Metadata

Geospatial data layers provided for the Global Atlas of the International Renewable Energy Agency (IRENA)

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1 Introduction

The International Renewable Energy Agency (IRENA) Global Atlas aims to provide access to a set of geographical information layers, which enables users to highlight areas of opportunity for developing renewable energy projects. The Renewable Energy Unit of the Institute for Energy and Transport (IET) of the European Commission Joint Research Centre (JRC) provided thematic data layers to the publically available geoserver of IRENA. The data layers were resulted by research on renewable energy and rural electrification options in Africa. The research has been done within the framework of the 'Renewable Energy Mapping and Monitoring in Europe and Africa' action (REMEA) and the research program of the African Renewable Energy Technology Platform (AFRETEP).

2 Description

The target geoserver, inventory and geodata catalogue were capable of integrate all GIS standards. The provided geospatial layers have been prepared and delivered in ESRI binary and ascii grid formats including the data layers, the definition of applied reference system as well as classification and graphical information regarding the legends for thematic mapping. ESRI ArcMap Document and the related layer files (.lyr) assisted the mapserver experts on visualisation the data as the authors had designed. Metadata in harmony with ISO standards (ISO 19115:2003/19139) and Inspire requirements have been compiled in XML and document formats (Annex I) interpreted by ESRI ArcCatalog XML metadata reader. The metadata should provide information about the identification, the extent, the quality, the spatial and temporal schema, spatial reference, and distribution of digital geographic data. ISO 19139 provides the XML implementation schema for ISO 19115 specifying the metadata record format which has been followed to edit the XML code describing the geospatial metadata.

The data transfer has been completed by using the anonymous ftp-site of the Renewable Energy Unit of the Institute for Energy and Transport having the archived and compressed data files temporarily available (http://re.jrc.ec.europa.eu/download/afretep/irena).

The first public layers are available from the IRENA Global Atlas geoserver (Annex II) using the following address: http://irena.masdar.ac.ae:8080/geoserver/JRC/wms

Detailed description on the complex analysis and modelling approach is published in the papers listed in the chapter on 'Related publications'.
3 Related publications


Acknowledgement

The research producing the results in the published information and papers had been conducted by Sándor Szabó (EC JRC AFRETEP) and Fabio Monforti (EC JRC REMEA). In addition to the contributing authors of the publications, Thomas Huld (EC JRC IET) assured the extra space and access to the FTP server. Gábor Barton (Scottish Natural Heritage) helped with guidelines solving standardisation and XML coding problems.

The REMEA team would like to thank Nicolas Fichaux (International Renewable Energy Agency) and Jacinto Estima (Research Center for Renewable Energy Mapping and Assessment) for their great work helping to publish the data in IRENA Geoserver.
Annex I. - Metadata
Estimated costs of electricity (Euro/kWh) delivered by a (15 kWp) off-grid PV system

Data format(s): ESRI ASCII GRID, ESRI BINARY GRID

Coordinate system: ETRS89_LAEA, EPSG:3035


Abstract: PV electricity production depends primarily on the amount of solar radiation available. For grid-connected systems, the energy output can be approximated, being proportional to the total solar irradiation impinging on the PV modules. For off-grid systems energy output fundamentally depends on the installed capacity size of the RE resource conversion technology (i.e. PV, small hydro, wind etc). The energy output will also depend on the size of the battery storage and on the consumption patterns. For the latter, it becomes useful to perform a simulation based on detailed time series of satellite solar irradiation data. The data contains the cell-based Estimated costs of electricity (Euro/kWh) delivered by a (15 kWp) off-grid PV system. This calculation was made using the photovoltaic geographic information system (PVGIS) database, which in turn is based on solar radiation data from HelioClim-1.

Relevant publications:


Reference System Information:

Reference system identifier: ETRS89_LAEAA, EPSG:3035
Value: +proj=laea +lat_0=0 +lon_0=18 +x_0=4321000 +y_0=3210000 +ellps=GRS80 +units=m +no_defs

Data Quality Information:

Scope of quality information:
Level of the data: dataset

Lineage:
Lineage statement:

Distribution Information:

Format:
Format name: ESRI ASCII GRID, ESRI BINARY GRID
Format version: from 7.x

Transfer options:
Online resource:
Online location: http://irena.masdar.ac.ae:8080/geoserver/JRC/wms
Function performed: unknown

File identifier: eurpvkwh2012.asc
Character set: UTF8: 8-bit variable size UCS Transfer Format, based on ISO/IEC 10646
Hierarchy level: Dataset: Information applies to the dataset
Date stamp: 2013-11-21 T10:54:04
Metadata standard name: ISO 19115:2003/19139
Metadata standard version: 1.0
Estimated costs of electricity (Euro/kWh) delivered by a diesel generator using the diesel price for each country and taking into account the cost of diesel transportation

**Data format(s):** ESRI ASCII GRID, ESRI BINARY GRID

**Coordinate system:** ETRS89_LAEA, EPSG:3035

**Location(s):** http://www.sciencedirect.com/science/article/pii/S1364032113005844

**Abstract:** Diesel generators have been the traditional solution to decentralized electrification needs. For off-grid applications, they present lower up-front capital costs per kilowatt installed; however, the dramatic increase of fuel costs in recent years and the cost of transport to remote areas greatly diminish the low capital cost advantage of the diesel option. In Africa the transport infrastructure is underdeveloped which has a severe consequence: the transport costs faced by African countries are almost twice as high as the world average. A global map of accessibility developed by the JRC formed this second component for the genset electricity cost calculations. To estimate the location specific operating costs for diesel gensets, the country-based diesel prices have been combined with the travel time data (derived from the accessibility map) integrating the transport costs.

**Relevant publications:**


**ISO 19115:2003/19139 Metadata:**

**Metadata Information:**

**Metadata language:** English

**Last update:** 2013-11-21

**Metadata contact – pointOfContact:**

- **Individual’s name:** Katalin Bodis
- **Organization’s name:** European Commission Joint Research Centre
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**Online resource:**

**Online location:** http://iet.jrc.ec.europa.eu/remea/

**Description:** European Commission Joint Research Centre website

**Scope of the data described by the metadata:** dataset

**Metadata identifier:** 51271ABE-B61B-4CAE-A054-9EA7F57AB5C5
Comparison between estimated PV and diesel minigrid costs (Euro/kWh)

Data format(s): ESRI ASCII GRID, ESRI BINARY GRID

Coordinate system: ETRS89_LAEA, EPSG:3035


Abstract: The map/data illustrates an economic comparison of the two off-grid options (diesel generator or PV). Negative values indicate the location where diesel is more economically advantageous, while positive values indicate where PV options are cheaper. The different policies prevailing in the various African countries on the fuel taxation/fuel subsidies are remarkable. The diesel versus PV map/data reveals that the effects of fuel subsidies play a crucial role: they change the picture of the most economically viable option dramatically.

Relevant publications:


ISO 19115:2003/19139 Metadata:

Metadata Information:

Metadata language: English
Last update: 2013-11-21

Metadata contact - pointOfContact:
  Individual's name: Katalin Bodis
  Organization's name: European Commission Joint Research Centre
  Contact's position: Senior GIS analyst
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Online resource:
  Online location: http://iet.jrc.ec.europa.eu/remea/
  Description: European Commission Joint Research Centre website

Scope of the data described by the metadata: dataset
Metadata identifier: 51271A0E-861B-4CAE-A054-8BC5F44BG7C8
Reference System Information:

Reference system identifier: ETRS89_LAEA, EPSG:3035
Value: +proj=laea +lat_0=0 +lon_0=18 +x_0=4321000 +y_0=3210000 +ellps=GRS80 +units=m +no_defs

Data Quality Information:

Scope of quality information:
Level of the data: dataset

Lineage:
Lineage statement:


Distribution Information:

Format:
Format name: ESRI ASCII GRID, ESRI BINARY GRID
Format version: from 7.x

Transfer options:
Online resource:
Online location: http://irena.masdar.ac.ae:8080/geoserver/JRC/wms
Function performed: unknown

File identifier: diffdipv2012.asc
Character set: UTF8: 8-bit variable size UCS Transfer Format, based on ISO/IEC 10646
Hierarchy level: Dataset: Information applies to the dataset
Date stamp: 2013-11-21 T09:35:17
Metadata standard name: ISO 19115:2003/19139
Metadata standard version: 1.0
Modelled most economic rural electrification option (off-grid PV system, grid extension, mini-hydro, diesel generator)

Data format(s): ESRI ASCII GRID, ESRI BINARY GRID

Coordinate system: ETRS89_LAEA, EPSG:3035

Location(s): http://www.sciencedirect.com/science/article/pii/S1364032113005844

Abstract: The cost of electricity delivered has been computed for each pixel of the African continent for four options: extension of the grid from the closest existing network, hydropower including the extension of a local grid from the closest permanent river section, off-grid PV system and stand-alone diesel generator. Based on the power generation costs belonging to each energy source the minimum price can be defined for each geographic location. The map/data on modelled most economic rural electrification option shows regions where off-grid PV system (value 1), grid extension (value 2), mini-hydro (value 3) or diesel generator (value 4) may prove to be the most economic electricity option.

Relevant publications:


ISO 19115:2003/19139 Metadata:

Metadata Information:

Metadata language: English
Last update: 2013-11-21

Metadata contact - pointOfContact:
Individual's name: Katalin Bodis
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Online resource:
Online location: http://iet.jrc.ec.europa.eu/remea/
Description: European Commission Joint Research Centre website

Scope of the data described by the metadata: dataset
Metadata identifier: 51271A0E-861B-4CAE-A054-SAB6F89RH4A1
Resource Identification Information:

Citation:
Title: Modelled most economic rural electrification option (off-grid PV system, grid extension, mini-hydro, diesel generator)
Reference date - publication: 2013-03-05

Themes or categories of the resource: economy
Descriptive keywords: Optimisation, Renewable technologies, Rural electrification, Off-grid systems
Keywords: Energy resources

Citation:
Title: GEMET - INSPIRE themes, version 1.0
Reference date - publication: 2008-06-01
Descriptive keywords: Renewable technologies, Rural electrification, Off-grid systems, Photovoltaic system
Keywords: Renewable energy, Solar energy

Citation:
Title: Integrated Public Sector Vocabulary, version 2.00
Reference date - publication: 2006-05-23

Dataset language: eng

Resource constraints:
Legal constraints:
Access constraints: otherRestrictions,
Use constraints: no constraints
Resource constraints:
Constraints:
Limitations of use: no conditions apply

Spatial representation type: grid

Spatial resolution: Ground sample distance: 1000

Extent:
Geographic extent:
Bounding rectangle:
EPSG:3857 "Google Mercator"  EPSG:4326 "WGS84"  ETRS89_LAEA_N00_E18
West longitude: -31.873  Xmin = -31.873  Xmin = -270000.000
East longitude: 61.863  Xmax = 61.863  Xmax = 8369000.000
North latitude: 37.829  Ymin = -35.271  Ymin = -655000.000
South latitude: -35.271  Ymax = 37.829  Ymax = 7345000.000

Temporal extent: 2010-01-01 2010-12-31

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Online resource:
Online location: http://iet.jrc.ec.europa.eu/remea/
Description: European Commission Joint Research Centre website

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Online resource:
Online location: http://iet.jrc.ec.europa.eu/remea/
Description: European Commission Joint Research Centre website
Reference System Information:

Reference system identifier: ETRS89_LAEA, EPSG:3035
Value: +proj=laea +lat_0=0 +lon_0=18 +x_0=4321000 +y_0=3210000 +ellps=GRS80 +units=m +no_defs

Data Quality Information:

Scope of quality information:
Level of the data: dataset

Lineage:
Lineage statement:

Distribution Information:

Format:
Format name: ESRI ASCII GRID, ESRI BINARY GRID
Format version: from 7.x

Transfer options:
Online resource:
Online location: http://irena.masdar.ac.ae:8080/geoserver/JRC/wms
Function performed: unknown

File identifier: opentype2012.asc
Character set: UTF8: 8-bit variable size UCS Transfer Format, based on ISO/IEC 10646
Hierarchy level: Dataset: Information applies to the dataset
Date stamp: 2013-11-21 T15:44:03
Metadata standard name: ISO 19115:2003/19139
Metadata standard version: 1.0
Annex II. - IRENA Geoserver View
Estimated costs of electricity (Euro/kWh) delivered by a (15 kWp) off-grid PV system

Estimated costs of electricity (Euro/kWh) delivered by a diesel generator using the diesel price for each country and taking into account the cost of diesel transportation.
Comparison between estimated PV and diesel minigrid costs (Euro/kWh)

Modelled most economic rural electrification option (off-grid PV system, grid extension, mini-hydro, diesel generator)
Abstract

The International Renewable Energy Agency (IRENA) Global Atlas aims to provide access to a set of geographical information layers, which enables users to highlight areas of opportunity for developing renewable energy projects. The Renewable Energy Unit of the Institute for Energy and Transport (IET) of the European Commission Joint Research Centre (JRC) provided thematic data layers to the publicly available geoserver of IRENA. The data layers were resulted by research on renewable energy and rural electrification options in Africa. The research has been done within the framework of the ‘Renewable Energy Mapping and Monitoring in Europe and Africa’ action (REMEA) and the research program of the African Renewable Energy Technology Platform (AFRETEP).
As the Commission’s in-house science service, the Joint Research Centre’s mission is to provide EU policies with independent, evidence-based scientific and technical support throughout the whole policy cycle.

Working in close cooperation with policy Directorates-General, the JRC addresses key societal challenges while stimulating innovation through developing new standards, methods and tools, and sharing and transferring its know-how to the Member States and international community.

Key policy areas include: environment and climate change; energy and transport; agriculture and food security; health and consumer protection; information society and digital agenda; safety and security including nuclear; all supported through a cross-cutting and multi-disciplinary approach.