European Energy Policy and Standardization -

Buildings and Building Components

J.J. BLOEM
DG JRC

http://ec.europa.eu/dgs/jrc

Serving society
Stimulating innovation
Supporting legislation

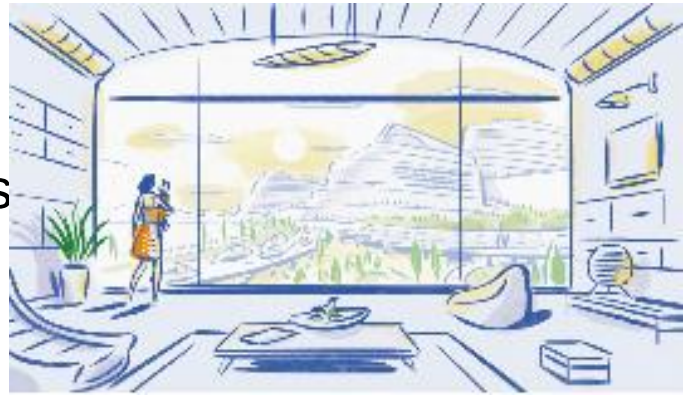
TOWARDS 2030

framework for climate and energy policies

- EU economy and energy system more competitive, secure and sustainable
- towards a low-carbon economy (Roadmap 2050)
- reduce EU domestic greenhouse gas emissions by 40% below the 1990 level by 2030 (emissions by at least 80% by 2050)
- share of renewable energy to at least 27%
- 30% energy savings target for 2030 (EED)
- **Buildings** have a huge potential to contribute to these targets

CONTEXT

Low Carbon Economy (2050)



- EU Energy **Policy**
  - Innovation of products, technologies
  - Sustainable Energy Consumption
  - Buildings and Transport
  - Economic and social stimulus

- EU **Directives** for implementation at M.S. level
  - EPBD, CPR, RESD, EED, INSPIRE, …

- EU **Standardisation**
  - CENELEC/IEC (energy efficiency, electricity including LVD)
  - CEN/ISO (energy performance, construction and products)
  - Member States regulations

BUILDING

- A protected enclosure (space/volume) taking into account its boundaries; climate, energy infra-structure and functionality.
- Key element in the energy infra structure
- For energy assessment the envelope is the most important part. It separates indoor- (volume) from outdoor environment.
- In terms of energy consumption:
  - Building needs; minimum requirements
  - Operational needs; apparatus, etc.
  - Occupancy/functionality energy needs

EU RELEVANT LEGISLATION

Agreement on reduction of CO_2 emission

- Directive (89/106/EEC) Construction Products
- CPR (2011/305/EU) Construction Products Regulation
- Directive 2001/77/EC Directive on **Electricity** produced from **Renewable** Energy Sources
- Directive 2005/32/EC Directive on the **Eco-design** of Energy-using Products
- Directive 2006/32/EC Directive on **Energy end-use Efficiency** and Energy Services. *2011 review*
- Directive 2007/2/EC on an Infrastructure for **Spatial Information** in the European Community
- Directive 2009/28/EC Directive on the promotion of Energy from **Renewable Sources**
- Directive 2010/31/EU Directive on the Energy Performance of **Buildings** *(recast). 2012 COM*

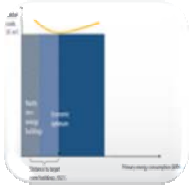
Construction Products Regulation

The Construction Products Regulation (CPR) lays down harmonised conditions for the marketing of construction products. Reliable information on construction products in relation to their performance is achieved by providing a common technical language and standardised assessment methods.

Regulation (EU) No 305/2011 of the European Parliament and of the Council of 9 March 2011

To be transposed by 9 July 2012

Energy Performance of Buildings Directive



Energy performance & Cost optimality

- MSs: Minimum energy performance requirements
- Cost-optimal methodology (common framework)
- Requirements for technical building systems

Existing Buildings

- All the buildings undergo major renovation should implement energy efficiency measures
- Minimum requirements for buildings and components

New Buildings → **Nearly Zero Energy Buildings**

- By 31 Dec. 2018 public admin. Bdgs
- By 31 Dec. 2020 all buildings
- National plans for nZEB

Energy performance certification

- Implement EPC schemes
- Recommendation for cost-optimal improvements
- Independent control systems

HVAC inspection

- Regular inspections (heating > 20kW, AC>12kW)
- Independent control systems

Financial incentives & Market barriers

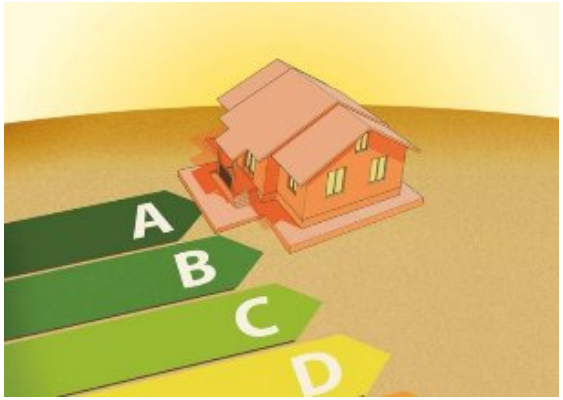
- MSs: to prepare lists of measures and instruments
- Take into account cost-optim. for these measures

OBJECTIVE

Find a consensus on the application of modelling software tools for the assessment of energy consumption in the future low-energy building sector.

Energy Performance Assessment is a key-issue:

- Energy Performance Certificate
- Buildings; New and major renovation
- Cost Optimality Method
- Economic evaluation (renovation)
- Monitoring of performance



Energy Performance of Buildings

Directive 2010/31/EU article 2:

*The '*energy performance of a building*' means the **calculated** or **measured** amount of energy needed to meet the energy demand associated with a typical use of the building, which includes, inter alia, energy used for heating, cooling, ventilation, hot water and lighting;*

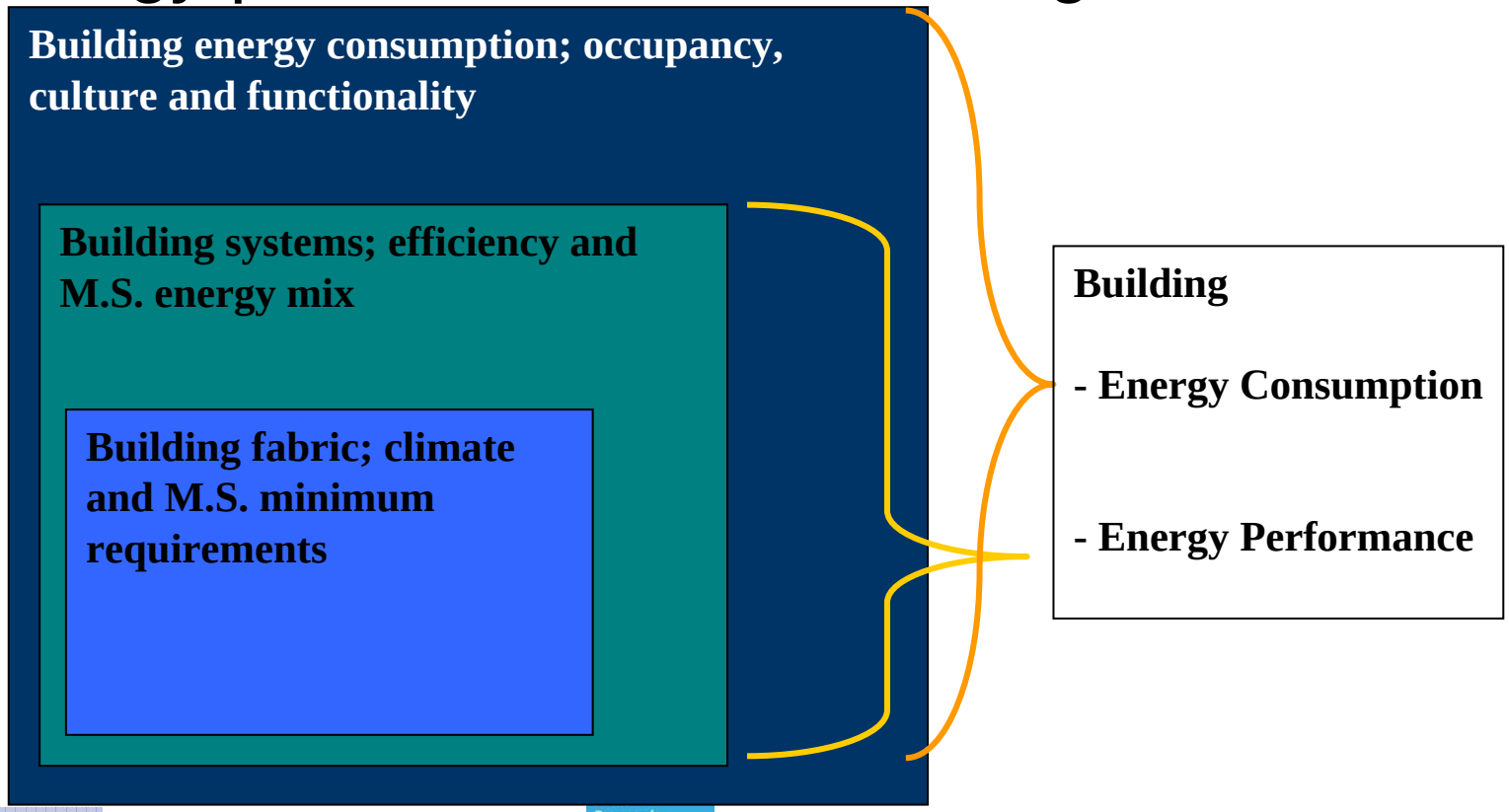
CONTEXT

*A '**nearly zero-energy building**' means "a building that has a **very high energy performance** (very low amount of energy required associated with a typical use of the building including energy used for heating, cooling, ventilation, hot water and lighting).*

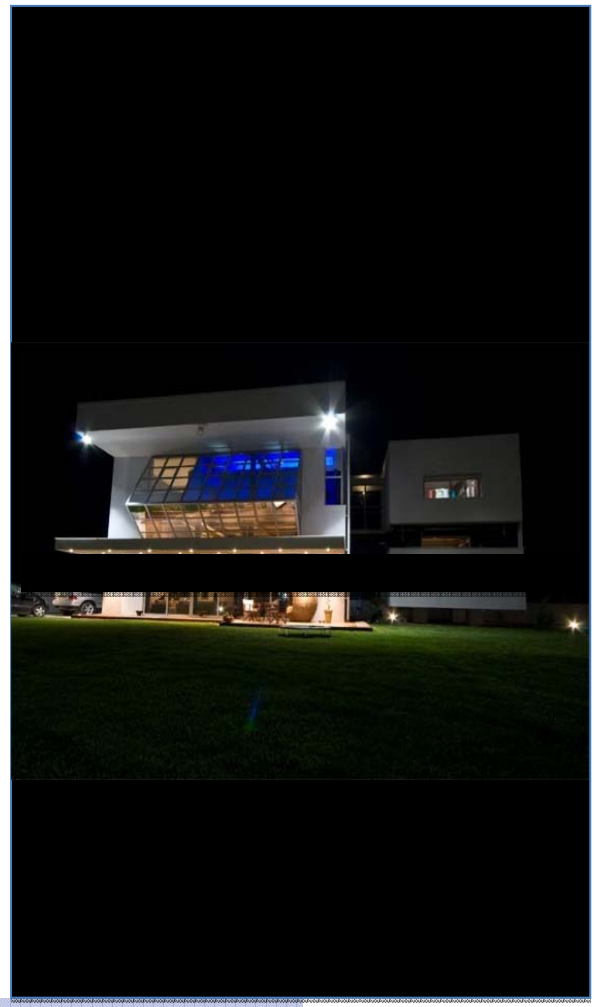
*The very low amount of energy required by a nearly zero-energy building has to be covered to a very significant extent by energy from renewable sources, including **energy from renewable sources produced on site or nearby**".*

ENERGY AND BUILDINGS

Relation of energy consumption and energy performance of a building



PHILOSOPHY



The philosophy, TRIAS ENERGETICA that supports the reduction of energy consumption in building sector is presented in three priority steps:

1. Energy **saving** (improve insulation),
2. Increase energy **efficiency** (building installations),
3. Use **renewable energy** resources (solar energy, bio-energy, etc.).

BUILDING ENERGY CONSUMPTION

Energy Consumption in buildings (3 consumption categories):

Relation to *Trias Energetica*: minimise, maximise and optimise

1. **Building energy needs (minimise; savings).**
   related to indoor (comfort level of temperature, air quality and light) and outdoor climate conditions (temperature, solar radiation and wind) for comfortable working and living in buildings.
2. **Building systems energy (maximise; efficiency).**
   combined efficiency of the installations for heating, cooling, ventilation, hot water and electricity in relation to available energy mix, are the relevant factors in the end-use energy consumption.
3. **Occupancy energy consumption (optimise; behavioural).**
   The remaining use of energy depends on how the occupant makes use of the building, including control and gains.

Performance assessment deals with points 1 and 2.

PERFORMANCE ASSESSMENT

CEN energy standards related to the EPBD

TC371 (Energy Performance of Buildings)

- Calculation (simulation)
  - Methods for fabric, systems, climate, comfort, etc
- Measurement (on-site)
  - Whole building (volume; occupied, non-occupied)
  - Building elements (thermal transmission of envelope)
- From building perspective to energy network perspective (involves ICT)
  - Building a cornerstone of the infra structure
  - Security of local supply (peak supply / demand)

STANDARDIZATION

CEN and EPBD related energy standards

- TC371 *Energy Performance of Buildings*
- TC89 *Thermal Performance of Buildings and Building Components*
- WG13 *In-situ thermal performance of construction products, building elements and structures*

Standards

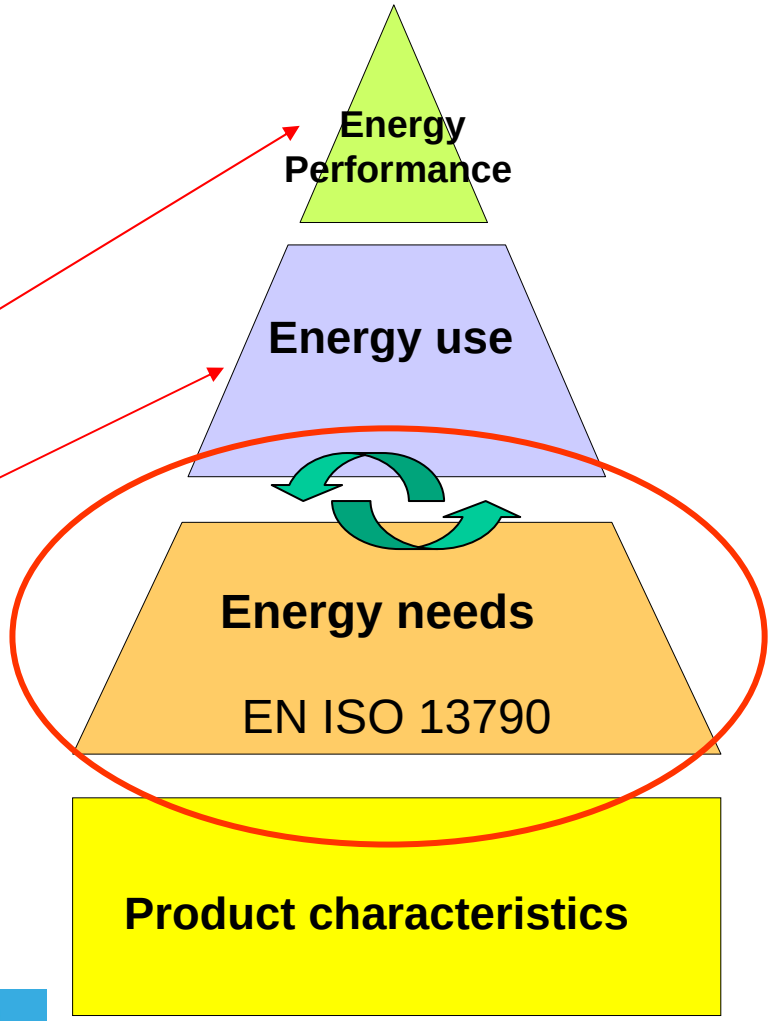
- EN 15603 Umbrella document
- TR 15615 Technical Report guidelines for 15603
- EN 13790 Calculation of Heating and Cooling needs

Position in set of EPBD standards

EN ISO 13790 is one of the key standards in the set of standards to support the EPBD.

Primary Energy

Efficiency



High Energy Performance Building

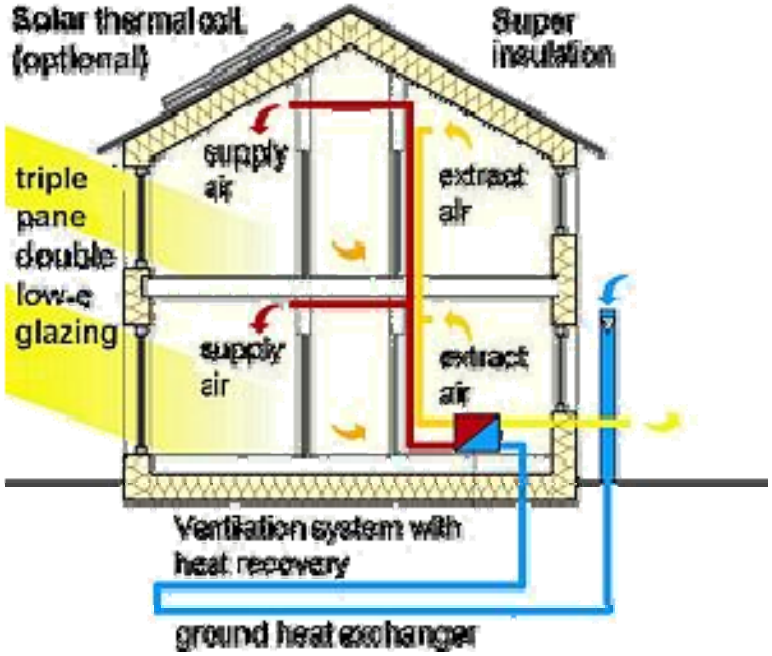
What is meant by nearly-Zero Energy Building? (EPBD 2010/31/EU)

- Rather a concept than a building
- Nearly-Zero
  - Thermal and electrical energy annual balance
  - **Balance** of Demand, Supply and Storage
- Energy
  - Energy consumption, GHG emissions (reduce)
- Building
  - From CPR (products) to EPBD (performance) to overall design
  - Traditionally consumes energy
  - Now are requested to produce energy
- **ICT** becomes an essential part of energy management
- **Urban area** (beyond the EPBD and other energy Directives)

RENEWABLE ENERGY

Building sector

- Direct : biomass, use of heat-pump, solar
  - Passive solar – design, orientation
  - Active solar
    - Thermal - water collectors
    - Electrical - PV systems
- Infra structure
  - Thermal – CHP (district)
  - Electricity
    - Yellow – nuclear
    - Black – fossil
    - Green - renewable

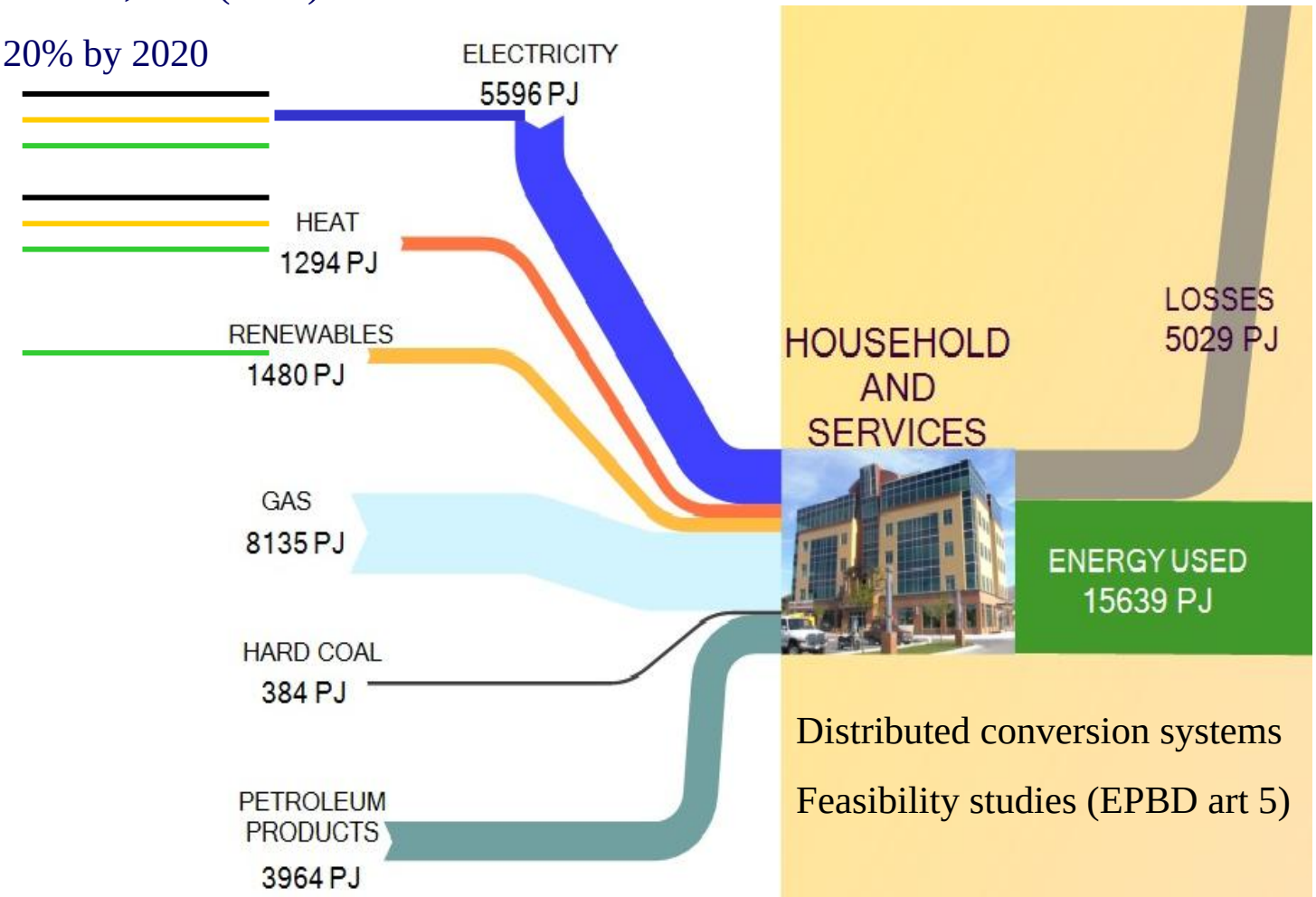


Source: Passive House Institute

EU BUILDING SECTOR

RE elec, heat (2005)

20% by 2020



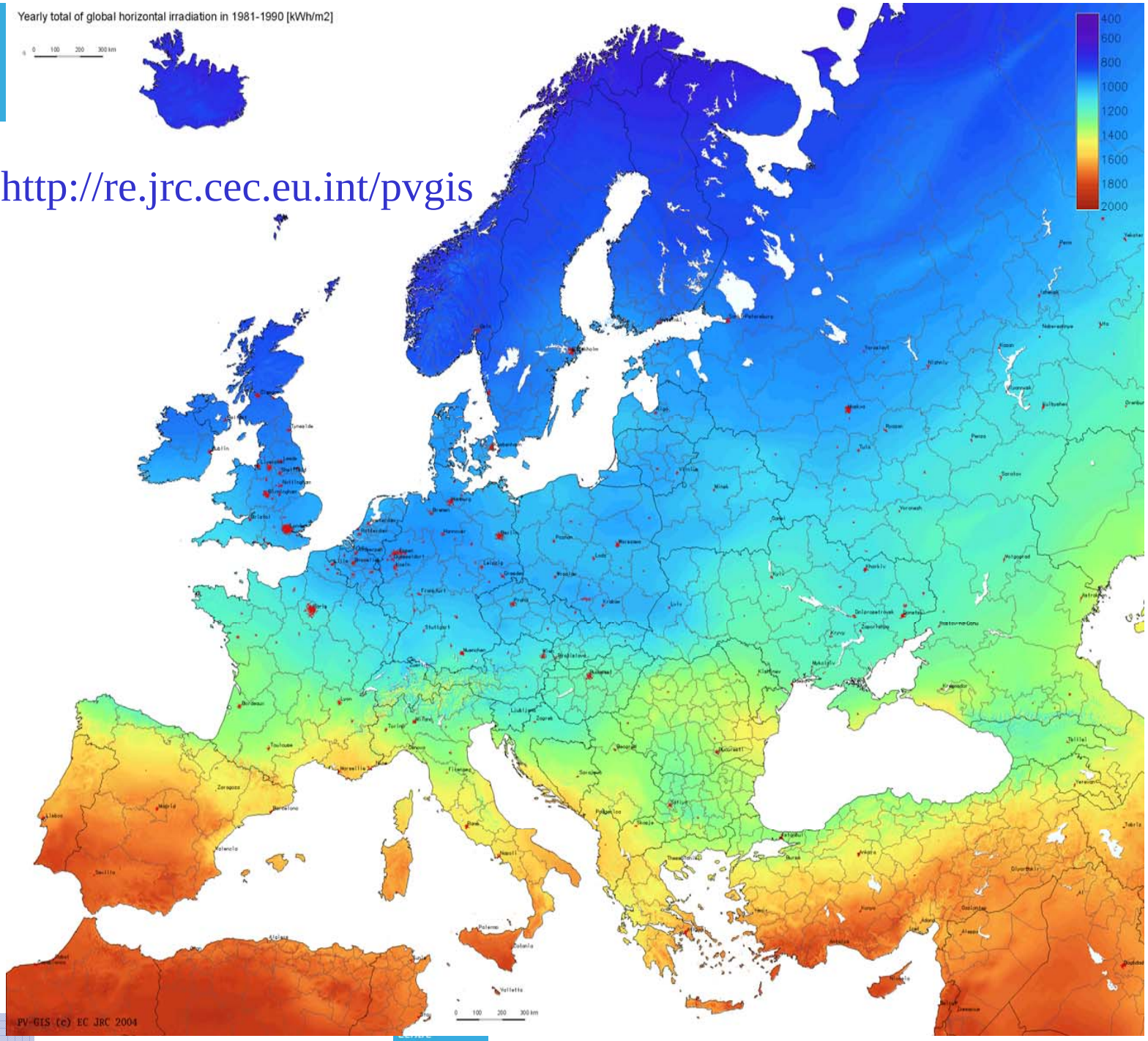
DIRECTIVES

STANDARDS

NORMS

Distributed conversion systems

Feasibility studies (EPBD art 5)



Web-site http://re.jrc.cec.eu.int/pvgis

GIS-RAD

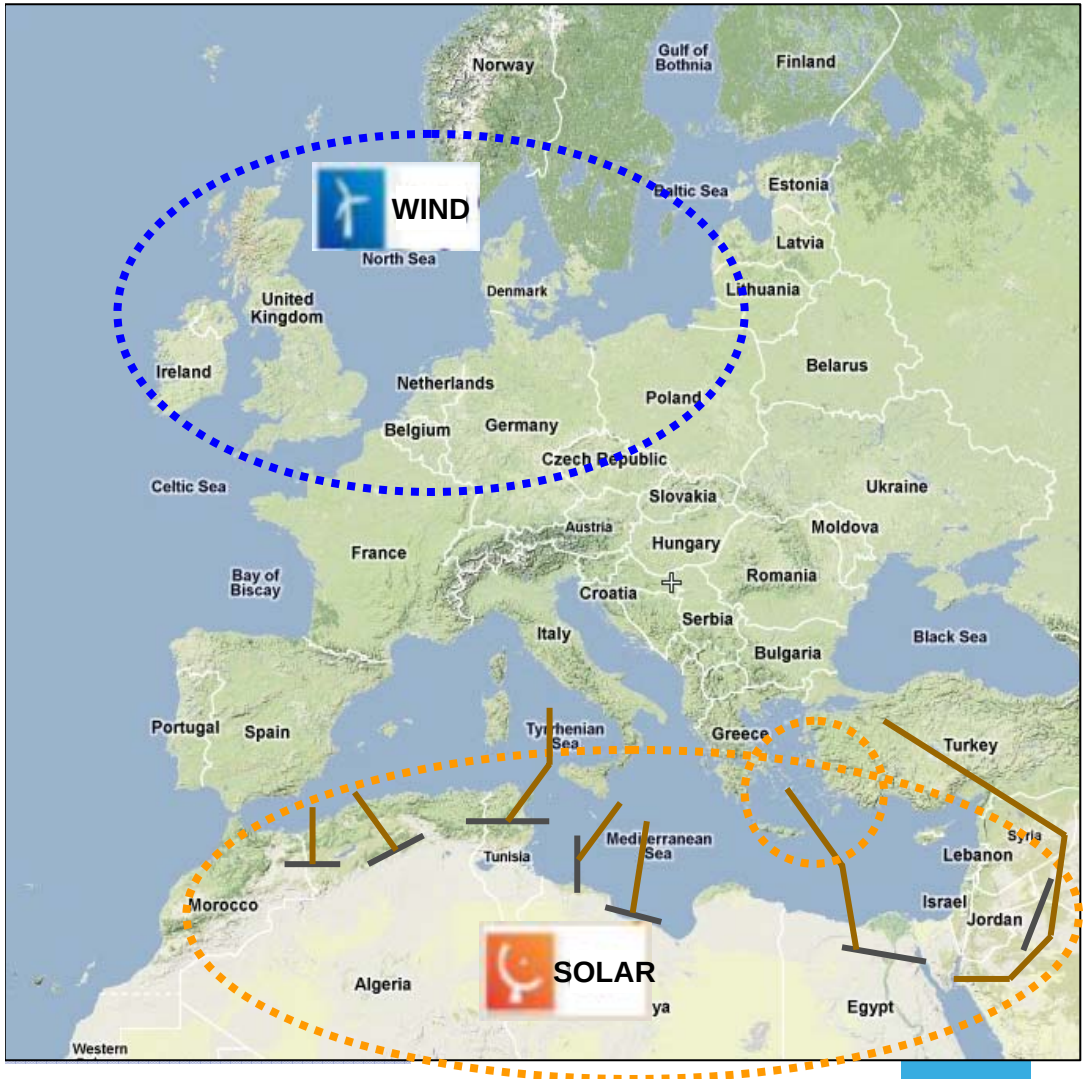
Climate

calculation

parameters

and data

Security of Energy Supply – Super Grids

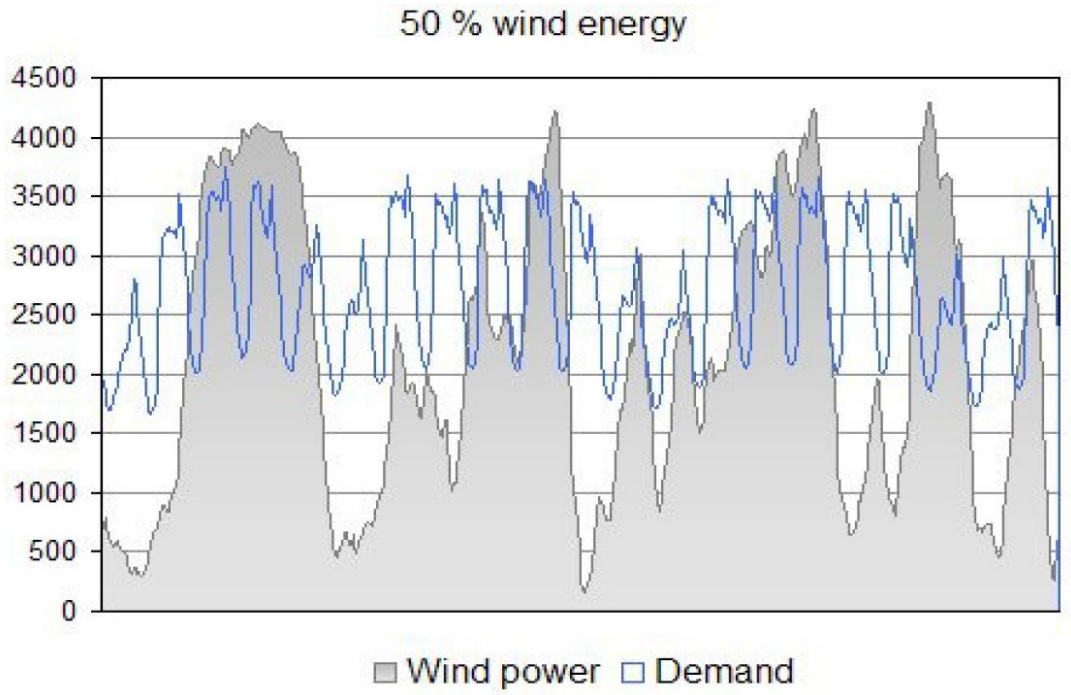


- JRC contribution:
- Communication on smart grids (202/2011)
- Standards (Mandate 490)
- European Industrial Initiative on Electricity Grids (SETIS)
- Smart Grids Task Force (DG ENER)
- Industry:
  - MEDGRID
  - Eurelectric
  - ENTSOE

RENEWABLE ENERGY INTEGRATION

- In Denmark wind power counts for about 50% of the total power.
- Balancing problem
- IMM has tools for:
  - Wind power forecasting
  - Solar power forecasting
  - Optimal planning
  - www.enfor.dk

- Total power and wind power 2013 :



25.4.2007 EN Official Journal of the European Union L 108/1

INSPIRE Directive

I

- General rules to establish an infrastructure for spatial information in Europe
  - Community environmental policies
  - Policies or activities which impact on the environment
- To be based on SDIs and LMOs established and operated by the Member States
- Does not require collection of new spatial data
- Scope:
  - Spatial data held by or on behalf of a public authority
  - 34 Spatial Data Themes laid down in 3 Annexes
- Entry into force 15 May 2007

(Acts adopted under the EC Treaty/Euratom Treaty whose publication is obligatory)

DIRECTIVES

DIRECTIVE 2007/2/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL

of 14 March 2007

establishing an Infrastructure for Spatial Information in the European Community (INSPIRE)

THE EUROPEAN PARLIAMENT AND THE COUNCIL OF THE EUROPEAN UNION,

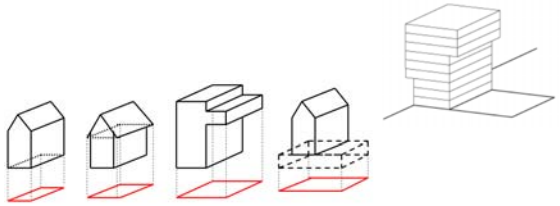
Having regard to the Treaty establishing the European Community, and in particular Article 175(1) thereof,

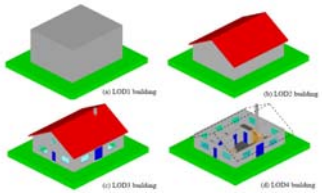
integration, it is necessary to establish a measure of coordination between the users and providers of the information so that information and knowledge from different sectors can be combined.

(2) The Sixth Environment Action Programme adopted by

How INSPIRE is relevant for building energy assessment ?

- One relevant theme: **Building**
- Current state of the data specifications:
  - Representations for buildings, building parts, openings, texture, etc.
  - 2D, 3D representations





  - Many thematic information, some may be relevant for building assessment (material of construction, etc.)

- **INSPIRE** could become a major data resource for building energy assessment

INSPIRE Thematic Scope

Annex I

1. Coordinate reference systems
2. Geographical grid systems
3. Geographical names
4. Administrative units
5. Addresses
6. Cadastral parcels
7. Transport networks
8. Hydrography
9. Protected sites

Annex II

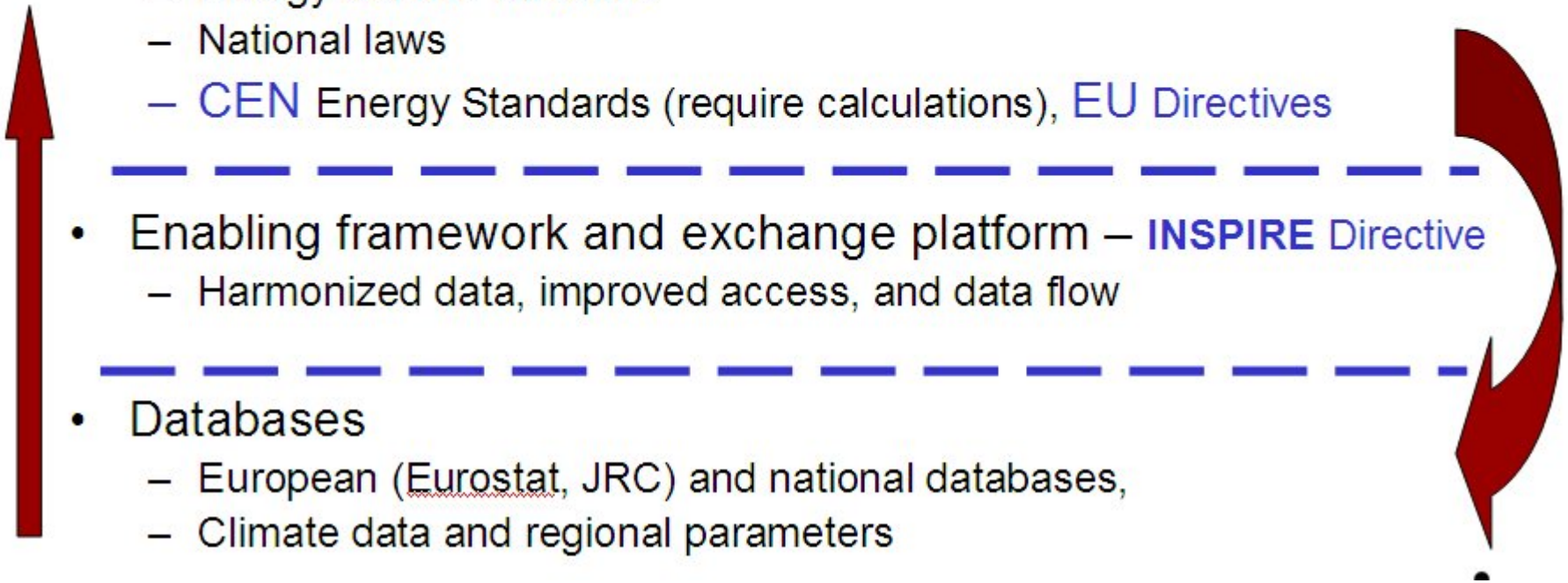
1. Elevation
2. Ortho-imagery
3. Land cover
4. Geology

Annex III

1. Statistical units
2. Buildings
3. Soil
4. Land use
5. Human health and safety
6. Utility and governmental services
7. Environmental monitoring facilities
8. Production and industrial facilities
9. Agricultural and aquaculture facilities
10. Population distribution – demography
11. Area management/ restriction/regulation zones & reporting units
12. Natural risk zones
13. Atmospheric conditions
14. Meteorological geographical features
15. Oceanographic geographical features
16. Sea regions
17. Bio-geographical regions
18. Habitats and biotopes
19. Species distribution
20. Energy Resources
21. Mineral resources

SYNERGY and HARMONISATION

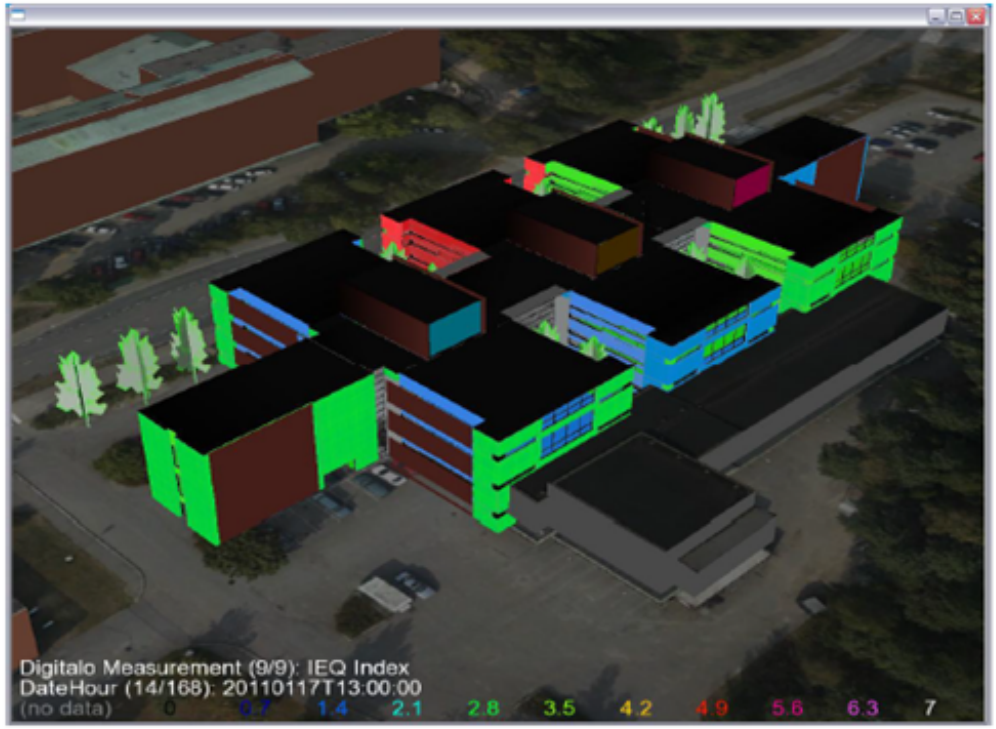
- Applications – Energy calculation, flows, grid
  - Energy Performance for Buildings Directive
  - Construction Product Directive
  - Energy Service Directive
  - National laws
  - CEN Energy Standards (require calculations), EU Directives
- Enabling framework and exchange platform – **INSPIRE** Directive
  - Harmonized data, improved access, and data flow
- Databases
  - European (Eurostat, JRC) and national databases,
  - Climate data and regional parameters



DESIGN and REAL PERFORMANCE

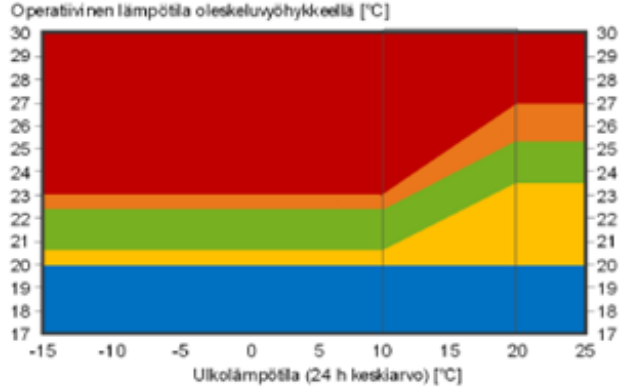
- Simulation software coupled to real data

- Comfortable room temperature = green; red = too hot, blue = too cold



IEQ index (temperature/CO_2/etc.)

Target values of temperature (FiSIAQ Cat S2)



Joint Research Centre

GIS –ENERGY BUILDING

solargis

SolarGIS home Knowledge base Account

Welcome admin! | Logout

1 Explore Map | 2 PV Planner | 3 Enhanced stats

45° 51' 07", 08° 37' 17", 200.0 m
Via Golfo, 32-44, 21020 Monvalle VA, Taliansko

Change location

PV System Parameters

Installed power (kWp): 1

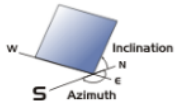
Type of modules: crystalline silicon (c-

Type of inverter: generic

Other DC/AC losses (%): 6 / 1.5

Availability (%): 99.5

Mounting system: roof mounted



Azimuth (°): 202 South

Inclination (°): 30

optimize

Calculate

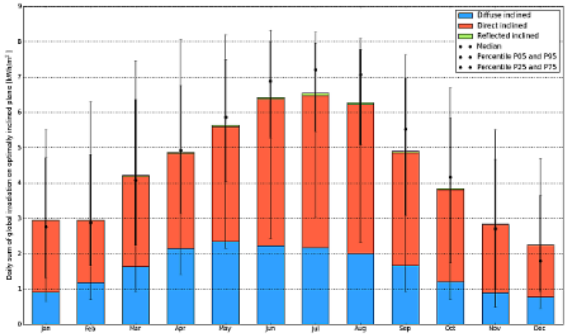
Solar radiation and air temperature – monthly values (show PV output) Manage/explain columns

Month	Gm	Gd	Dd	Gcd	Dcd	GP05	Gmed	GP95	Td	T24
Jan	79	2.55	0.84	4.06	0.96	0.36	3.25	4.17	2.4	2.1
Feb	95	3.38	1.15	5.29	1.27	0.53	4.3	5.4	4.1	3.5
Mar	143	4.61	1.64	6.79	1.6	0.91	5.77	6.97	8.8	8.0
Apr	155	5.17	1.97	7.81	1.85	1.01	6.61	7.94	11.9	11.2
May	172	5.54	2.42	8.32	2.03	1.28	6.7	8.3	17.5	16.7
Jun	188	6.28	2.52	8.33	2.01	1.95	7.69	8.26	21.4	20.6
Jul	203	6.54	2.39	8.18	1.96	2.52	7.76	8.24	23.2	22.4
Aug	170	5.49	2.23	7.69	1.85	1.44	6.7	7.88	23.1	22.3
Sep	141	4.69	1.91	6.89	1.7	1.01	5.66	7.11	17.8	17.3
Oct	95	3.07	1.35	5.54	1.36	0.52	3.26	5.57	12.7	12.4
Nov	75	2.51	0.86	4.31	0.98	0.36	3.03	4.31	7.3	7.1
Dec	68	2.2	0.71	3.72	0.81	0.31	2.82	3.55	3.3	3.1
Year	**1584**	**4.34**	**1.67**	**6.41**	**1.53**	–	–	–	**12.8**	**12.2**

PV Conversion losses and performance ratio

Energy losses	[kWh/kWp]	[%]	Pr
Global irradiation input	*1584*	-	*100.0*
Terrain shadowing (horizon)	1584	-0	100.0
Angular reflectivity at modules	1539	-2.9	97.1
Conversion efficiency of modules (irradiance and temperature)	1399	-9.0	88.3
DC losses (mismatch, dirt, snow, self-shading, cables)	1316	-6.0	83.0
Inverter(s) (DC/AC conversion)	1263	-4.0	79.7
AC losses and transformer	1244	-1.5	78.5
Availability (downtime from failure and maintenance)	1238	-0.5	78.1
Total system output and performance ratio	**1238**	–	**78.1**

Solar radiation – monthly values



GeoModel © 2009 GeoModel s.r.o.

BUILDING STOCK

BPIE Europe's buildings under the microscope;
a country-by-country review of the energy performance of buildings (2011)

Over 75% of building stock is older than 25 years (estimation)

Averaged final energy consumption data

- Residential 185 kWh/m^2
- Non-Residential 280 kWh/m^2

THANK YOU

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