



Large Valorisation on Sustainability of Steel Structures

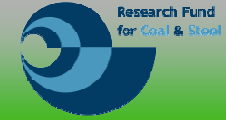
AMECO3 software



June 2014



AMECO General presentation



AMECO :

- ◆ Software to deal with **Life Cycle Assessment** of **bridges** and **buildings** with **structural steel**
- ◆ Calculations according to **ISO 14040 & 44**
- ◆ Free tool developed by **CTICM** (France) on the behalf of **ArcelorMittal**





AMECO includes following modules:

◆ **Module A :**

Production stage (Raw material supply, transport, manufacturing)

Construction stage (transport, construction)

◆ **Module B :** Use stage

Module added in AMECO version 3 in the frame of LVS3 project

For buildings only

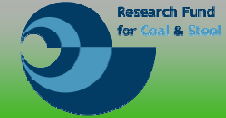
An option is available to ignore this module during calculations

◆ **Module C :** End-of-life stage (deconstruction, transport, waste process, disposal)

◆ **Module D :** Benefits and loads beyond system boundaries (Reuse, recycling and recovery)

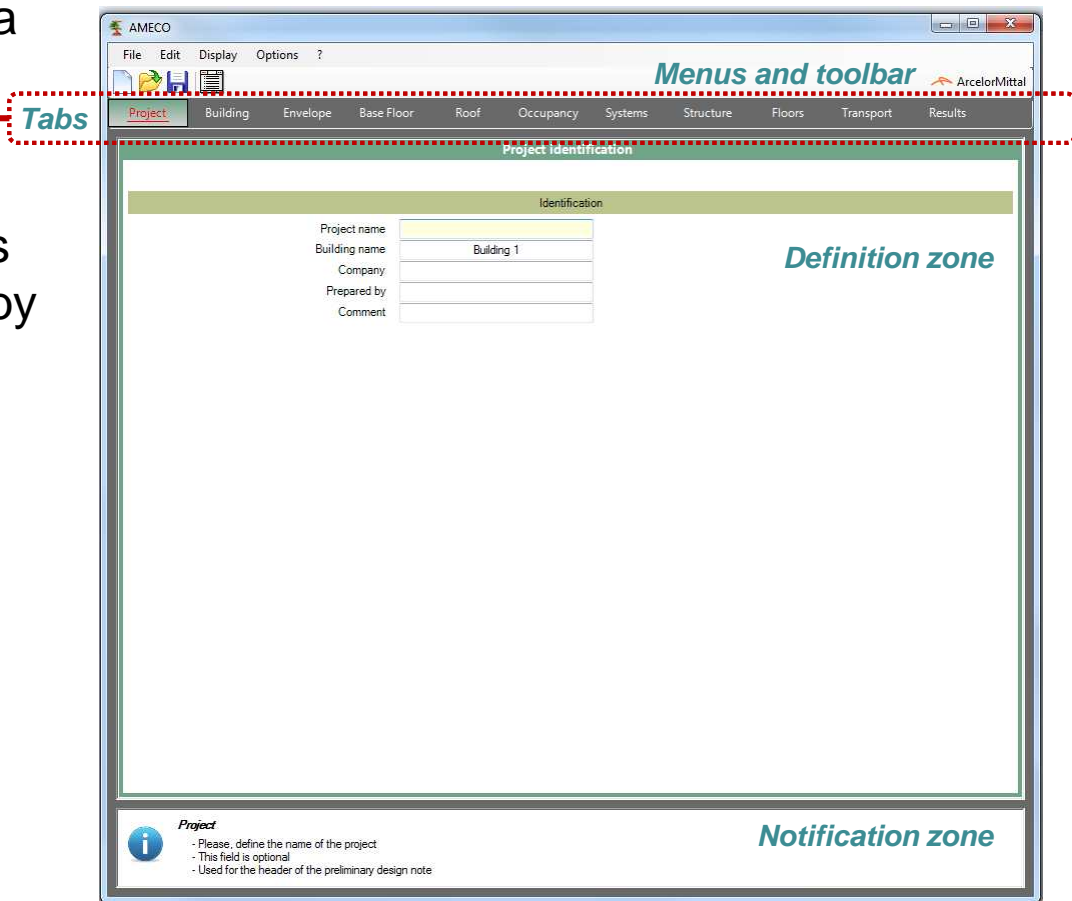


AMECO General presentation



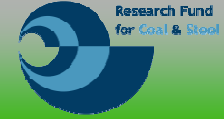
AMECO general organisation

- ◆ Based on a user friendly multilingual interface
- ◆ For windows OS (from Vista versions)
- ◆ Definition of the parameters through windows selected by tabs





AMECO Definition of a building



Main parameters for the definition of a building in **AMECO** (1st tab)

- ◆ Building defined by its main dimensions
 - Width of each façade
 - Height between floors
 - Number of floors
- ◆ 4 possible types of buildings : **residential**, **offices**, **industrial** or **commercial**
- ◆ The User has to define the location of the building among one of the 52 European cities already included in the geographical database of **AMECO**

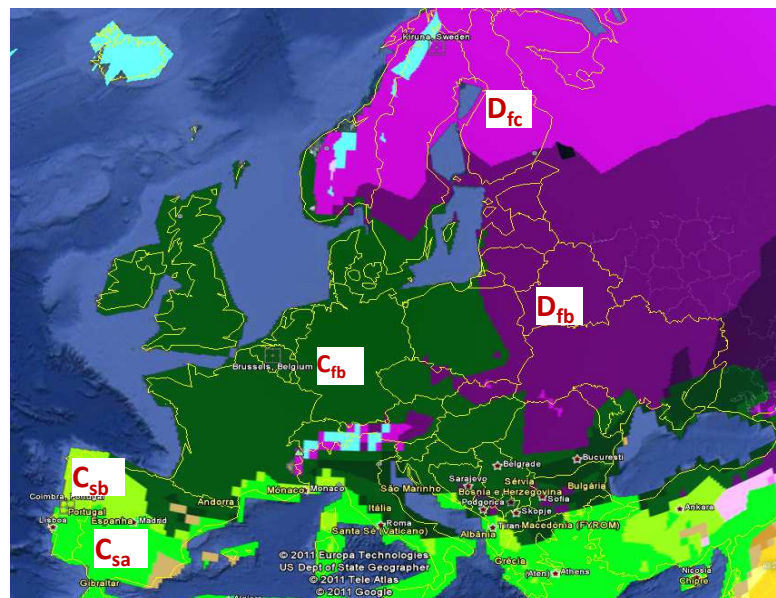


AMECO Definition of a building



Data included in **AMECO** for each location :

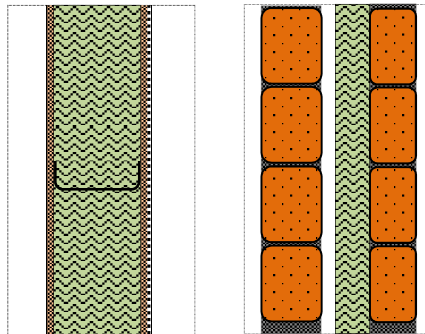
- ◆ For each month of the year
- ◆ Outside temperature
- ◆ Solar incident radiation for each of the 4 main orientations (S, W, N, E)
- ◆ Night fraction of the day
- ◆ Type of climatic region (5 possible choices)



Location data												
Month	January	February	March	April	May	June	July	August	September	October	November	December
Outside temperature	-1,4	0,3	5,3	10,1	14,8	17,4	19,6	19,2	15,1	9,9	3,5	-0,8
North solar incident radiation	17,0	27,3	40,8	57,1	68,3	77,0	73,8	62,5	46,8	32,2	19,5	14,7
East solar incident radiation	32,1	44,8	67,2	87,6	104,9	109,2	116,6	105,8	85,8	54,4	27,8	21,5
South solar incident radiation	89,4	85,2	109,0	108,6	108,0	106,3	116,1	124,1	126,2	111,0	55,0	45,3
West solar incident radiation	34,8	41,8	67,2	83,2	97,9	112,5	113,2	106,6	82,6	59,9	27,5	19,8
Roof solar incident radiation	49,2	71,6	115,6	156,7	190,2	207,5	217,0	192,4	142,2	92,5	46,4	33,9
Night fraction of the day	0,603	0,565	0,489	0,418	0,364	0,333	0,336	0,397	0,454	0,538	0,600	0,625
fraction of solar shading use (north)	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
fraction of solar shading use (east)	0,000	0,000	0,100	0,130	0,210	0,170	0,220	0,200	0,270	0,030	0,000	0,000
fraction of solar shading use (south)	0,690	0,400	0,430	0,280	0,120	0,050	0,060	0,280	0,420	0,500	0,380	0,220
fraction of solar shading use (west)	0,000	0,020	0,140	0,080	0,110	0,170	0,150	0,230	0,160	0,040	0,000	0,000

Definition of the **facades** (2nd tab)

- ◆ Façade areas automatically calculated
- ◆ Definition of opening areas for each façade by the User
- ◆ Definition of the type of façade through a list of macro-components

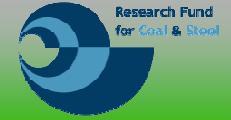


Light steel panel walls, double clay walls
For each one, several type of insulation

Data associated to each macro component : U values, Recycling rates, LCA impact coefficients (see background document)



AMECO Definition of a building



Definition of the **facades**

- ◆ Definition of the type of glazing through a list of macro-components
Double glazing, several emissivity types
- ◆ Definition of the shading and shutter devices

AMECO

File Edit Display Options ?

Project Building **Envelope** Base Floor Roof Occupancy Systems Structure Floors Transport Results

Definition of the building envelope

	North	East	South	West	
Direction	North	East	South	West	
Facade area	450	180	450	180	m ²
Opening area	30	30	30	30	%

Facade properties

Wall type: Light steel panel wall (rock wool)

U-value for walls: 0.296 W/(m².K)

Opening type: Double glazing

U-value for openings: 2.9 W/(m².K)

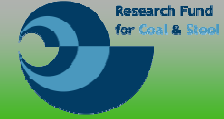
Shading device type and color: No shading device

Shutter type: No shutter

- Exterior aluminum roller shutter (no insulation)
- Exterior opaque wood device (no insulation)
- Exterior wood roller shutter (no insulation)
- Exterior plastic roller shutter (no insulation)
- Exterior wood venetian blinds
- Exterior metal venetian blinds
- Exterior opaque roller blind

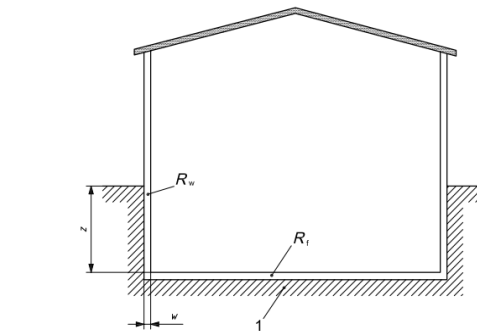


AMECO Definition of a building

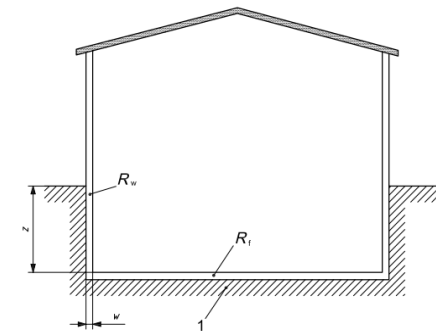


Definition of the **base floor** (3rd tab)

- ◆ 2 types of base floors
 - Slab on ground floor
 - Suspended floor



Key
1 floor slab
 R_f thermal resistance of floor construction
 R_w thermal resistance of walls of the basement, including all layers
 w thickness of external walls
 z depth of basement floor below ground level



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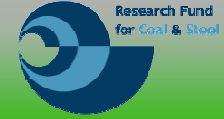
- ◆ Definition of the masses of concrete and reinforcement for base floor

Definition of the **roof** (4th tab)

- ◆ 2 types of roofs (macro-components)



AMECO Definition of a building



Display of the **occupancy** data (5th tab)

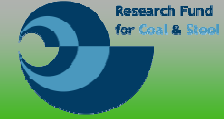
- ◆ Occupancy data are not modifiable. They are linked to the type of building :
 - heating temperature
 - cooling temperature
 - air flow rate (heating and cooling)
 - occupancy and light period of the day

Residential building light

	Kitchen and living area			Other conditioned areas		
	From	To	Gain (W/m ²)	From	To	Gain (W/m ²)
Monday to Friday	7	17	0	7	17	0
	17	23	10	17	23	5
	23	7	0	23	7	0
Saturday and Sunday	7	17	10	7	17	5
	17	23	10	17	23	5
	23	7	0	23	7	0



AMECO Definition of a building

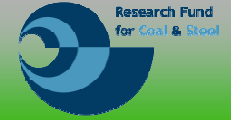


Definition of the **systems** in the building (6th tab)

- ◆ Heating system : electric resistance, gas fuel heater, liquid fuel h., solid fuel h., split, no heating
- ◆ Cooling system : split, absorption cooling device, compression cooling device, no cooling
- ◆ Mechanical ventilation unit with or without heat recovery system (definition of the efficiency and heat recovery percentage)
- ◆ Domestic Hot Water : electric boiler, gas boiler, stand alone water heater, no DHW

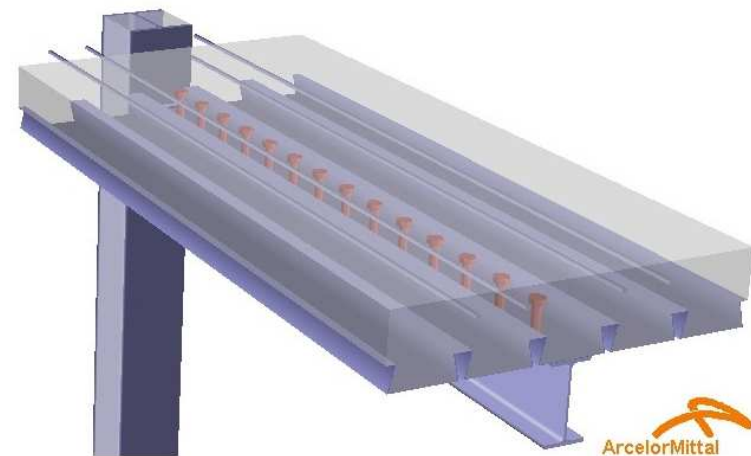


AMECO Definition of a building



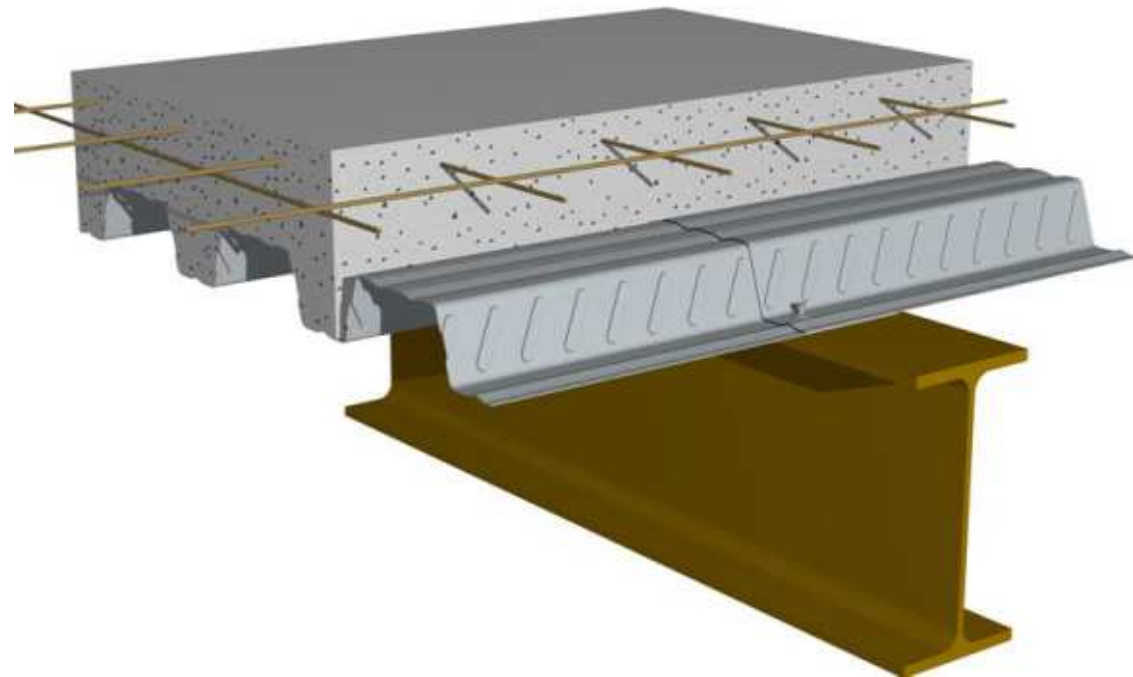
Definition of the **structure** of the building (7th tab)

- ◆ Steel columns (mass)
- ◆ Steel beams
- ◆ Studs
- ◆ Bolts
- ◆ Plate for connections



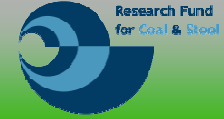
Definition of the structural systems of **floors** in the building (8th tab)

- ◆ Type of slabs : plain slab, composite slab, permanent formwork, prefabricated, dry floors
- ◆ Several types of steel sheeting proposed from database
- ◆ Type of concrete (poured in situ or prefabricated elements)
- ◆ Concrete grade
- ◆ Steel reinforcement





AMECO Definition of a building

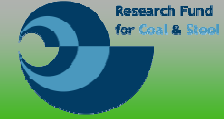


Definition of **transport conditions** for the elements used the building (9th tab)

- ◆ Either average (european data) or user defined values
- ◆ User defined values : by electric trains or by regular trucks, with the definition of the distances
- ◆ For concrete elements, distance by mixer trucks (poured in situ) or by regular trucks (prefabricated elements)



AMECO Results

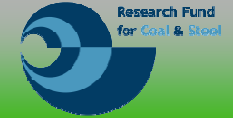


Following **impacts** are calculated and displayed (10th tab) :

- ◆ Global warming potential
- ◆ Ozone depletion potential
- ◆ Acidification potential
- ◆ Use of renewable primary energy
- ◆ Use of non renewable fuel energy
- ◆ Use of fresh water
- ◆
- ◆ A total of 24 impacts

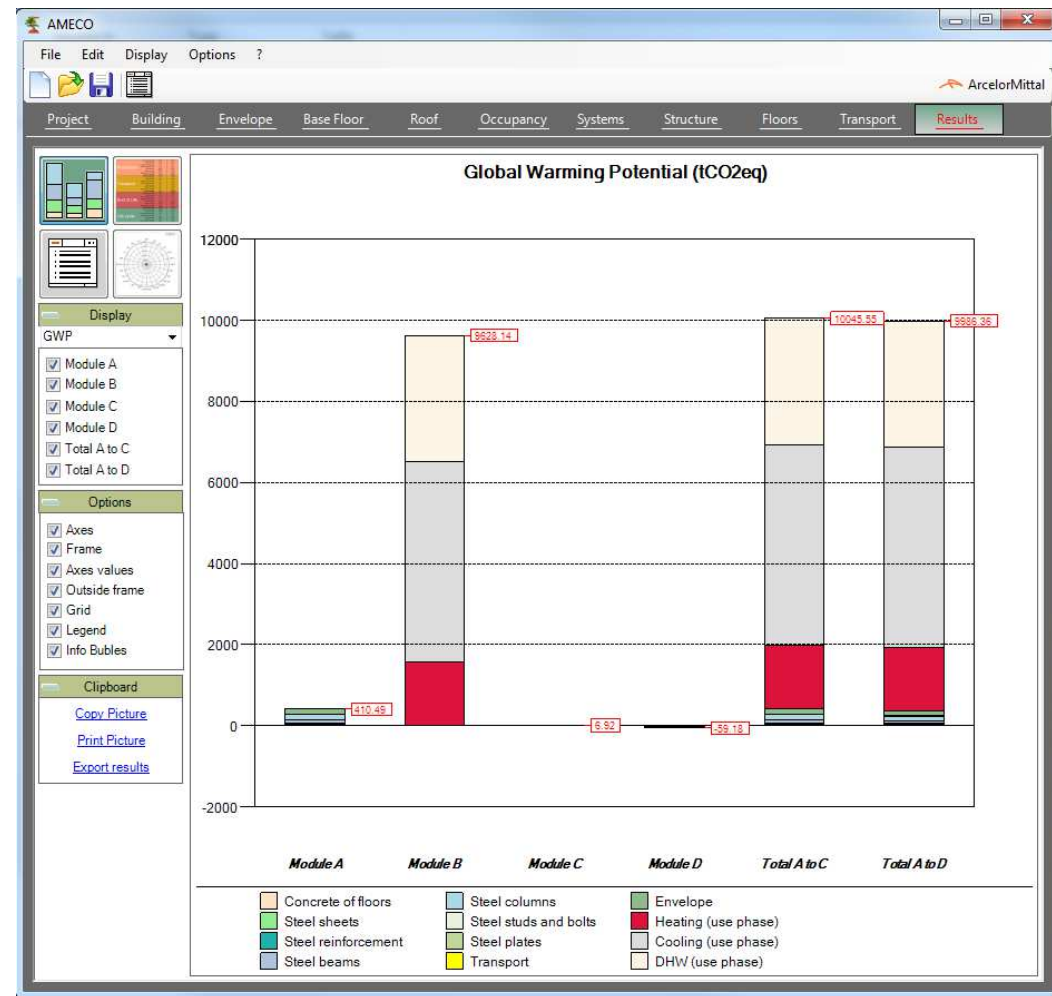


AMECO Results



Several type of graphical outputs

◆ Bar charts





AMECO Results



◆ Tables

AMECO

File Edit Display Options ?

Project Building Envelope Base Floor Roof Occupancy Systems Structure Floors Transport Results

Module A

Building 1	GWP (tCO ₂ eq)
Concrete of floors	32.17
Steel sheets	31.40
Steel reinforcement	0.00
Steel beams	69.26
Steel columns	138.52
Steel studs and bolts	0.75
Plate Connections	0.00
Transport	5.71
Envelope	132.68
Module A	410.49
Energy need for space heating	1580.76
Energy need for space cooling	4935.78
Energy need for DHW production	3111.59
Module B	9628.14
Concrete of floors	4.28
Steel sheets	0.08
Steel reinforcement	0.00
Steel beams	0.38
Steel columns	0.76
Steel studs and bolts	0.00
Plate Connections	0.00
Transport	0.00
Envelope	1.43
Module C	6.92
Concrete of floors	-0.08
Steel sheets	-15.94
Steel reinforcement	0.00
Steel beams	-6.79
Steel columns	-13.58
Steel studs and bolts	-0.23
Plate Connections	0.00
Transport	0.00
Envelope	-22.57
Module D	-59.18
Concrete of floors	36.45
Steel sheets	31.48
Steel reinforcement	0.00
Steel beams	69.64
Steel columns	139.27
Steel studs and bolts	0.75
Total A to C	

Display

GWP

- ☒ Module A
- ☒ Module B
- ☒ Module C
- ☒ Module D
- ☒ Total A to C
- ☒ Total A to D

Options

Clipboard

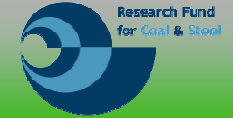
[Copy Picture](#)

[Print Picture](#)

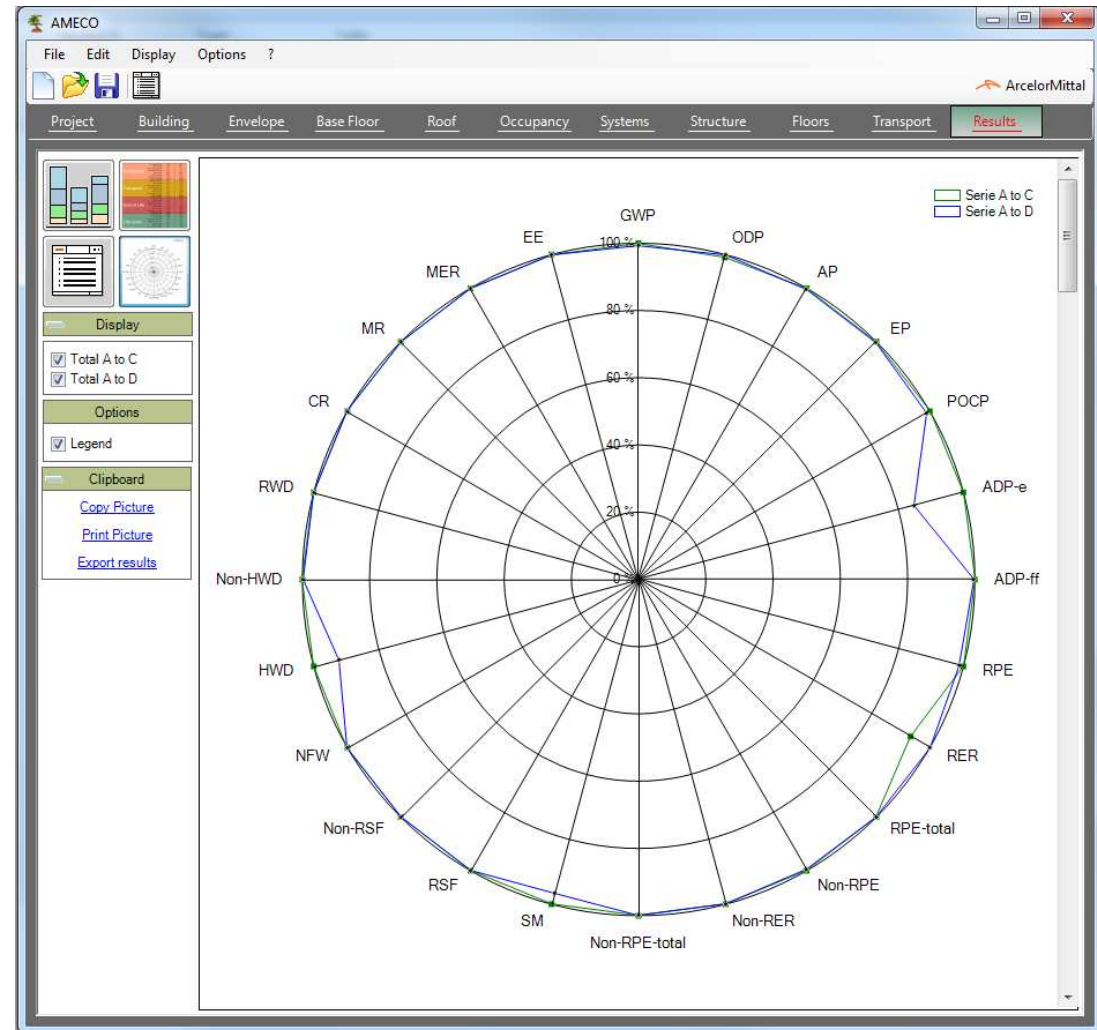
[Export results](#)



AMECO Results

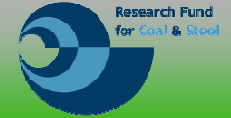


◆ Radial graphics

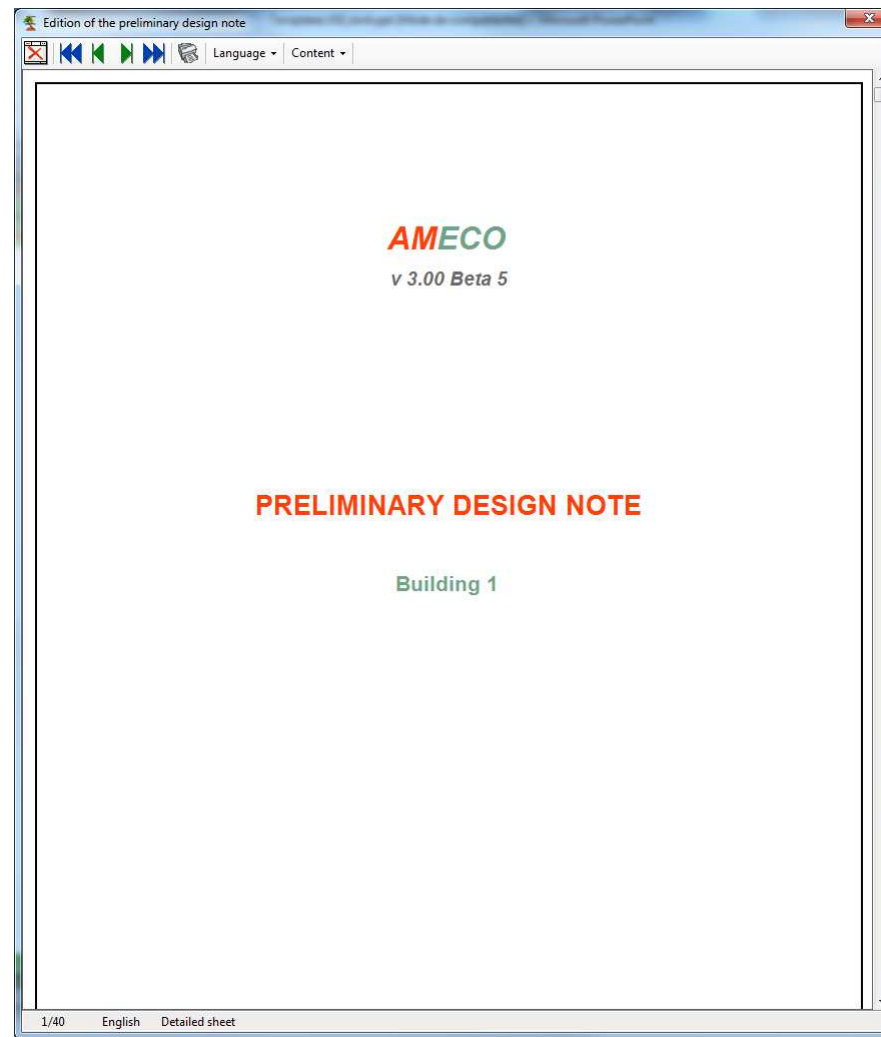




AMECO Results

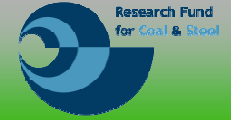


All data, parameters and results can also be displayed, saved and printed from a calculation report





AMECO Results



Parameters used in the calculations can be displayed in a specific window (options). Sources and values of these parameters are described in the background document.

