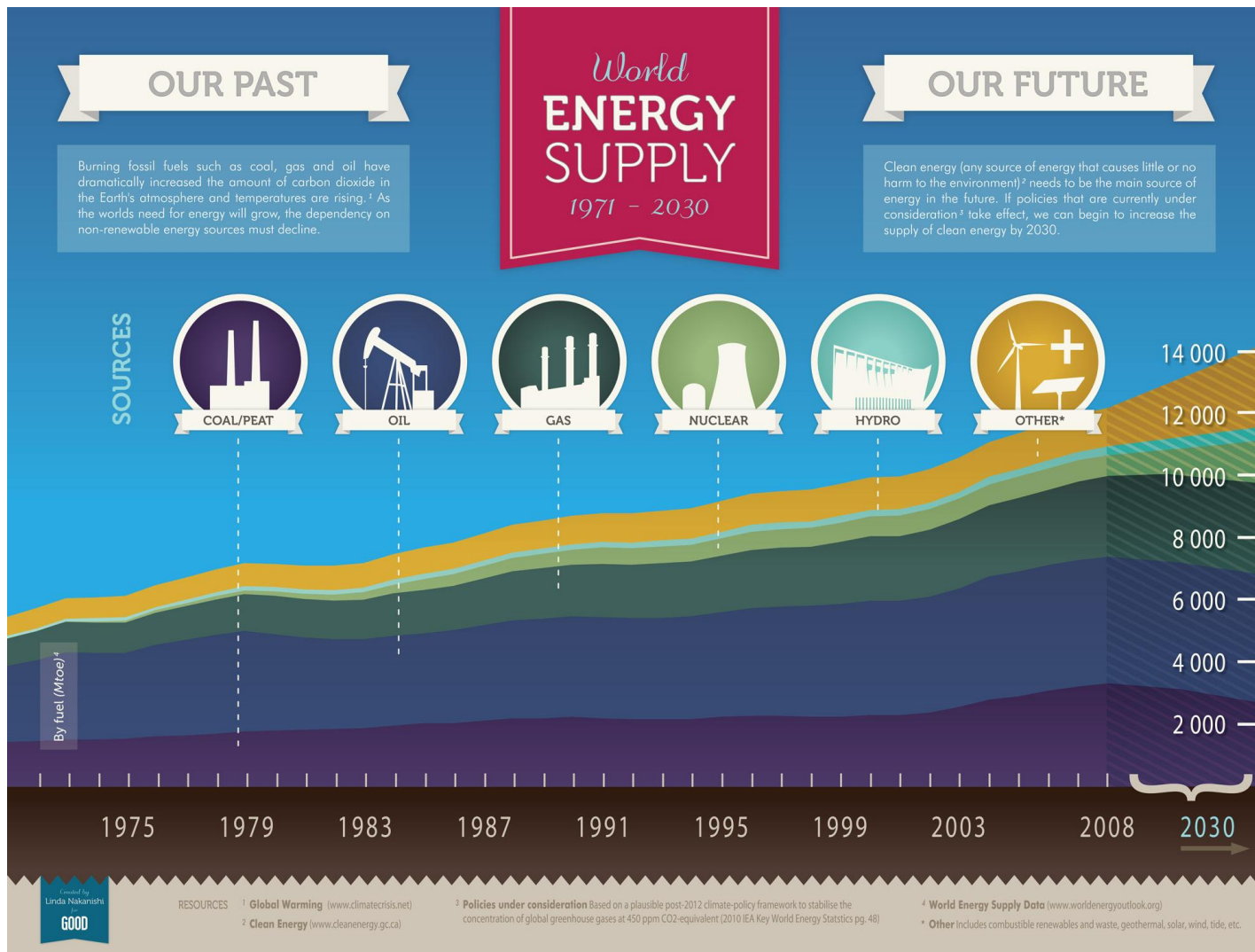
0 - 3k 3k - 4k 4k - 6k 6k - 7k 7k - 51k no data

We use data for ...

 PRIMARY ENERGY CONSUMPTION BY SOURCE AND SECTOR, 2010 (QUADRILLION BTU)



We use data for ...

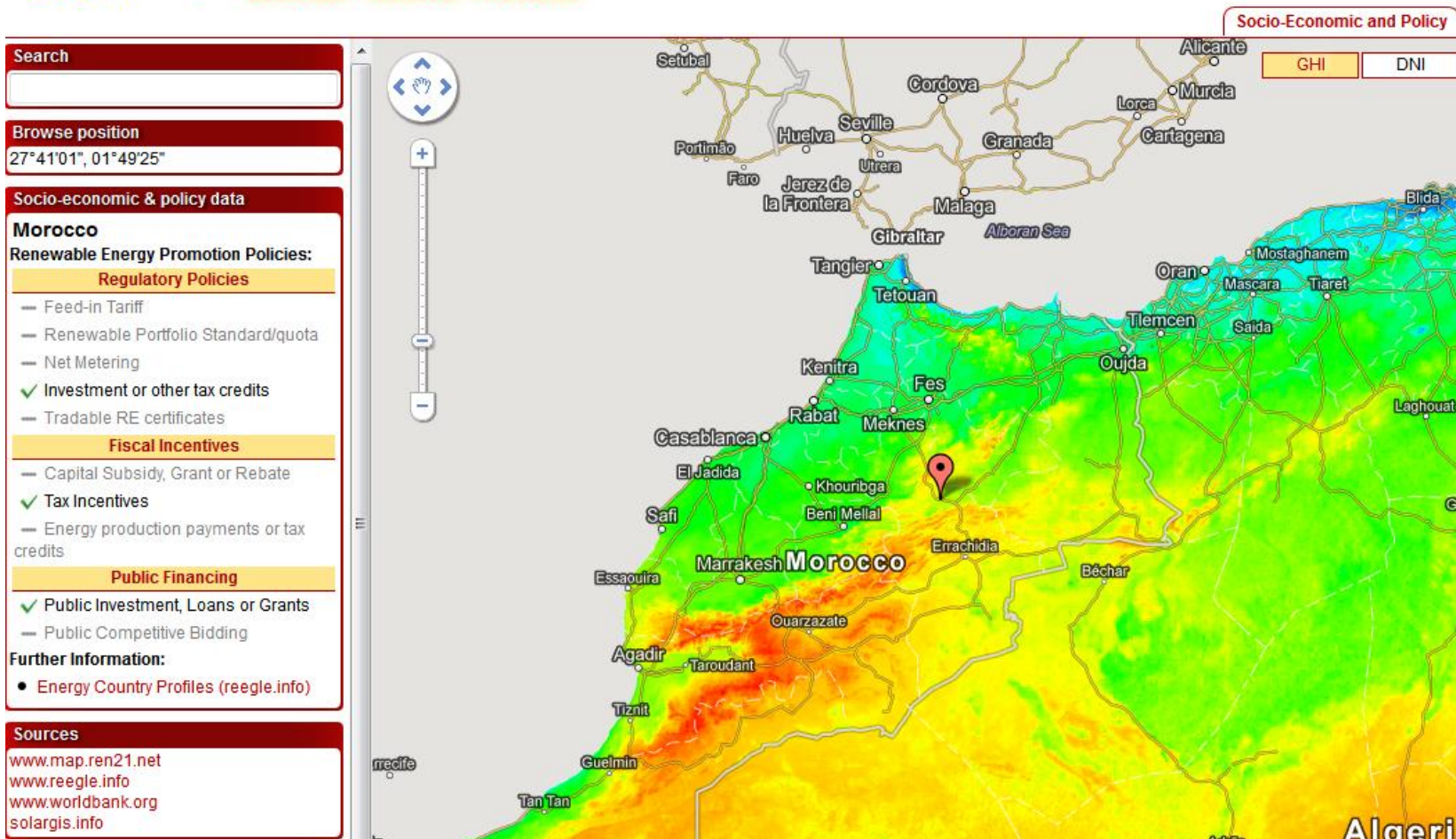


<http://awesome.good.is/transparency/web/1012/energy-submissions/linda-nakanishi/flat.html>

We use data for ...



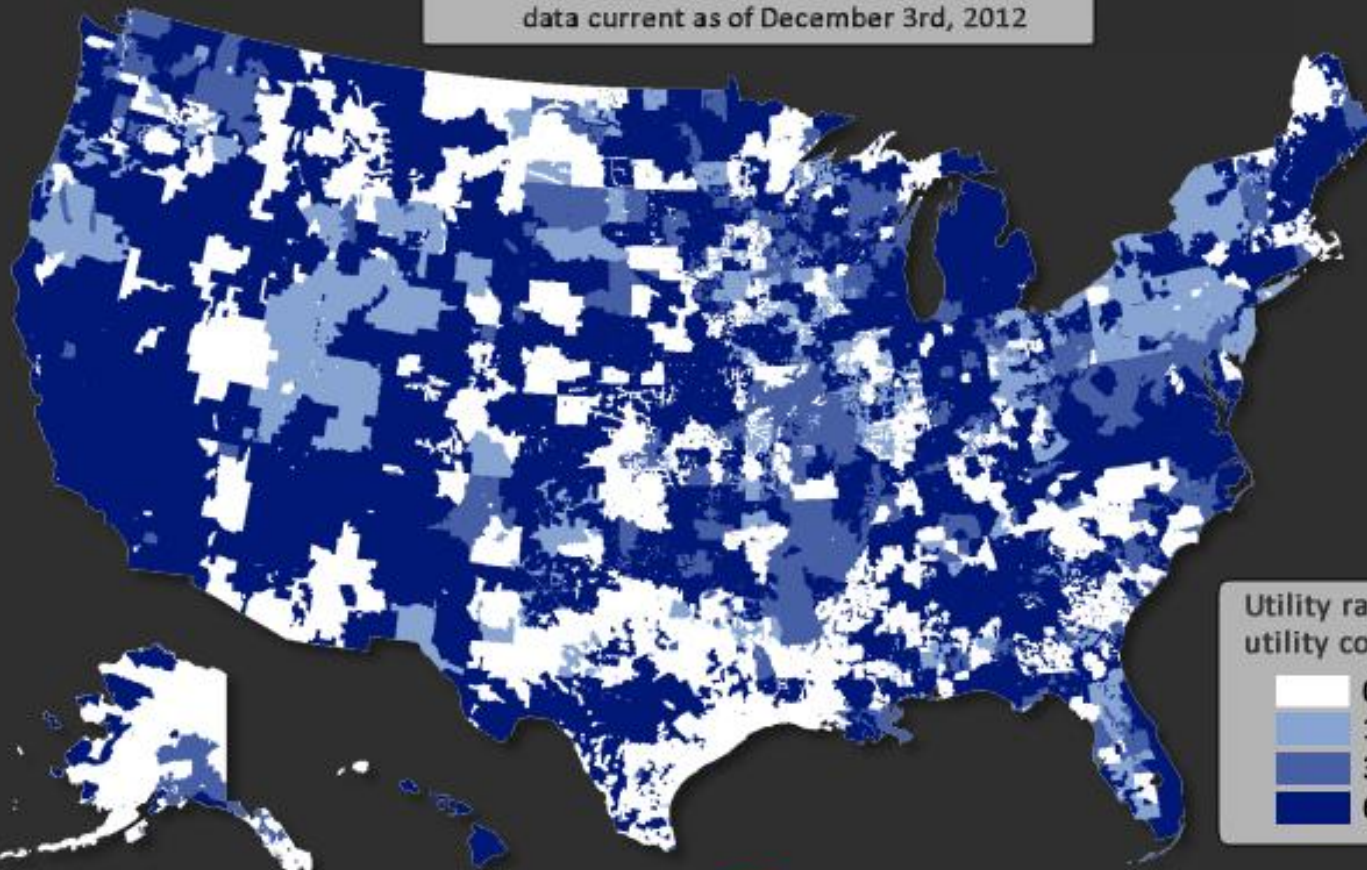
Solar-Med-Atlas



We use data for ...

Utility rate coverage on OpenEI

data current as of December 3rd, 2012



Utility rates per utility company

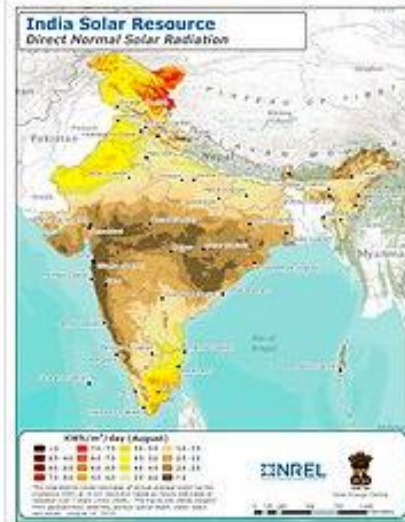
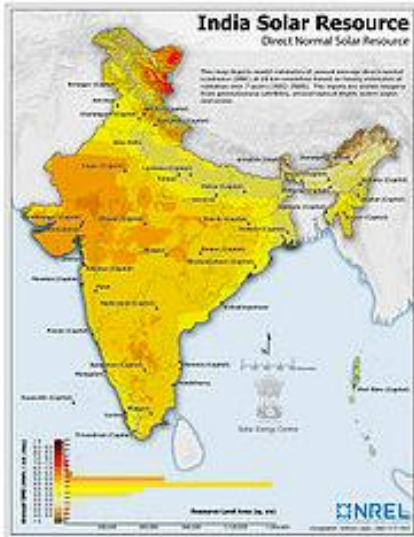
- 0
- 1-2
- 3-6
- 6+



Energy Resources

Resource	Value	Units	Rank	Period	Source
Wind Potential	0	Area(km ²) Class 3-7 Wind at 50m	120	1990	NREL ↗
Solar Potential	9,877,095,200	MWh/year	8	2008	NREL ↗
Coal Reserves	66,800.07	Million Short Tons	5	2008	EIA ↗
Natural Gas Reserves	1,075,000,000,000	Cubic Meters (cu m)	26	2010	CIA World Factbook 🔒
Oil Reserves	5,800,000,000	Barrels (bbl)	23	2010	CIA World Factbook 🔒

Energy Maps featuring India



More Maps..

Great, but how to get the data?

... and why do we need LOD?

“Every day, we create 2.5 quintillion bytes of data – so much that 90% of the data in the world today has been created in the last two years alone.” - IBM, 2012 (<http://www-01.ibm.com/software/data/bigdata>)

Usual way to store and share data



- **Stores all information in its own database**

Usual way to store and share data



- Stores all information in its own database
- Other sites have similar design pattern
=> Duplication of effort and information

Using data from another site requires you to download a copy of it to install into your database.

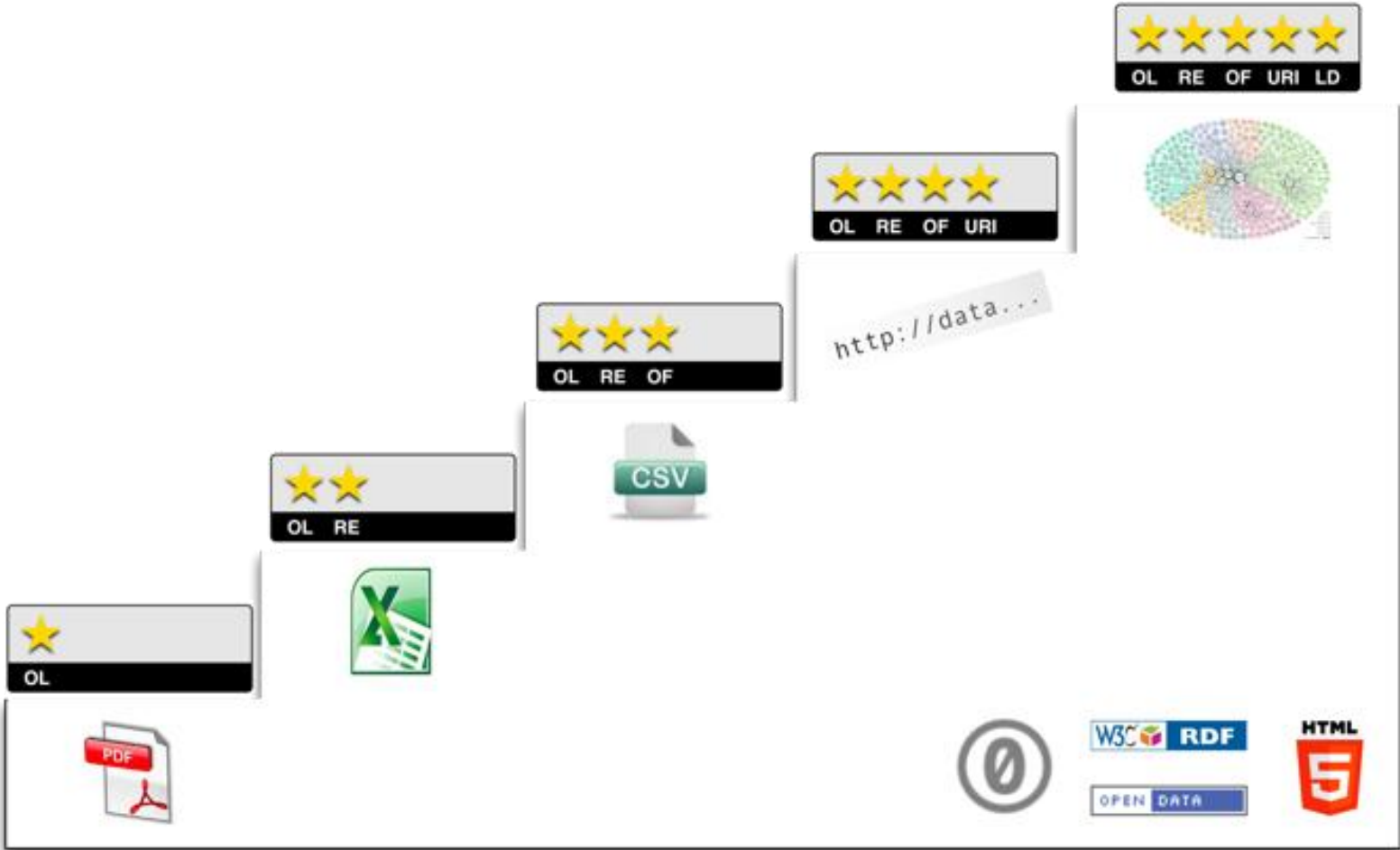
Usual way to store and share data



- **Stores all information in its own database**
- Other sites have similar design pattern
=> Duplication of effort and information
- Both sites responsible for updating information
=> Potential for online community to be presented with conflicting information

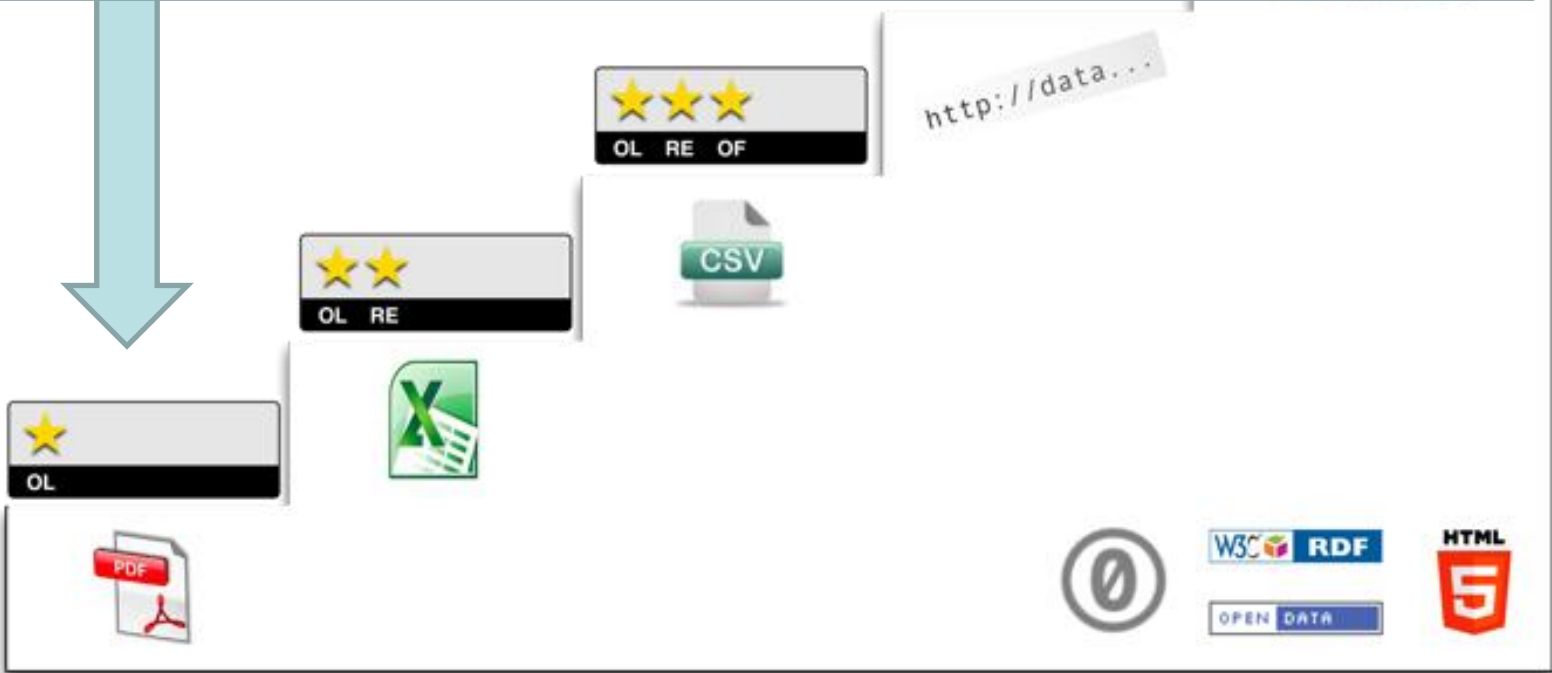
If the original site updates its data, the two sites become out of sync. How does the online community know which site is more accurate?

The 5 steps to Linked Open Data



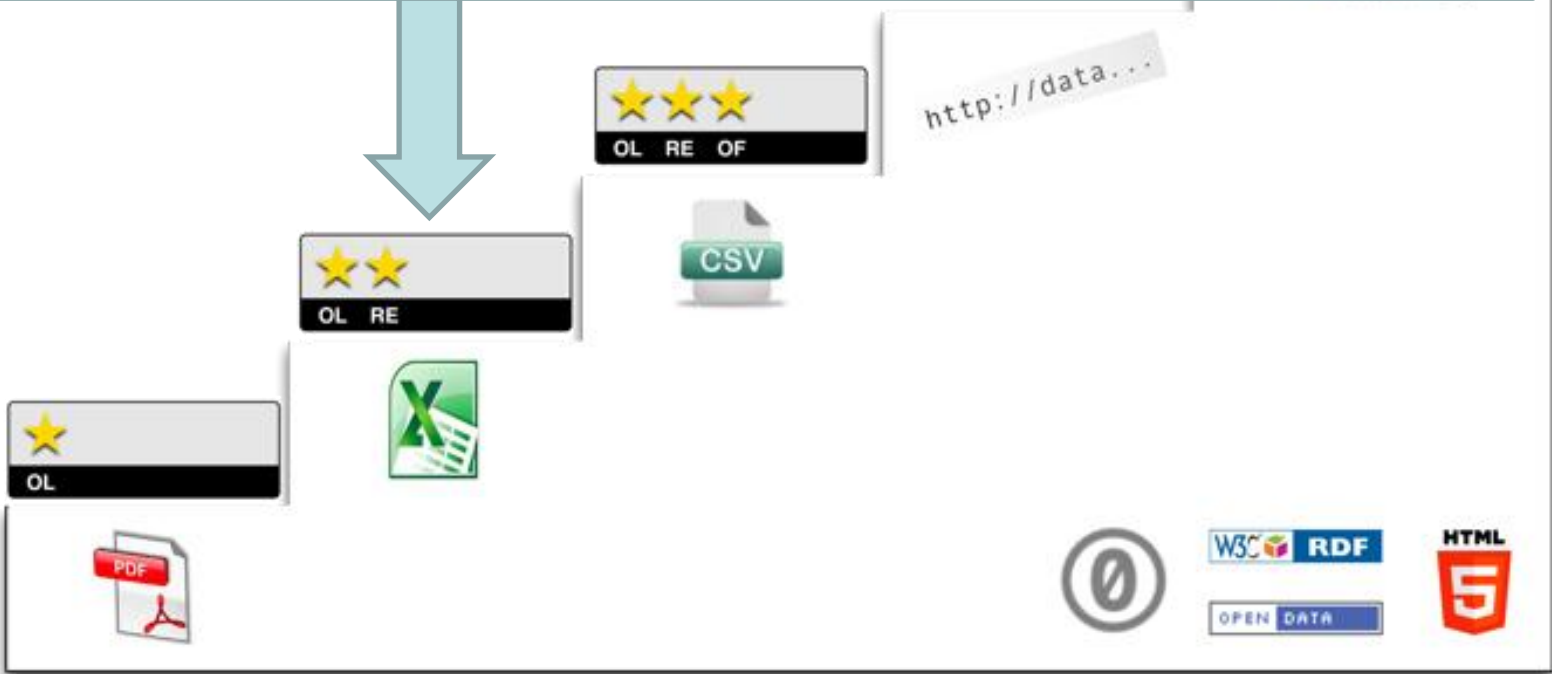
The 5 steps to Linked Open Data

make your stuff available on the Web (whatever format) under an open license



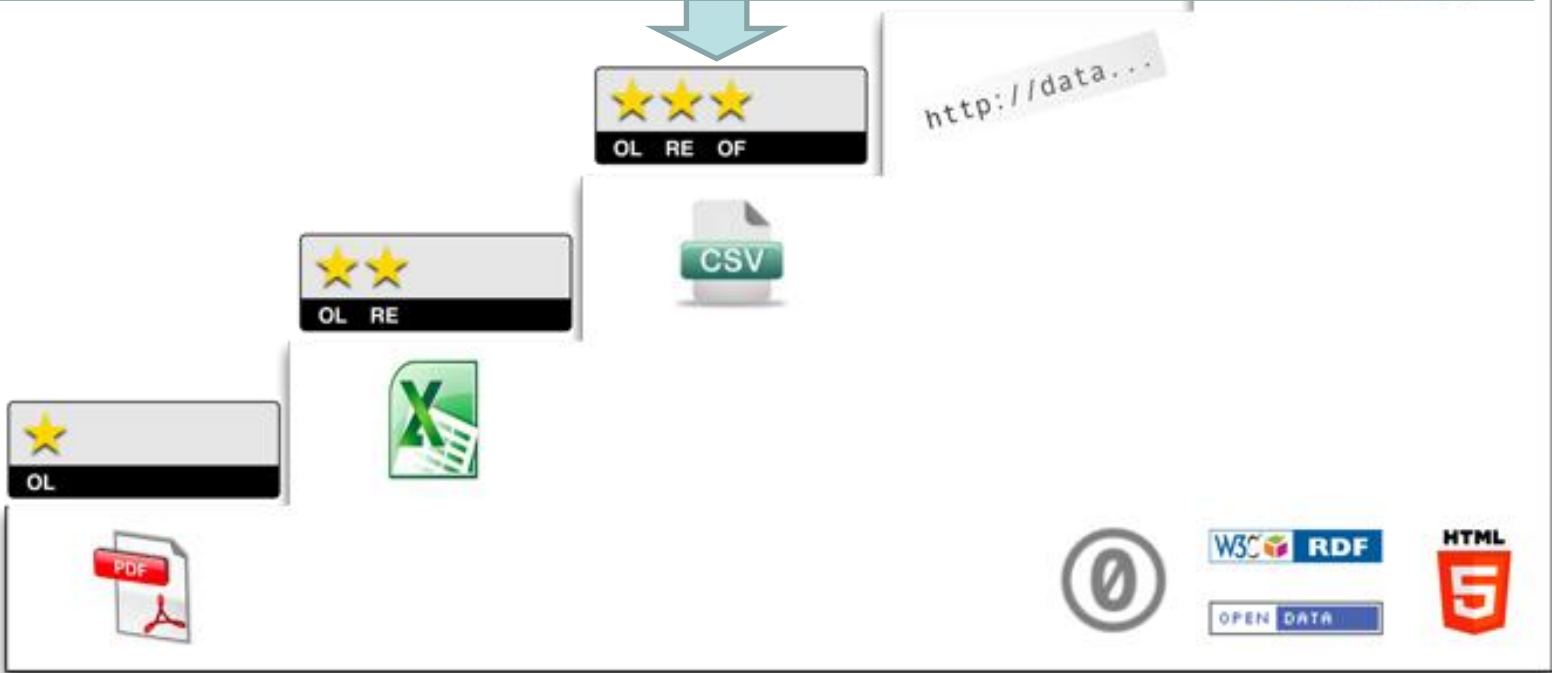
The 5 steps to Linked Open Data

make it available as structured data (e.g., Excel instead of image scan of a table)

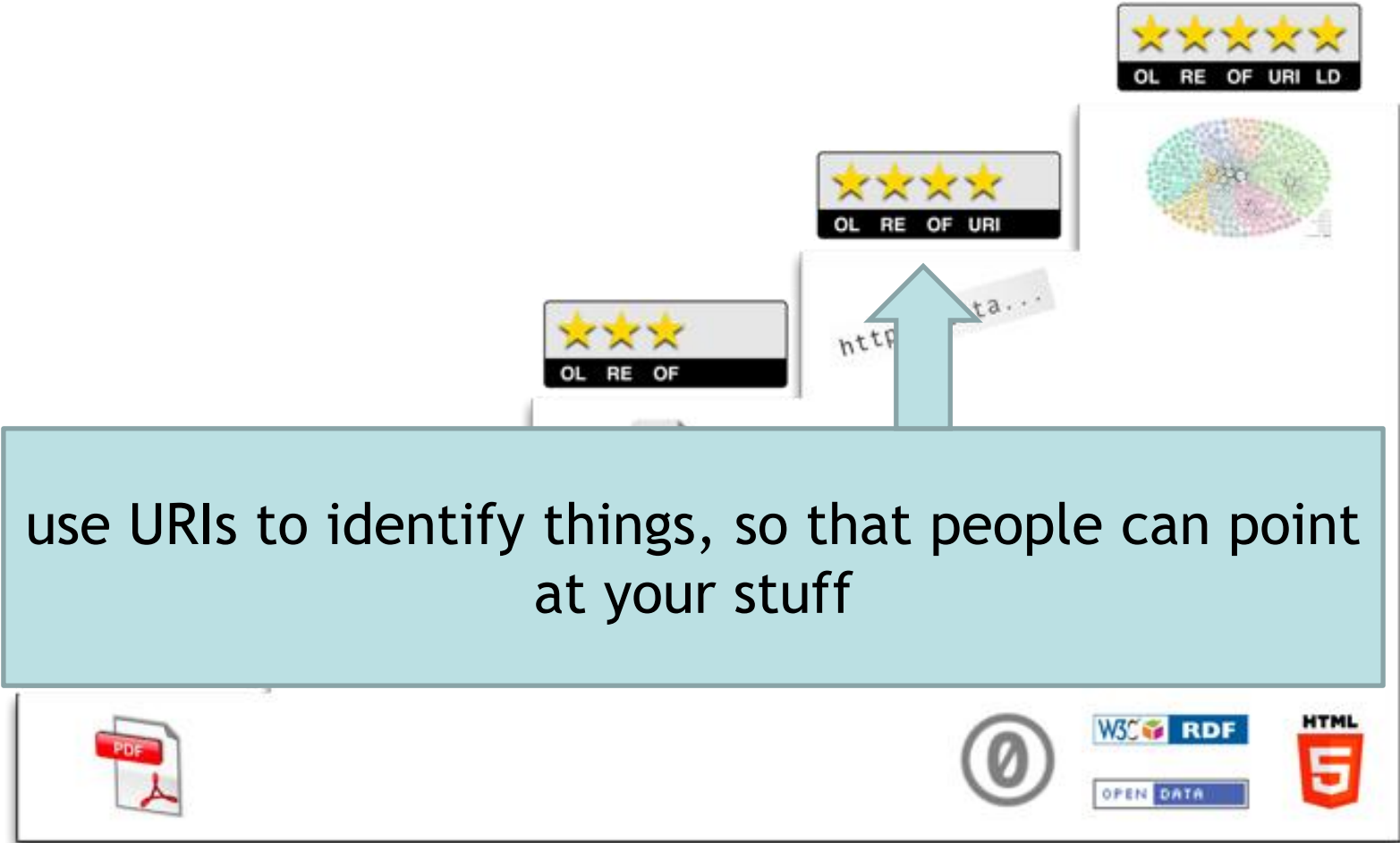


The 5 steps to Linked Open Data

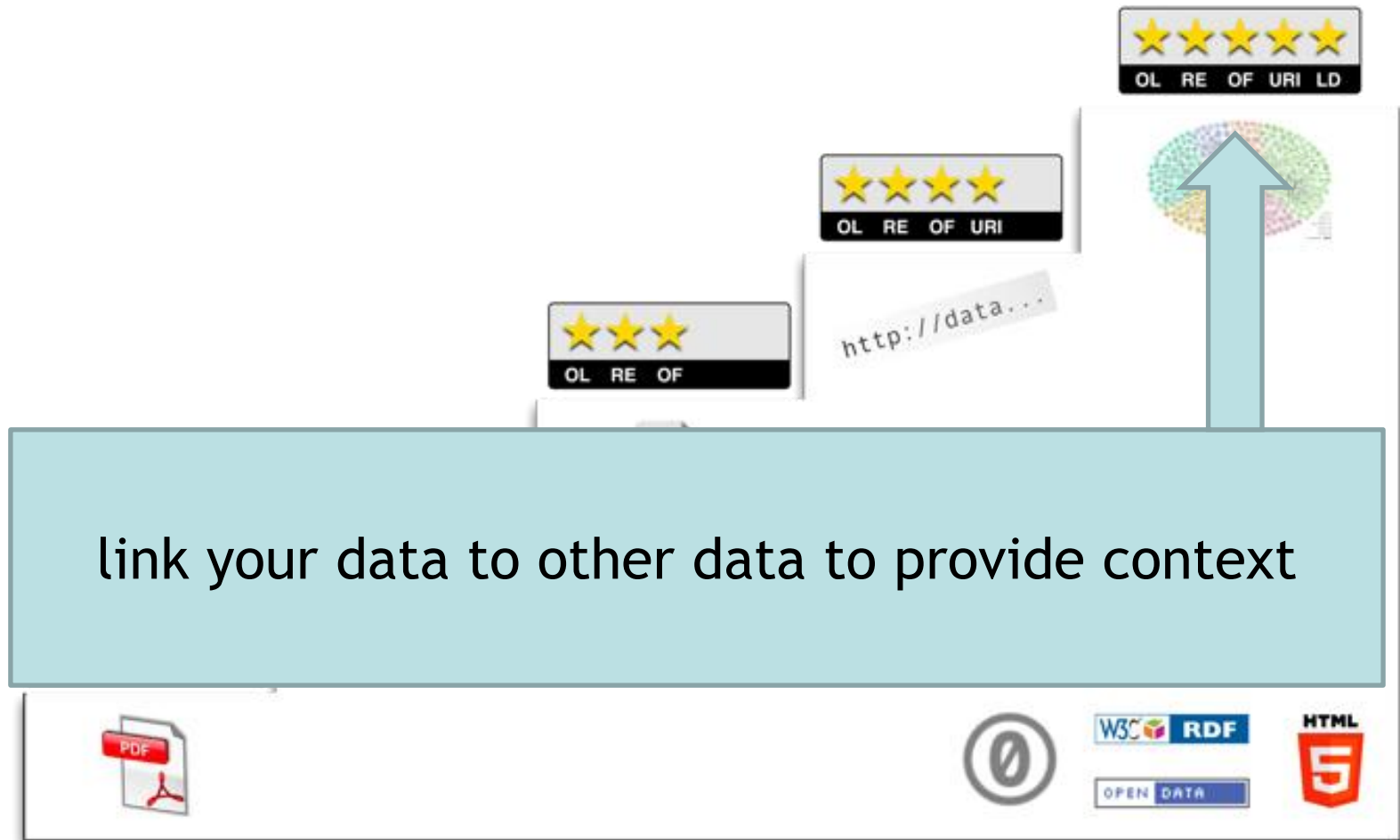
use non-proprietary formats (e.g., CSV instead of Excel)



The 5 steps to Linked Open Data



The 5 steps to Linked Open Data



What changes with LOD?

With Linked Open Data



- **Datasets are shared behind the scenes**
=> Each site can focus on key data and import supplemental data

What changes with LOD?

With Linked Open Data



- **Datasets are shared behind the scenes**
=> Each site can focus on key data and import supplemental data
- **Imported data updates automatically**
=> Provides users with consistent information across multiple sites

Source: Jon Weers, NREL

Data is shared at the database level. Updates to a linked database appear instantly on partner sites.

What changes with LOD?

With Linked Open Data



- **Datasets are shared behind the scenes**
=> Each site can focus on key data and import supplemental data
- **Imported data updates automatically**
=> Provides users with consistent information across multiple sites
- **Other Websites can consume LOD** resources to present new content in exciting and unanticipated ways

Source: Jon Weers, NREL

Third party websites can combine (or “mashup”) linked open data to form innovative content, or new data.

Summary: Why LOD in Clean Energy

There is a need to focus efforts

- We want to display all relevant information about a topic but need to focus on providing only the information we are subject matter experts

We need to avoid replication

- Re-using existing datasets avoids replication of work already done and saves costs

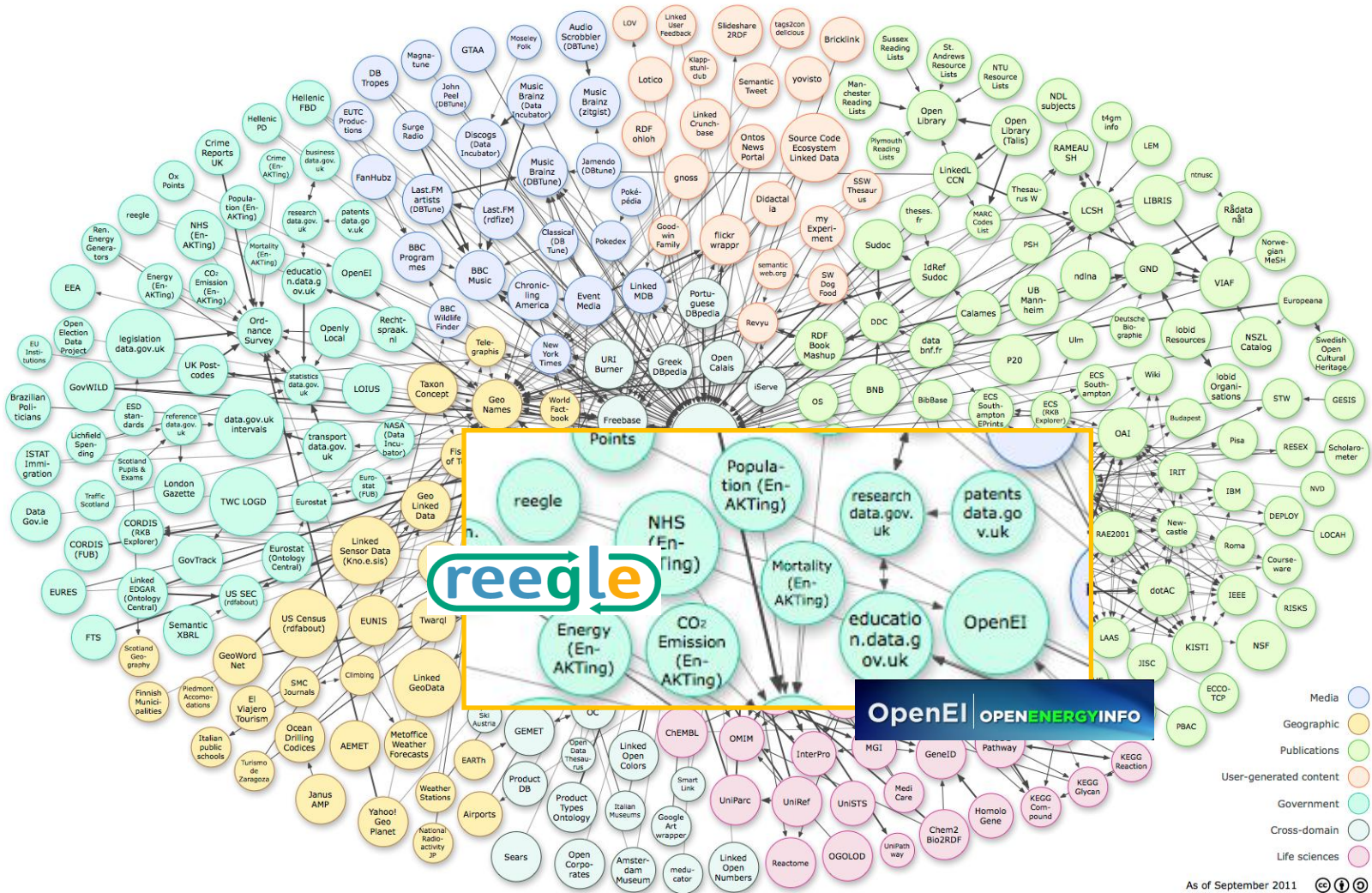
We want to reduced maintenance and effort

- Updates to linked open data are propagated instantly

Our aim is to move towards semantic linkages and interoperability

- Concepts become part of the semantic web
 - Data mash-ups and utilizations never before imaged
 - SPARQL queries can span multiple data sources

LOD cooperation – an example



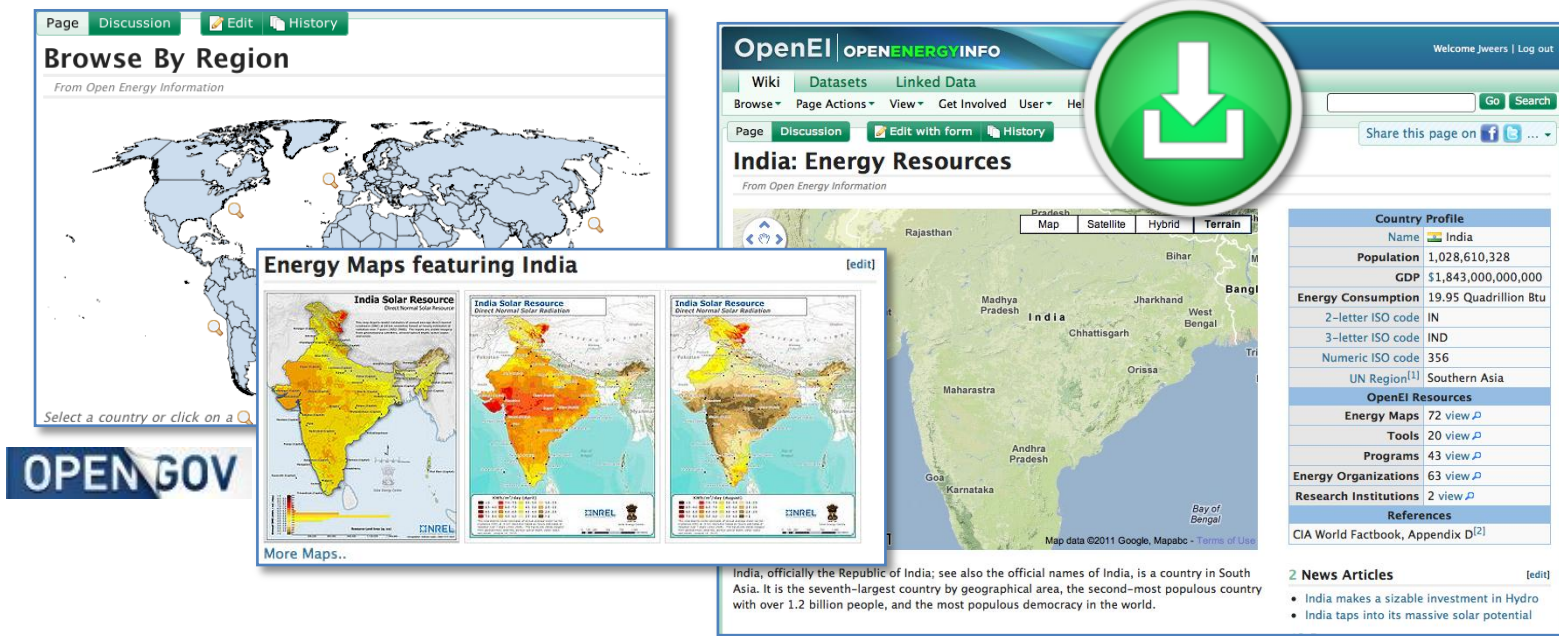
Linking Open Data cloud diagram, by Richard Cyganiak and Anja Jentzsch. <http://lod-cloud.net/>

<http://en.openei.org>

OpenEI is a collaborative knowledge-sharing platform with free and open access to energy-related data, models, tools, and information.

OpenEI features:

- ▶ more than 56,000 content pages
- ▶ more than 840 downloadable datasets
- ▶ regional gateways on a variety of energy-related topics
- ▶ Over 160 registered apps, including 64 Green Button apps.



The screenshot displays the OpenEI website interface. On the left, there is a 'Browse By Region' section with a world map and a link to 'Energy Maps featuring India'. Below this is an 'OPEN GOV' logo. The main content area shows a page titled 'India: Energy Resources' with a map of India and a 'Country Profile' table. A large green download icon is overlaid on the page. At the bottom, there is a '2 News Articles' section with a list of articles.

Country Profile

Name	India
Population	1,028,610,328
GDP	\$1,843,000,000,000
Energy Consumption	19.95 Quadrillion Btu
2-letter ISO code	IN
3-letter ISO code	IND
Numeric ISO code	356
UN Region ^[1]	Southern Asia
OpenEI Resources	
Energy Maps	72 view ↗
Tools	20 view ↗
Programs	43 view ↗
Energy Organizations	63 view ↗
Research Institutions	2 view ↗
References	
CIA World Factbook, Appendix D ^[2]	

2 News Articles [\[edit\]](#)

- India makes a sizable investment in Hydro
- India taps into its massive solar potential

One of the featured pieces of content on OpenEI's country pages is the reegle Policy and Regulatory Overview:

The image shows a screenshot of the OpenEI website. The main page is titled "India: Energy Resources" and features a map of India with state names like Rajasthan, Gujarat, Madhya Pradesh, Maharashtra, Andhra Pradesh, Karnataka, Bihar, Jharkhand, West Bengal, Chhattisgarh, Orissa, and Tripura. Below the map is a description of India and a link to the "reegle Policy and Regulatory Overview" page. The linked page is titled "India Policy and Regulatory Overview" and contains the following content:

India Policy and Regulatory Overview [3] [edit]

Extend network [edit]

Population Access to Electricity (2008): 64.5%

Rural: 52.5%
Urban: 93.1%

The Integrated Energy Policy states that "Access to electricity is very uneven. Around 57% of rural and 12% of urban households i.e. 84 million households (over 44.2% of total) did not have electricity in 2000. Even those who have access to electricity suffer from shortages and poor quality of supply. Unscheduled outages, load shedding, fluctuating voltage and erratic frequency are common. Consumers and the economy bear a large burden of the consequences of this poor quality of supply." Currently, some 404.5 million people do not have electricity. The majority of electricity transmission infrastructure is operated at 132 kV or above, and five regional grids serve the country, connecting the Northern, Southern, Western, Eastern and North-Eastern regions.

Energy procedure [edit]

The policies and plans are developed on a five-year basis, apart from the annual plans. Each department/ ministry prepares plans, which go as inputs to the 'Five Year Plan' prepared by the Planning Commission of India. The government is also developing a scheme for energy efficiency trading as part of its National Action Plan on Climate Change. Under the proposed scheme of Perform, Achieve, Trade (PAT), specific industries would be required to commit to energy-intensity reductions, and the government will give trading certificates to entities successful in meeting their goals. Penalties for non-compliance are mentioned under the proposed plan, but not mandated. Ultra Mega Power Projects (UMPP) are a series of ambitious power projects planned by the Government of India. The ultra-mega-power projects, each with a capacity of 4,000 MW or above, are being developed with an aim to bridge the current supply gap. The UMPPs are seen as an

Behind The Scenes, Linked Open Data at Work:

India: Energy Resources
From Open Energy Information

Country Profile

Name	India
Population	1,028,610,328
GDP	\$1,843,000,000,000
Energy Consumption	19.95 Quadrillion Btu
2-letter ISO code	IN
3-letter ISO code	IND
Numeric ISO code	356
UN Region ^[1]	Southern Asia

OpenEI Resources

Energy Maps	72 view
Tools	20 view
Programs	43 view
Energy Organizations	63 view
Research Institutions	2 view

References

- CIA World Factbook, Appendix D^[2]

2 News Articles

- India makes a sizable investment in Hydro
- India taps into its massive solar potential

43 Programs

- UNEP-Low Carbon Transport in India
- WRI-India-Measurement and Performance Tracking (MAPT) Initiative
- Ecofys-India-Quantifying Emission Reduction Opportunities in Emerging Economies
- ESMAP-India-Options for Low Carbon

reegle profiles are consumed in real time using SPARQL

use of semantic concepts allows the correct profile to be pulled

SPARQL

reegle Policy and Regulatory Overview

India Policy and Regulatory Overview

Extend network

Population Access to Electricity (2008): 64.5%

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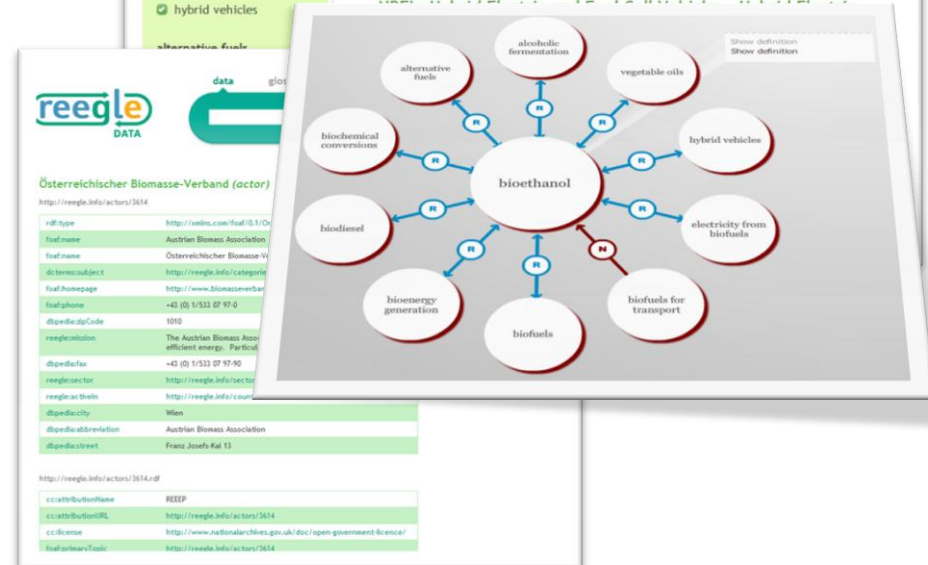
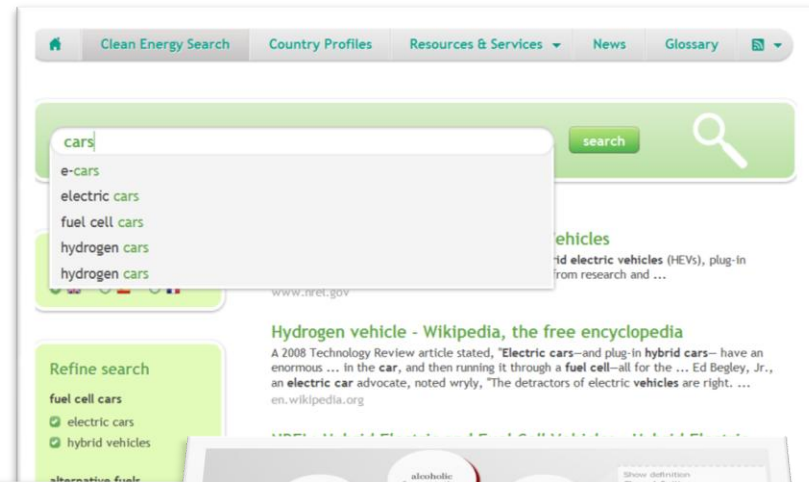
- SPARQL Endpoint
- Print page
- Contact reegle

<http://www.reegle.info>

- Well established information gateway for high quality information on renewable energy, efficiency and climate compatible development
- More than 220,000 users per month
- Data portal data.reegle.info launched in 2011

Available as Linked Open Data:

- key datasets including energy statistics
- over 1,700 stakeholders worldwide
- extensive glossary enriched with DBpedia linked data
- country energy profiles including policy & regulation data



reegle DATA

Österreichischer Biomasse-Verband (actor)

<http://reegle.info/actors/3614>

rdf:type	http://reegle.com/foaf/0.1.0/
foaf:name	Austrian Biomass Association
foaf:name	Österreichischer Biomasse-Verband
sk:terms:subject	http://reegle.info/categories/1010
foaf:homepage	http://www.biomasseverband.at
foaf:phone	+43 (0) 1/533 07 97-0
fbpedia:dc:code	1010
reegle:mission	The Austrian Biomass Association promotes efficient energy. Particularly in the area of biomass energy.
fbpedia:dc:fax	+43 (0) 1/533 07 97-90
reegle:actor	http://reegle.info/actors/3614
reegle:ac:short	http://reegle.info/actors/3614
fbpedia:city	Wien
fbpedia:abbreviation	Austrian Biomass Association
fbpedia:street	Franz-Josefs-Kai 13

<http://reegle.info/actors/3614.rdf>

cc:attributionName	REEEP
cc:attributionURL	http://reegle.info/actors/3614
cc:license	http://www.nationalarchives.gov.uk/doc/open-government-licence/
foaf:isPrimaryTopicOf	http://reegle.info/actors/3614



Energy Profile Germany

Germany, officially the Federal Republic of Germany, is a federal parliamentary republic in Europe. The country consists of sixteen states while the capital and largest city is Berlin. It covers an area of 357,021 km and has a largely temperate seasonal climate. With 81.8 million inhabitants, it is the most populous member state and the largest economy in the European Union. It is one of the major political powers of the European continent and a technological leader in many fields. A region named Germania, inhabited by several Germanic peoples, was documented before AD 100. During the Migration Age, the Germanic tribes expanded southward, and established successor kingdoms throughout much of Europe. Beginning in the 10th century, German territories formed a central part of the Holy Roman Empire of the German Nation. During the 16th century, northern German regions became the centre of the Protestant Reformation while southern and western parts remained dominated by Roman Catholic denominations, with the two factions clashing in the Thirty Years' War. Occupied during the Napoleonic ... [read more](#)

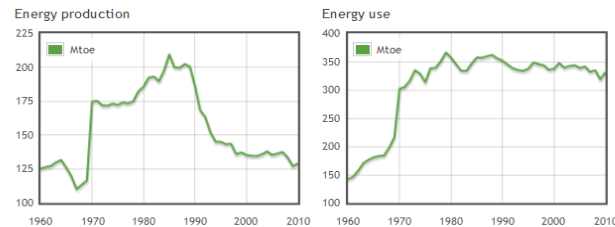
Source: [dbpedia](#)

Capital	Berlin
ISO Code	DE, DEU
Area	357.021 km ²
Population	81.799.600 (2010)
GDP, PPP	3.044.241.583.883,- current international \$ (2010)

Events	
23.04.2012	Hannover Messe Industrial Greentec
15.07.2012	Sustainable Energy Finance Summer Academy

Key Statistic Charts (26)

Energy production and use



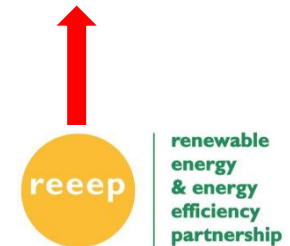
Legal sources on support schemes and grid issues

Project Outputs (28)

Stakeholders (104)

Source: [reegle Actors](#)

- ⇒ [500 PPM GmbH \(500 PPM GmbH\)](#)
- ⇒ [Abo Wind](#)
- ⇒ [AeroCratf Energietec](#)
- ⇒ [Aircon International](#)
- ⇒ [Aufwind](#)
- ⇒ [BioKraftstoff](#)
- ⇒ [RioStrom Energie System](#)





Tagcloud – City of Edmonton (Canada) Workshop

Providing standards and putting data in context is important

Standardisation and consistency is key

Based on our experience in establishing knowledge broker portals we know:

- There is a strong need to **increase consistency when tagging** climate and energy resources
- We need to ensure the **consistency of message** being delivered to the public to avoid confusion using terms in different ways
- This needs **standardization** of the used categories and tags

Can we support that with
an automated system ?

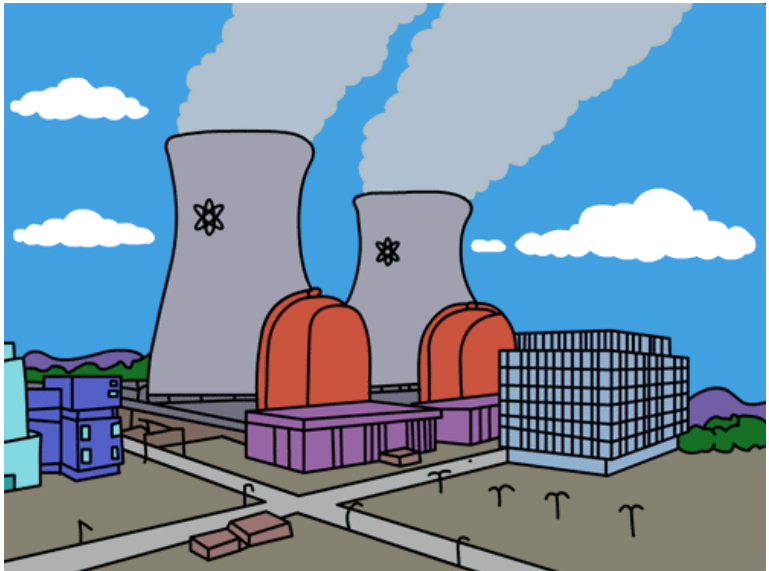
Site address or country [Find](#)

Document
tagged:
photovoltaic

Same
document
tagged: PV

Understanding synonyms & relations?

Dealing with disambiguation ...



A new tool to help
with consistent tagging:

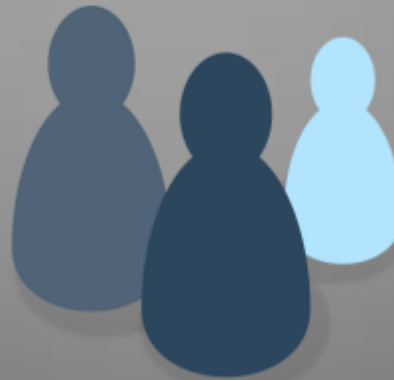
The reegle tagging API



Unstructured Data



reegle tagging API turns data into knowledge

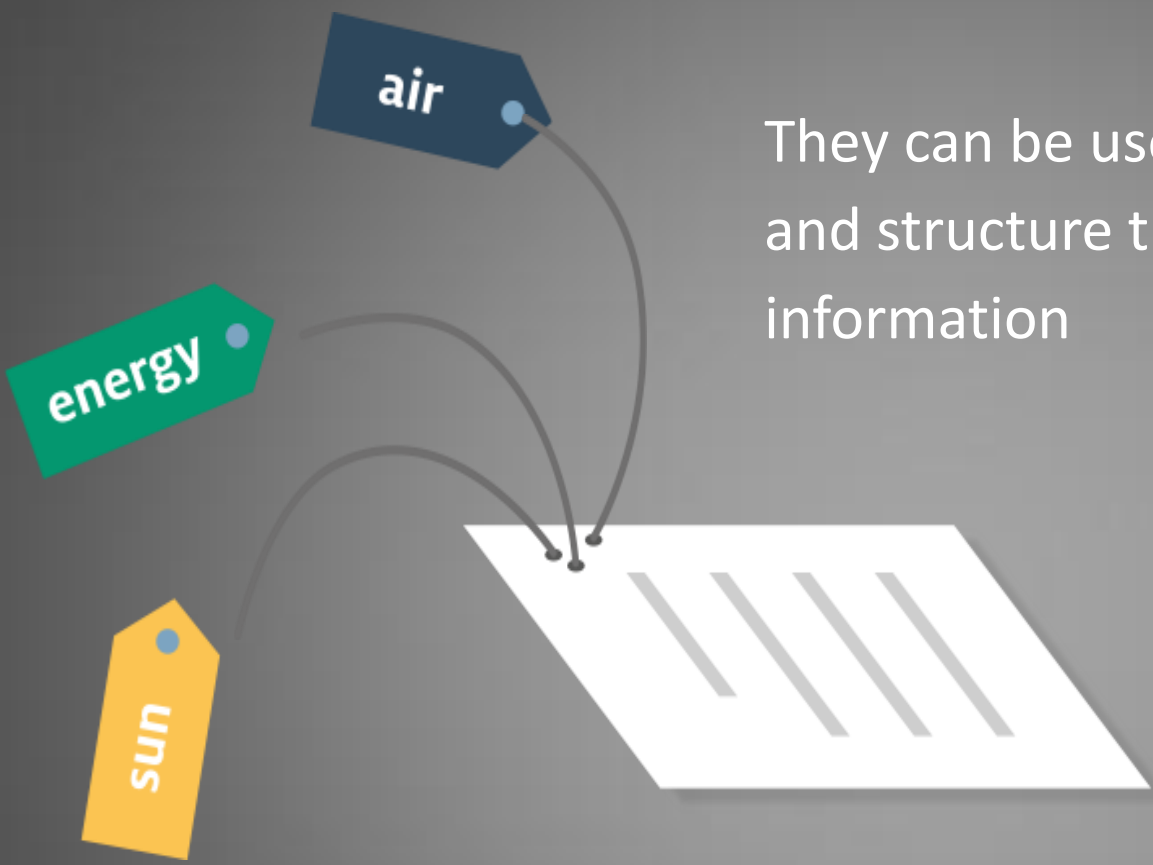


A file is sent ...



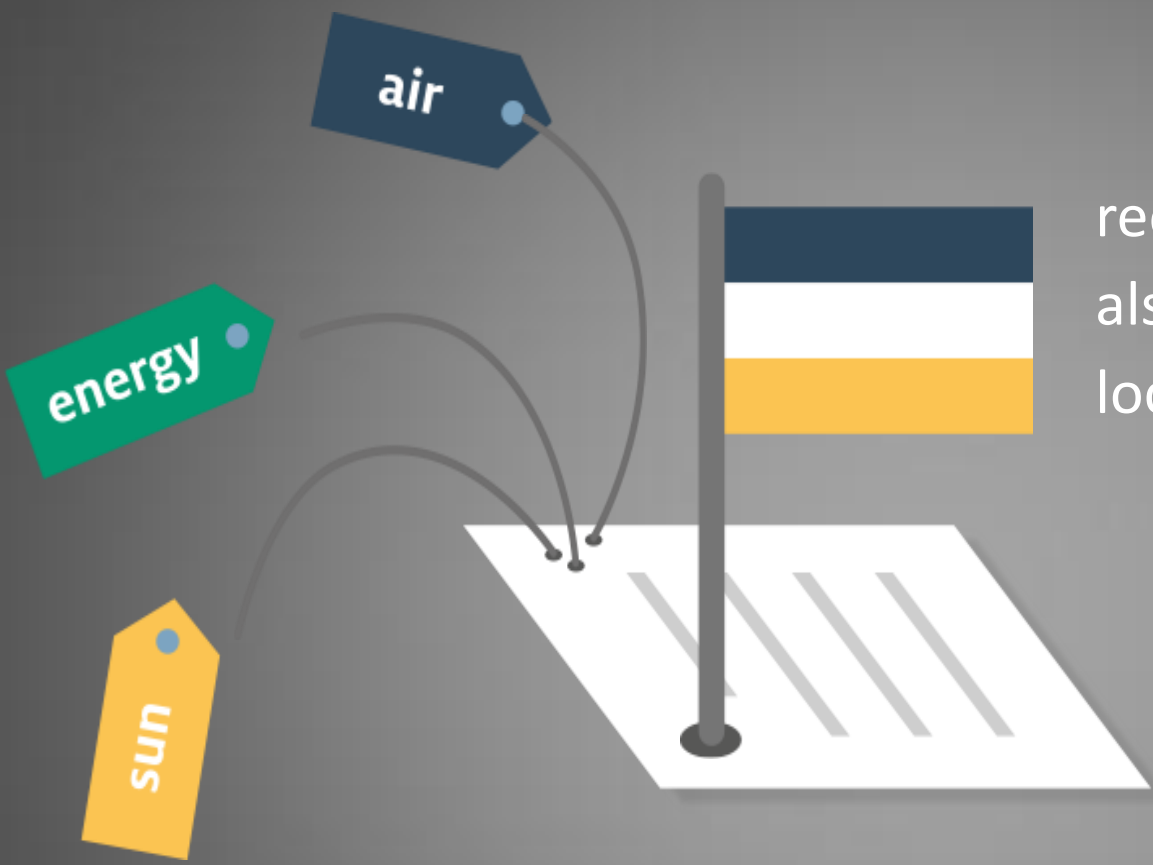
... to the reegle tagging API,
where its content is analyzed.





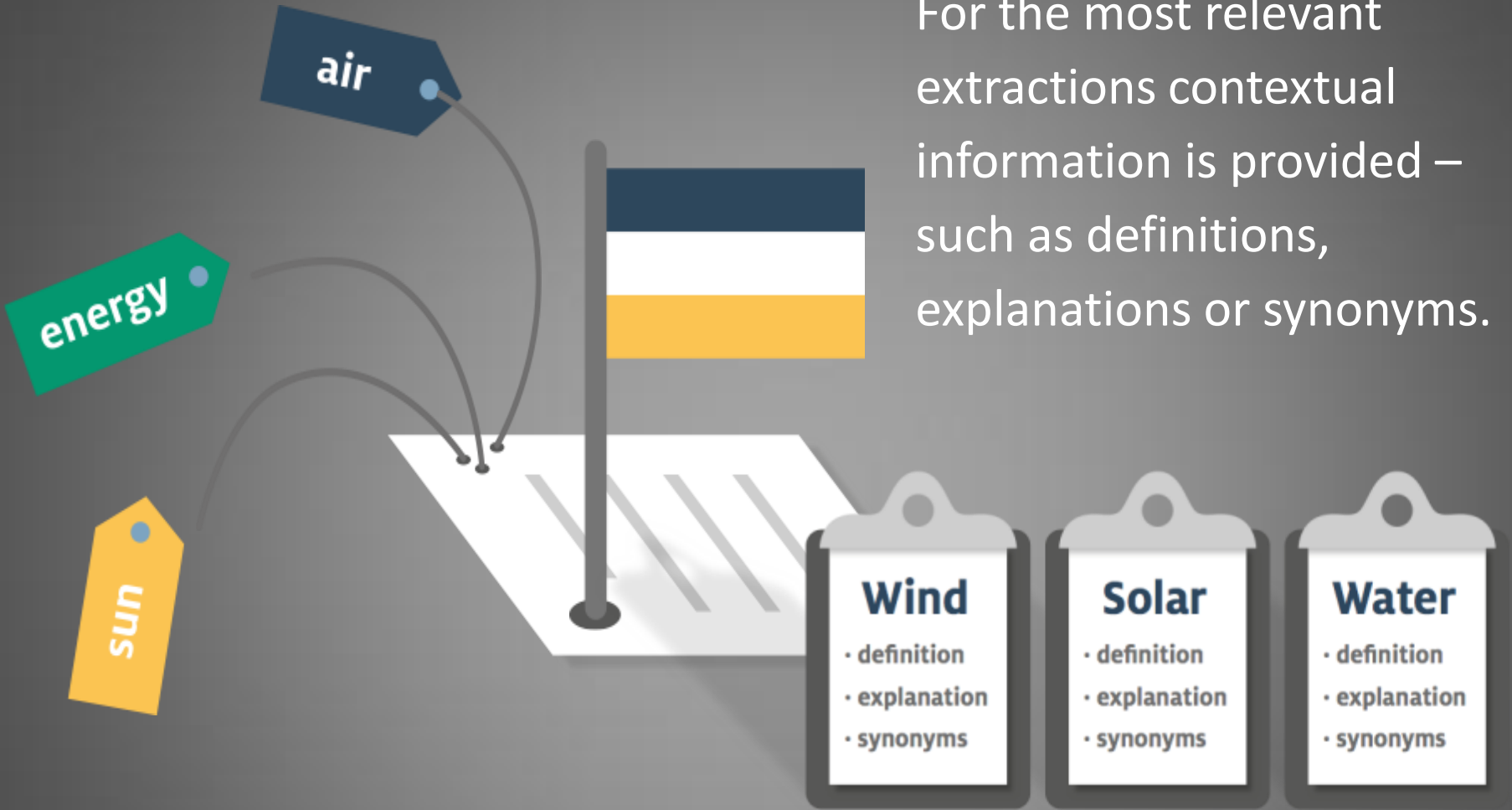
They can be used to tag and structure the information

The most relevant terms are extracted



reegle tagging API
also extracts geographic
locations

For the most relevant extractions contextual information is provided – such as definitions, explanations or synonyms.





Enrich your documents with related articles from our content pool.

You can also add documents to the pool, making them available to others.



Content Pool

Use the tagging API to ...

- ... ensure consistency in tagging your information
- ... make your documents better searchable and accesible
- ... share your documents with others
- ... receive suggestions for similar other existing documents

Have a look on <http://api.reegle.info> !

reegle tagging API funded by:

... enrich content by matching terms to definitions



Have a look at
<http://openei.org/wiki/Gateway:Wind!>

reegle tagging API funded by:




Use the tagging API to ...


... providing users with real-time definitions of key terms

Equation for Wind Power

$$P = \frac{1}{2} \rho A V^3$$

- **Wind speed**
The amount of energy if the wind speed doubles. Small changes in wind speed have a large impact on the amount of power available in the wind [4].

 Broadly defined as the capacity to do work. There are many forms of energy, including: chemical, electrical, gravitational, mechanical, nuclear, radiant, and thermal energy. The official SI unit for energy is the joule (J); energy can also be measured in calories or British thermal units (Btu).
View full definition on OpenEI.

 OpenEI

... recommending related articles by searching similar terms

Related articles: [Clean Energy Economy](#), [International Clean Energy Analysis](#), [Incentives and Policies](#), [Solar](#), [Utilities](#),

Have a look at <http://openei.org/wiki/Gateway:Wind!>

reegle tagging API funded by:

Questions? Please contact us ...



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