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BIM GATHERING

Building Capabilities in Complex Environments

CitA BIM Gathering 2017, Croke Park, November 23rd & 24th, 2017

IMPRESS BIM Methodology & Software Tools (iBIMm) for Façade Retrofitting Using Pre–fabricated Concrete Panels

IMPRESS

New Easy to Install and Manufacture PRE-Fabricated Modules
Supported by a BIM based Integrated Design ProceSS

Adalberto Guerra Cabrera

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 636717

Building Capabilities in Complex Environments

About IMPRESS

http://www.project-impress.eu/

- IMPRESS is a H2020 collaborative project that is developing **three different prefabricated panels** for the over and re cladding of building facades: (i) a polyurethane based insulated panel (ii) a thin, lightweight pre-cast concrete sandwich panel and (iii) a lightweight pre-cast concrete sandwich panel incorporating Phase Change Materials (PCM).
- To create the panels, an **innovative manufacturing process** is being created that includes Reconfigurable Moulding (RM) techniques, 3D laser scanning and 3D printed technology and 3D printed microstructured formworks.
- The overall manufacturing process will take into account **complex architectural** and aesthetic issues and will allow for **faster production** while lowering prefabrication costs.
- IMPRESS has also developed a new **Iterative Design Methodology**, which incorporates all stages of the Design-Construct-Install-Operate process and brings energy efficiency in as early as possible in the design process.
- The result will be demonstrated on **two existing buildings** where final as-built product performance will be validated against the initial design.

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iBIM overview

Research methodology and sources of information

Desktop research (Documentation, recorded conferences, peer-reviewed papers)

Interview research (Face-to-face, virtual meetings, e-mail, knowledge sharing)

BIM Standards, protocols and guidelines.

Case studies.

Manufacturer's product data.

iBIM

Iterative design methodology

Information management

IMPRESS software

Decision support software

Online management platform

Interoperable data server

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Research methodology & sources of information

Continent	Country	Organisation/Champion	Protocol / Guidelines	Collaborative production of information standards	Information/work flow standards
Europe	Czech Republic	Czech BIM Council Expert Council for BIM			
	France	FFB (Fédération Française du Bâtiment), buildingSMART (France)	BIM Road Map: Plan for the digital transition in the building industry, June 2015.		
	Germany	Federal Office for Building and Regional Planning Planenbauen 4.0 DIN VDI buildingSMART (Germany)	BIM guide for Germany: Road Map for Digital Design and Construction		
	Hungary	Hungarian BIM Council buildingSMART (Hungary)			
	Lithuania	Founded public body "Skaitmeninė statyba" (Digital Construction), established by Lietuvos Architektu Sajunga (a Lithuanian architects body).			
	Norway	Statsbygg buildingSMART Norway Norwegian Homebuilders Association	Statsbygg BIM Manual 1.2.1 (2013) Norwegian Home Builders Manual Version 1.0 (2011)		
	Slovakia	BIM Association of Slovakia, "BIMaS", (There are neither standards nor legislative requirements to deliver projects in BIM)[0]			
	Spain	Ministry of Infrastructure Current Guide adapted from CoBIM from Finland Comisión para la implantación de la metodología BIM buildingSMART Spain Standardization Committees AEN/CTN 41/SC13	DTIE 7.07. BIM Methodology for HVAC.	BuildingSmart UBIM Guides 1-13	
	Switzerland	ETH Zurich university, Swiss Society for Engineers and Architects, SIA. Digital Construction Switzerland Syndicate buildingSMART Switzerland SwissBIMalliance	Open BIM Guide for Switzerland		
	The Netherlands	The Rijksgebouwendienst BIM Loket Building Information Council TNO Boun Informatie Raad buildingSMART (Benelux)	Nationaal Model BIM Uitvoeringsplan Information Modelling BIM Project Specifi cation		
	United Kingdom	The Construction Project, Information Committee (CPIC), UK BIM Task Group, The Royal Institute of British Architects (RIBA), Construction Industry Council, buildingSMART UKI	CIC/BIM Protocol, Product Data Definition document CPIx Protocols	IFC: BS ISO 16739:2013, IDM: BS ISO 29481-1:2010, IFD: BS ISO 12006-3:2007, COBie: BS 1192-4:2014, BS 1192-4:2014	BIM LEVEL2: BS 1192:2007 +A2:2016 BS 7000-4:2013
	EU-level	The technical committee 442	CEN/TC 442 WG4	CEN/TC 442: IFD (ISO 12006-3:2007), IFC (ISO 16739:2013) and IDM (ISO 29481-2:2012)	

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Continent	Country	Organisation/Champion	Protocol / Guidelines	Collaborative production of information standards	Information/ work flow standards
Asia	Hong Kong	The Hong Kong Institute of Building Information Modelling (HKIBIM) Hong Kong Housing Authority (HKHA) Real Estate Developer Association buildingSMART (Hong Kong)	Hong Kong Institute of Building Information Modelling BIM Project Specification, HKIBIM (Rev 3.0)		
	India	Professionals implementing this technology in Indian construction projects			
	Iran	The Iran Building Information Modelling Association (IBIMA)			
	South Korea	buildingSMART (South Korea)		IFC Road bSI SPEC	
	China	Ministry of Science and Technology China BIM Union		IFC Rail bSI SPEC National BIM Standard	
	Singapore	The Building and Construction Authority (BCA) buildingSMART Singapore	Singapore BIM Guide Version 2.0		
North America	Canada	The Institute for BIM in Canada (IBC), The Canada BIM Council, buildingSMART (Canada).	AEC(CAN) BIM Protocol Canadian BIM Practice Manual		
	United States of America	The Associated General Contractors of America and U.S. contracting firms, The American Institute of Architects, GSA, USACE, National Institute of Building Science, buildingSMART USA.	GSA BIM Guide 01 to 08, National BIM Standard-United States, Penn State Project Execution Planning Guide V 2.1	US COBie Version 2.26, US BIM Standard for Precast Concrete, BIM steel initiatives	
Oceania	New Zealand	BIM Acceleration Committee	New Zealand BIM Handbook, A guide to enabling BIM on building projects	Open IFC Model Repository	
International		Building SMART alliance		IFC: ISO 16739:2013 BIM Collaboration Format XML, BIM Collaboration Format API	

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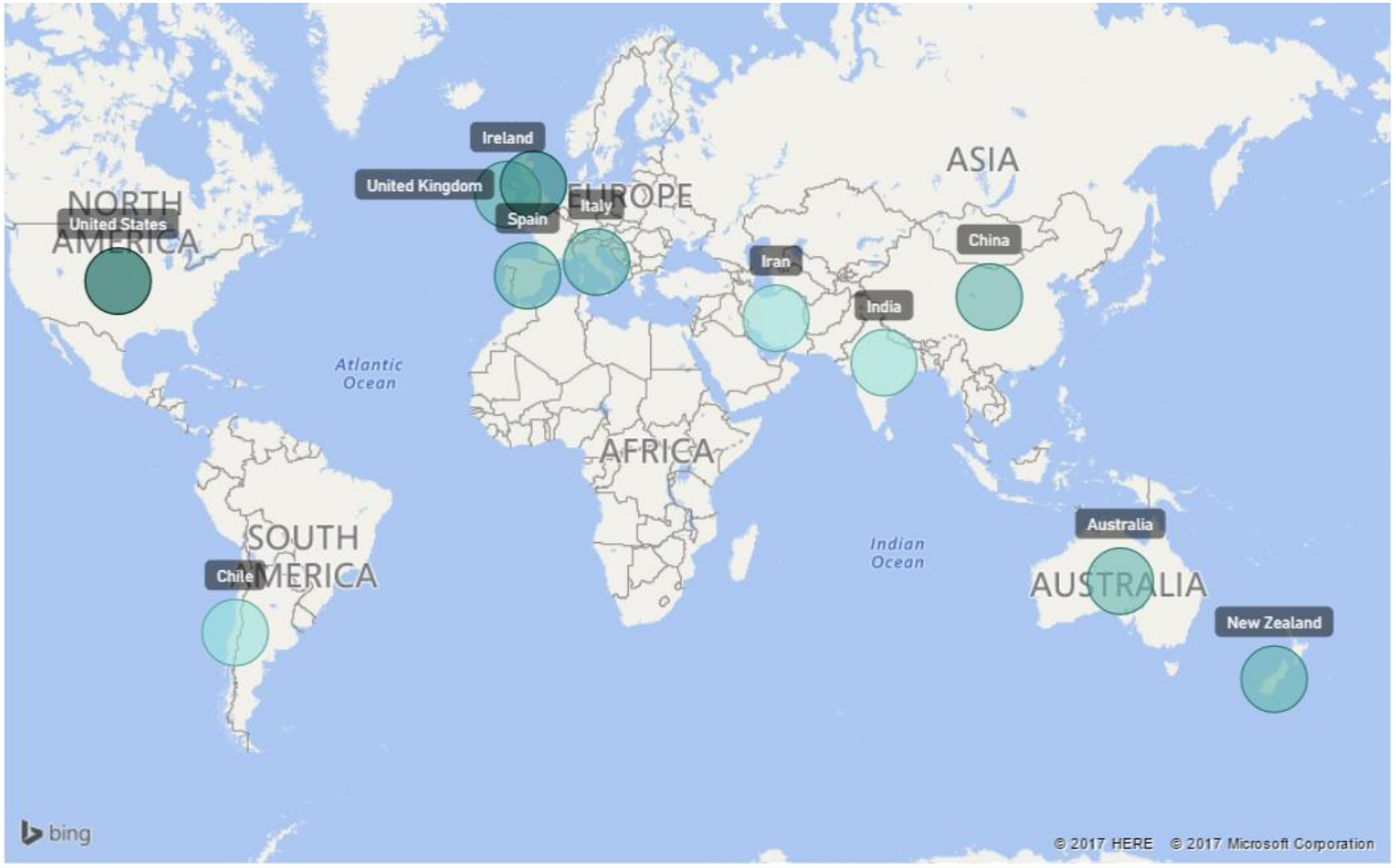
BIM case studies for retrofitting documented



BIM challenges areas
BIM methodologies and collaboration format
Cost of hardware and software licenses;
Lack of knowledge and technical skills
Knowledge and training
Demonstrating benefits
Standardisation challenges
Software and ICT related
Business challenges

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Manufacturer's product data of IMPRESS panels

Product data definition

- Share panel product information using a standard terminology
- Define information requirements on product performance, availability and logistics.
- Exchanged through standards including IS 16739 IFC 4 and BS 1192-4 COBie
- Products to comply with European Construction Product Regulation (Regulation (EU) No 305/2011)
- Include product lifecycle

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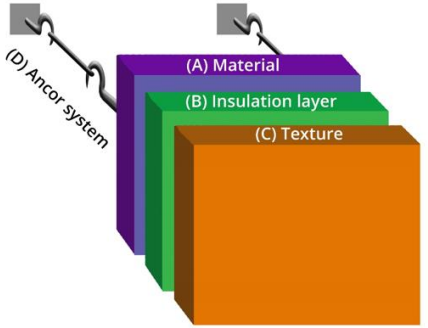

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Template revision	Completion revision	Responsibility fields	Template author	Defining Selections
Template status	Relevant Authority / client	Completion fields	Template reference	Parameter identifier

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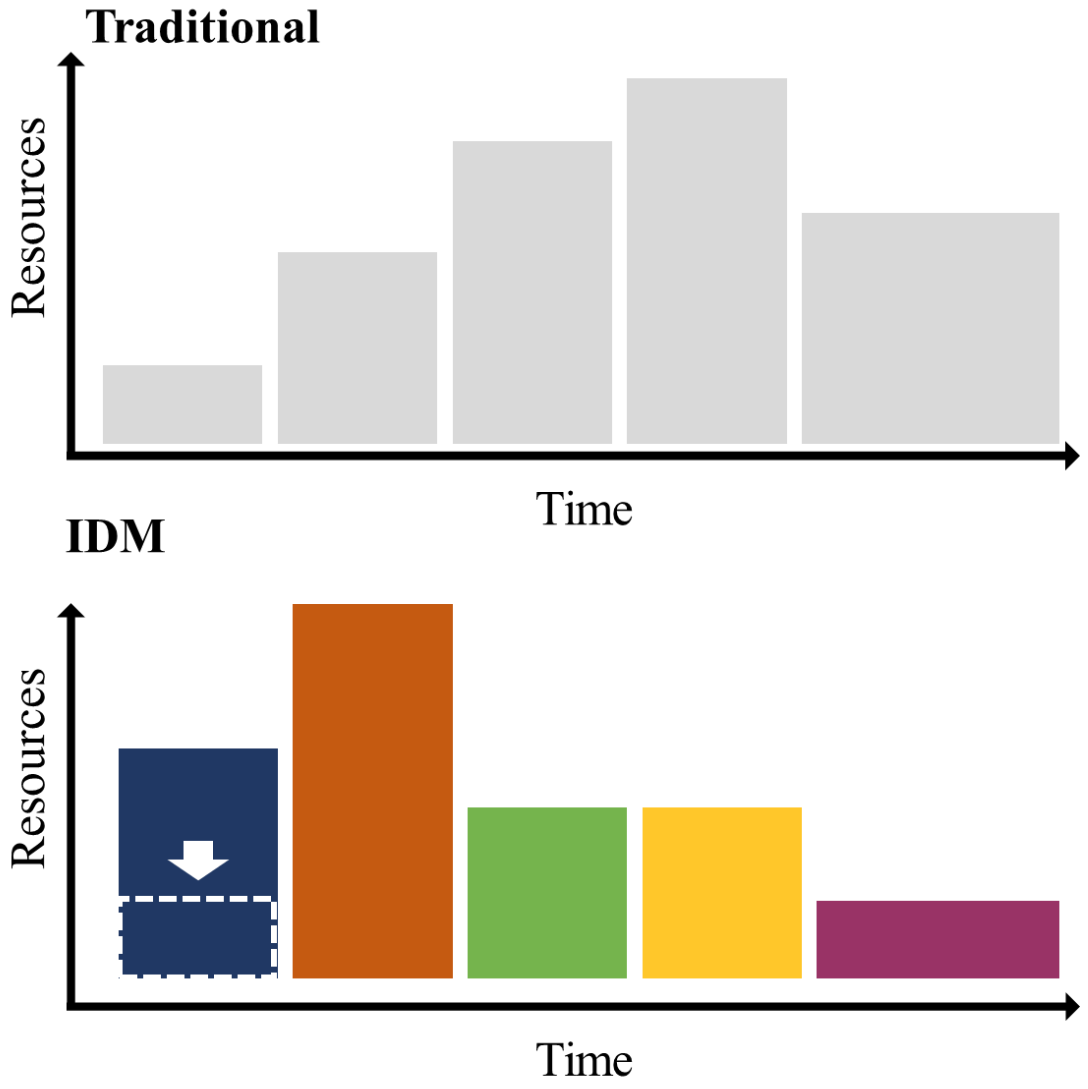
The iterative design methodology

The iterative design methodology

- Energy design considerations early in the design process;
- Incorporation of all stages of the Design-Construct-Install-Operate process



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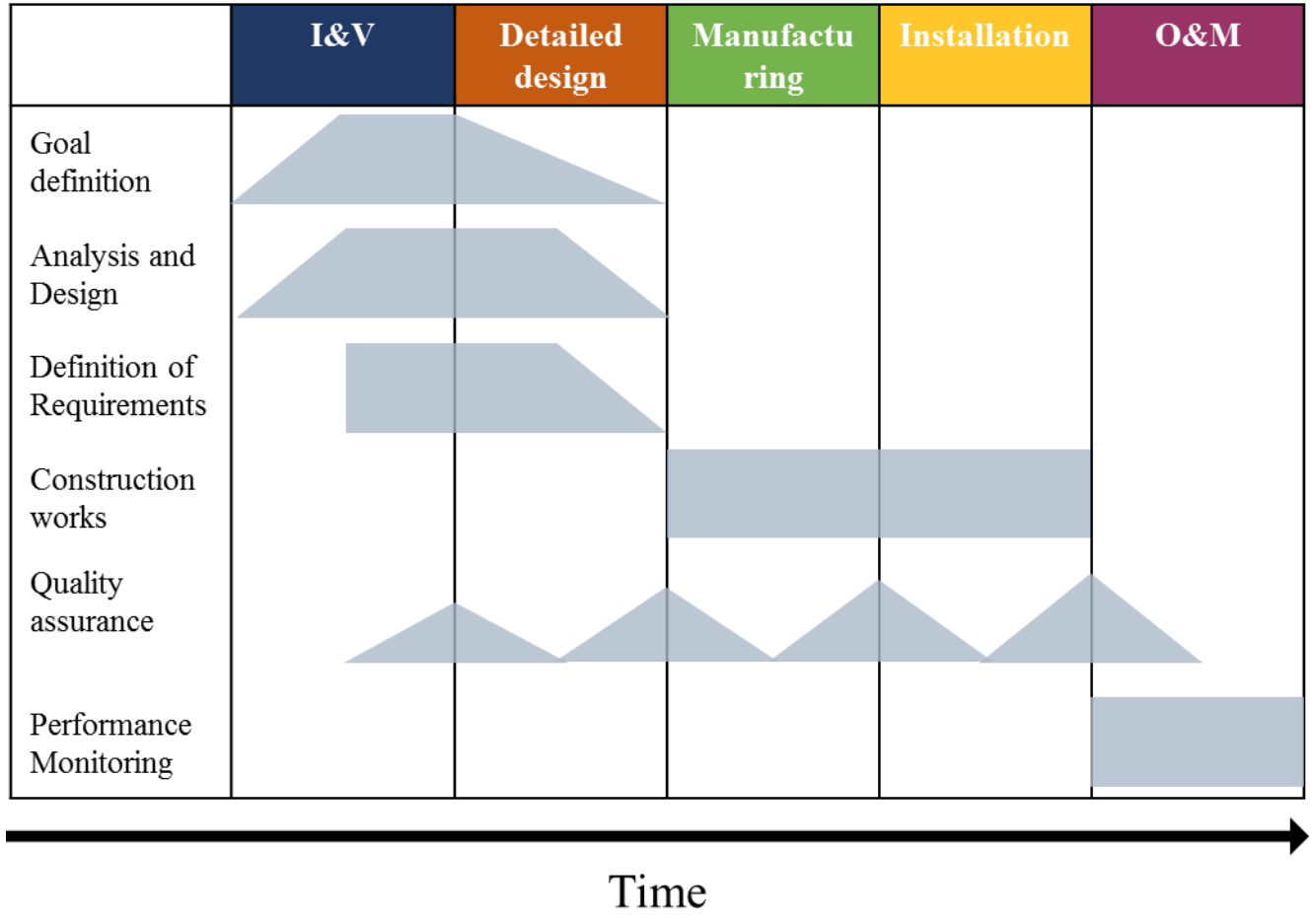
Efforts allocated per stage

- Iterative and incremental;
- Risk-focused;
- Model based decision-making;
- Replicable for future façade renovation projects.



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I- Initiation & Viability

I-1	I-2	I-3	I-4	I-5	I-6	I-7	I-8	I-9	I-10
Identification of Need and Awareness of Possible Solutions	Use IMPRESS website and Decision Support Software	Contacted by IMPRESS Commercial Service	Building Assessment	Agree Project Performance Brief	Evaluate and Cost Project Resource Requirements	Establish an in-house Project Team	Finalise IMPRESS Design Solutions	Provide Costed Options	Agree and sign contract

Project Performance Brief

Contract

→ Detailed Design

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II- Detailed Design

Initiation & Viability

II-1	II-2	II-3	II-4	II-5	II-6	II-7	II-8	II-9
Implement QHSEE Management Policy and Procedures	Define communication plan	Undertake 3rd Party Consultation- Site Development Issues	Develop and Agree Project Execution Plan	3D Building Survey	Generate BIM Model	Develop panel design and structural support system	Energy Performance Simulation	Complete and Approve BIM generated design documents

Design Documents

Iterative BIM Model

Continue to undertake 3rd Party Consultation

Implement Communication Plan

Continue implementation of QHSEE Management System

Contract

Project Performance Brief

Manufacturing

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III - Manufacturing

III-1	III-2	III-3	III-4	III-5	III-6
3D Reconfigurable Formwork, 3D Printed Soluble Formwork and Standard Formwork	Incorporate monitoring sensors	Panel Casting	Demoulding/Curing	Installation of External Wall Completions	Transport

Detailed Design → III-1 … III-6 → Installation

3D Reconfigurable, 3D Printed Soluble & Standard Formworks

Design Documents

Iterative BIM Model

Continue to undertake 3rd Party Consultation

Implement Communication Plan

Continue implementation of QHSEE Management System

Contract

Project Performance Brief

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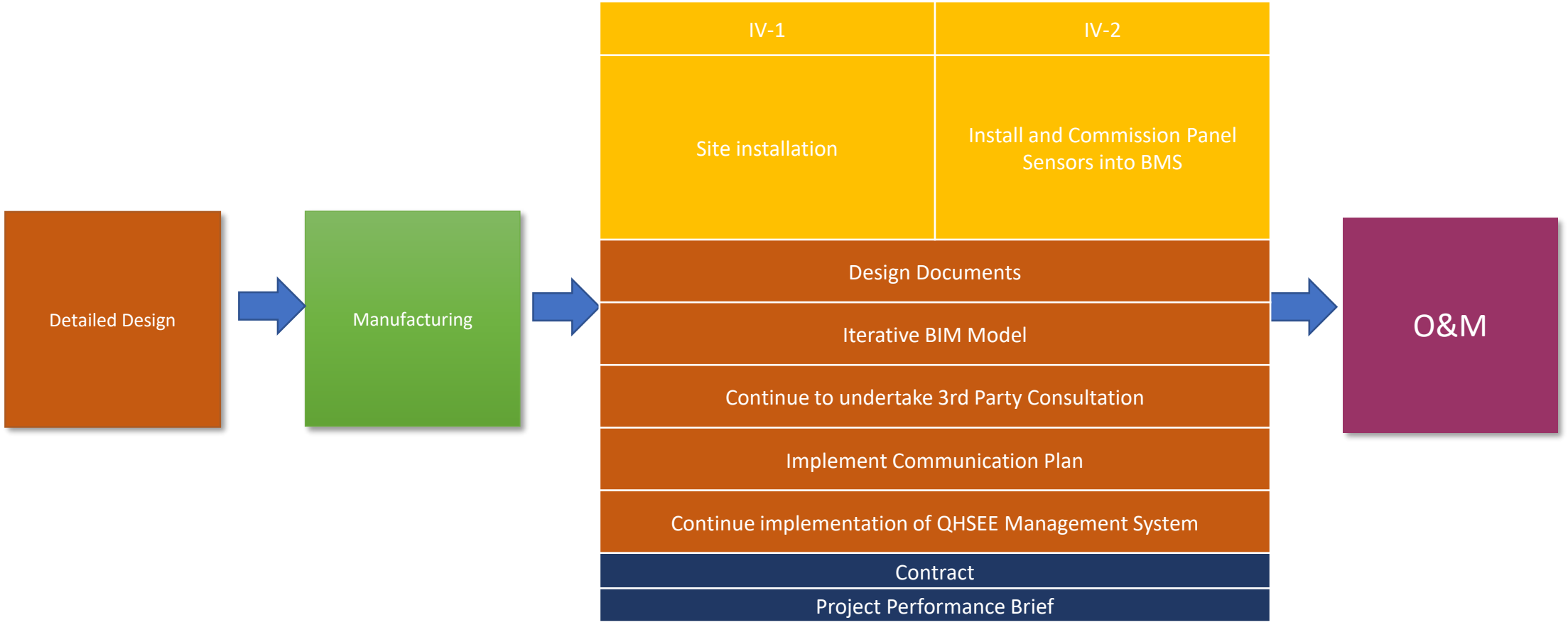
IV - Installation



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V – Operations and Maintenance

Initiation & Viability → Detailed Design → Manufacturing → Installation →

V-1	V-2
Ongoing BMS Sensor Monitoring and Data Collection	Life Cycle Analysis (LCA)
	End of life plan
Energy Performance Assessment	
Design Documents	
Iterative BIM Model	
Continue implementation of QHSE Management System	
Contract- 1 year Warranty & O&M	

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Central model evolution

Concept model (Energy)

Generated in the DSS (I-2)

Uses master templates and GIS data both for static and dynamic parameters

Base model

Uses information from the Building Assessment (I-4) and from the 3D Building Survey (II-5)

Structural information.

Static parameters: Geometry, physical properties of materials, heater capacities

Dynamic parameters: actual weather, equipment profiles, ventilation, occupancy

Calibrated model (Energy)

Static parameters: Thermal imaging, pressurization tests

Dynamic parameters: Indoor air temperature, humidity, BMS data

Scenario model (Energy)

Used for predicting the energy performance of the building accurately (II-8).

Static: Thermal properties of the selected panels, potential facade design changes

Dynamic: Same as in the base or calibrated model

Operational model

Static: as-built model using the auditing/ compliance procedure

Dynamic: ongoing monitoring systems

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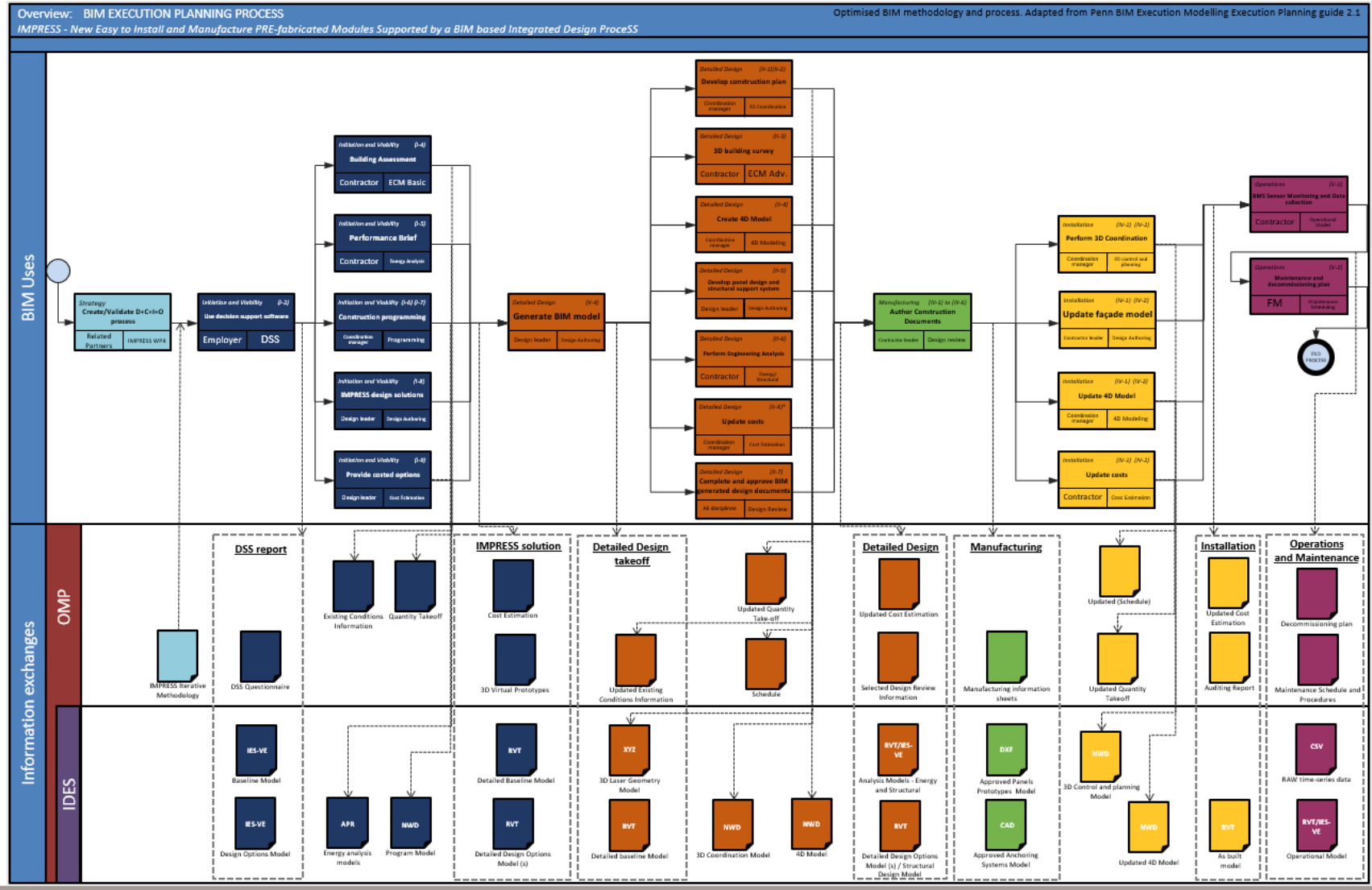
The Information management in BIM

IMPRESS BIM Process Map

- BIM Execution planning guide
- Defines information exchanges



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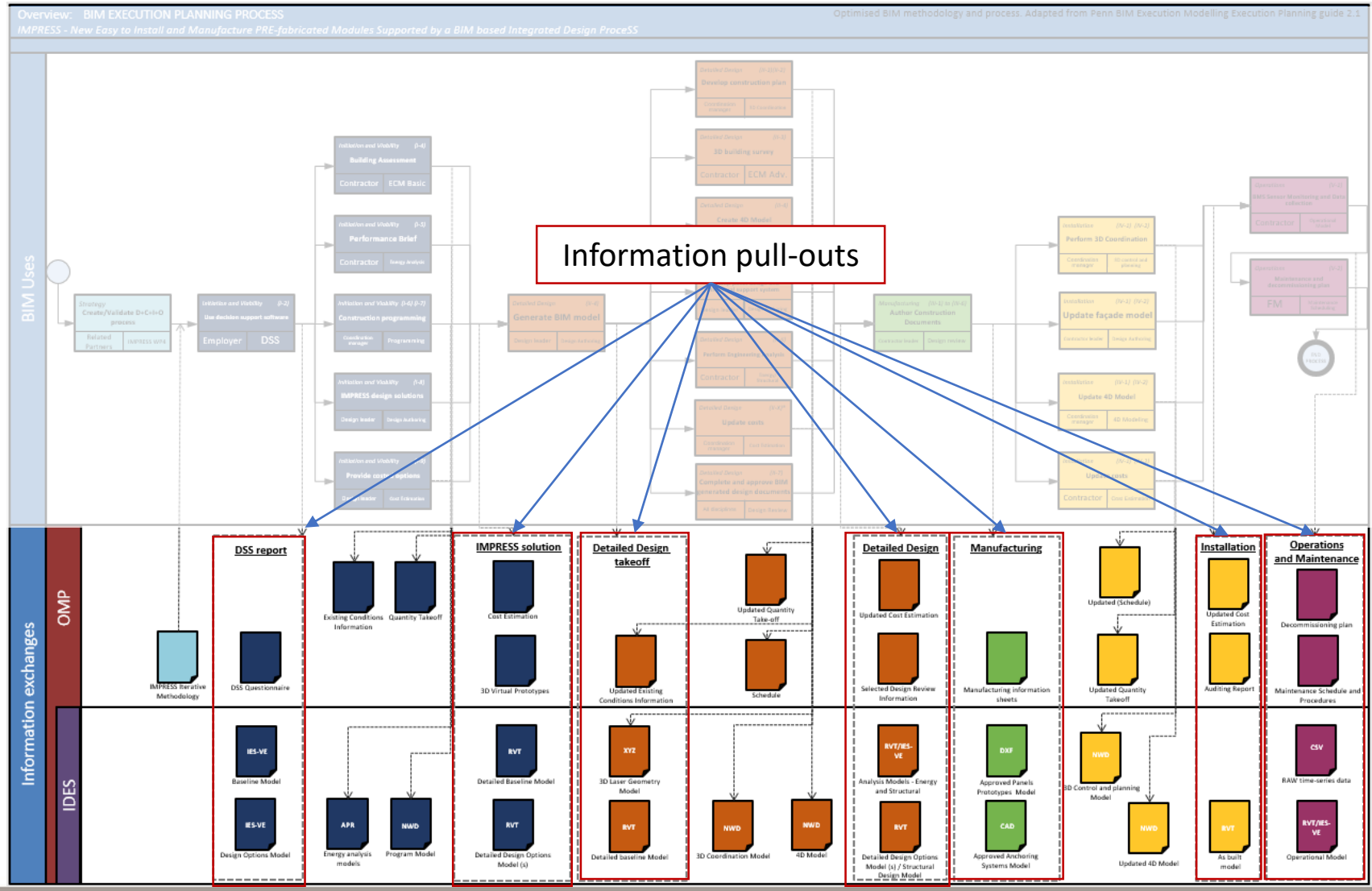
IMPRESS BIM Process Map

- Information pull-outs for each stage clearly defined



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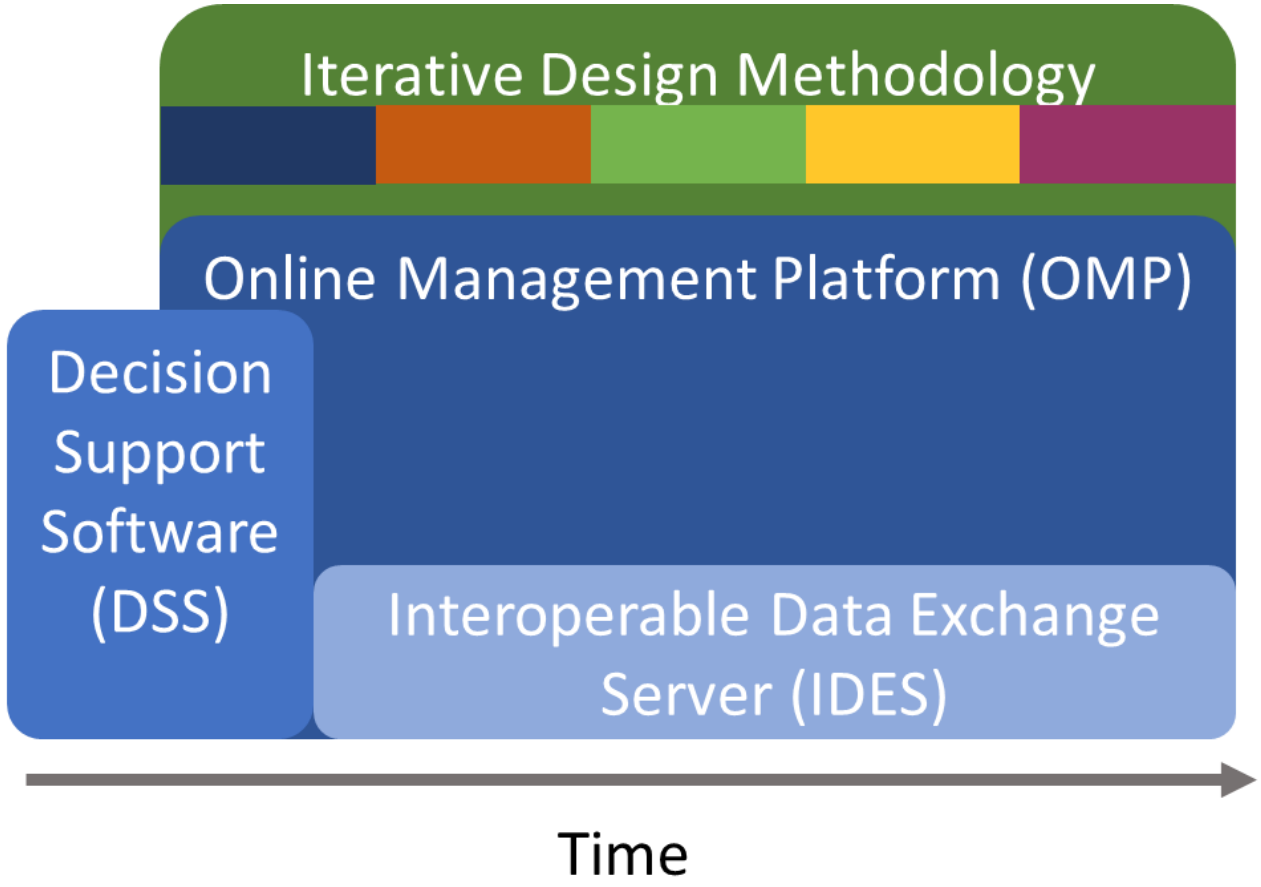
BIM methodology and IMPRESS software



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IMPRESS and 3rd party software

	Use DSS	Initiation and Viability	Concept Design	Development Design	Technical Design	Manufacturing	Installation	Operational phase
Owner/Operator / Maintainer	IMPRESS DSS							FM, Thermal analysis
Employers Representative/ Auditor		PLQ/RFI's/Other Information pulls (PDFs)						
			IMPRESS Auditing tool					
Design/ Contractor lead		Design, thermal analysis	Laser scan, Design, thermal analysis	Design, structural design/analysis, thermal analysis		XYZ, CAD, NURBS		
Engineering & Specialist Design (Tier 1)								
Common Data Environment	IMPRESS OMP	IMPRESS IDES						
Information Management			COBie exporter, Model merging, Model validation					
Commercial Management		Micro and macro coordination, Scheduling, Costs, Other 4D-5D-6D attributes						

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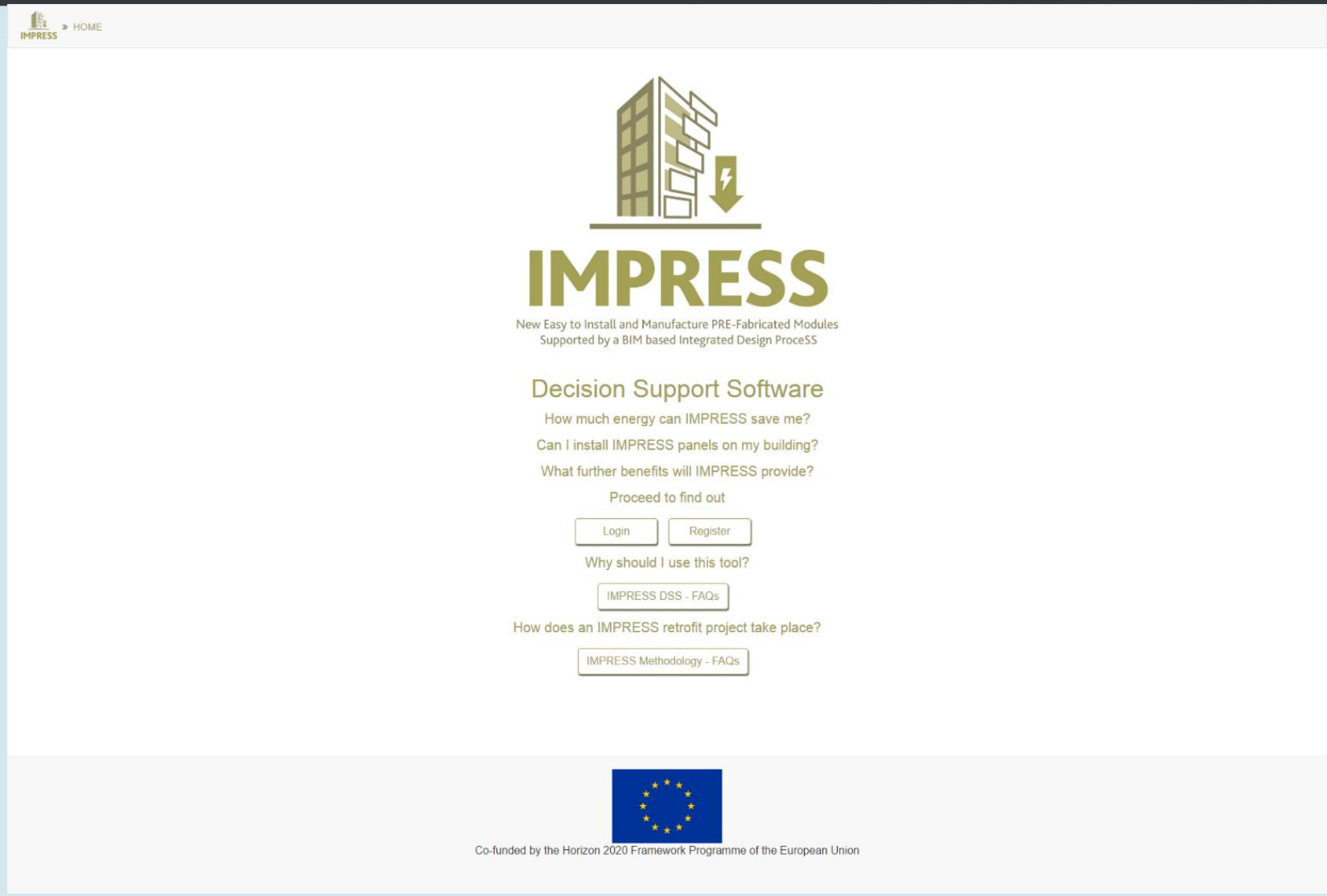
Software – Decision Support Software

DSS welcome

- Free tool for early assessment of the energy savings by using IMPRESS panels;
- Web-based.



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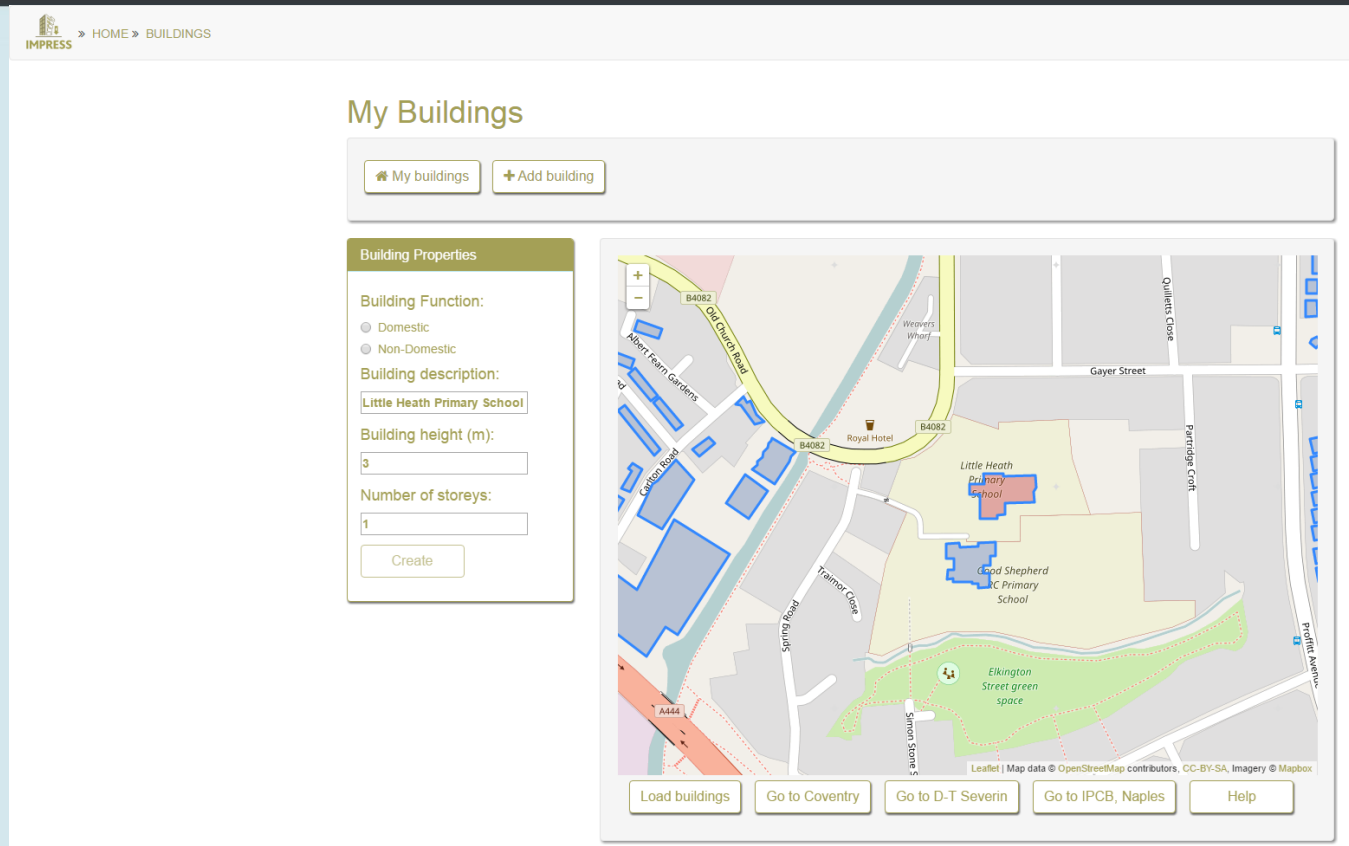
Building footprint

- Uses footprint information from openstreetmap.
- Assigns location-specific weather data

https://www.openstreetmap.org



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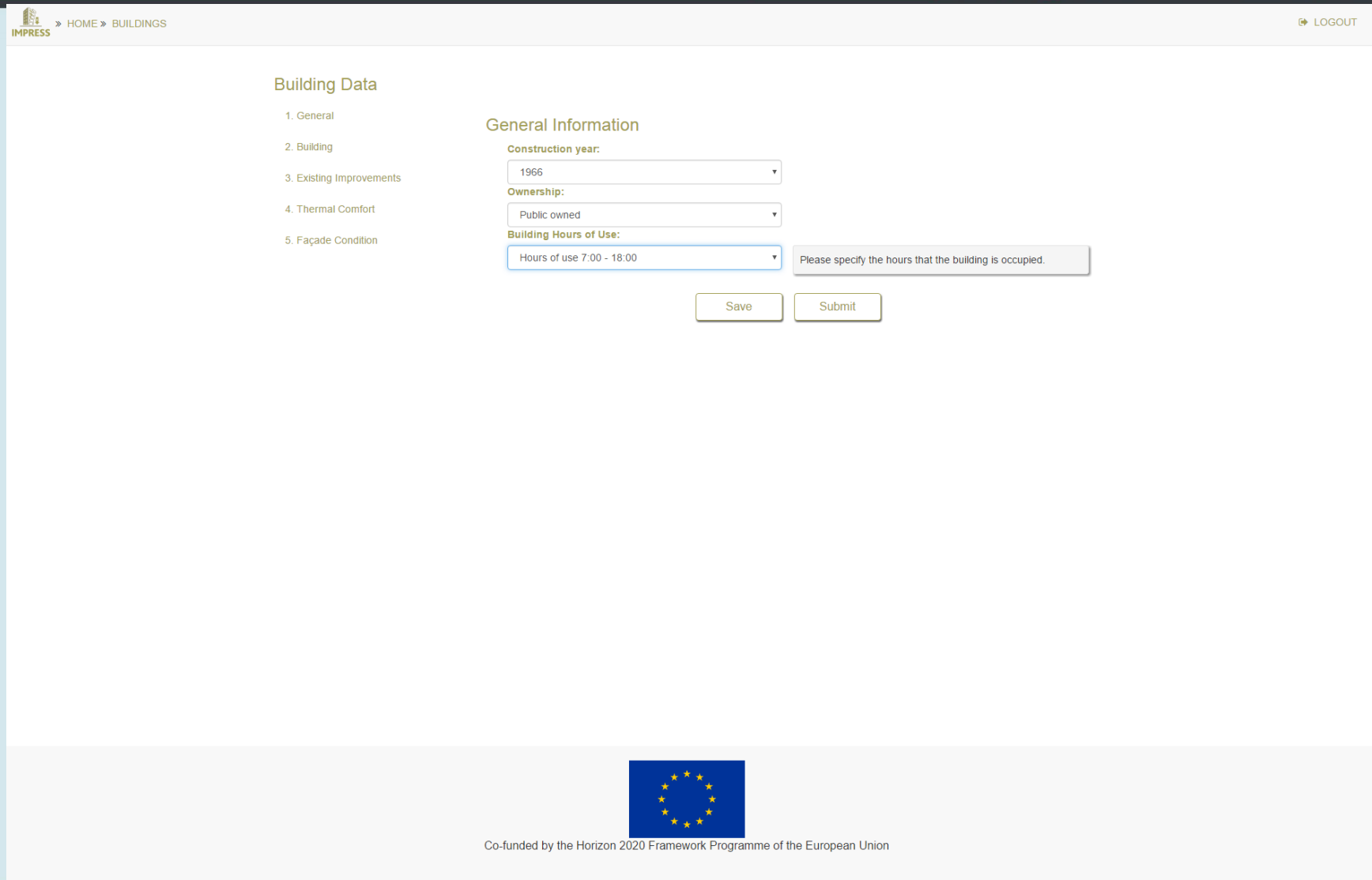
DSS: Survey

- General information including:
  - Construction year;
  - Ownership;
  - Schedules.



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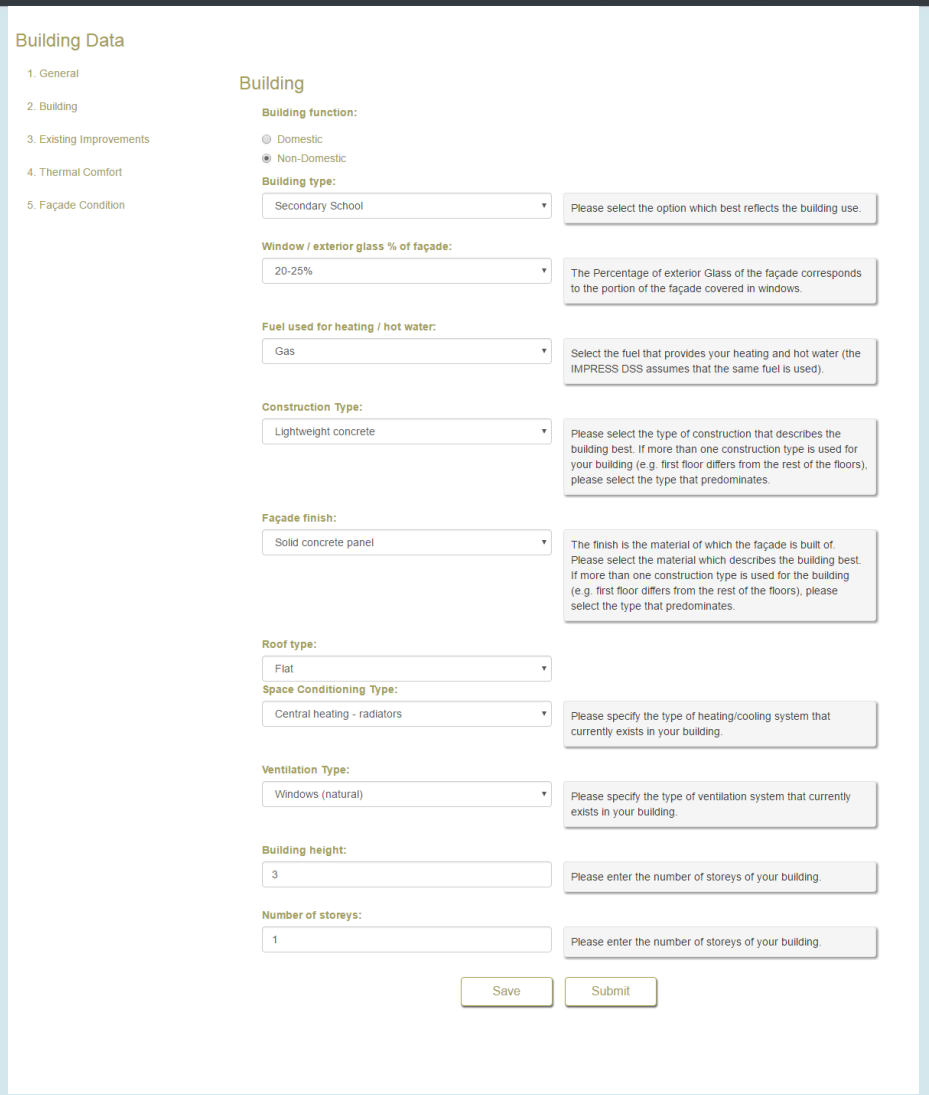
DSS: Survey

- Add relevant information about the use of the building:
  - Window to wall ration;
  - Fuel used for heating;
  - Construction type
  - Type of heating system;
  - Façade finish;
  - Roof type;
  - Ventilation type;
  - Building height and stories.



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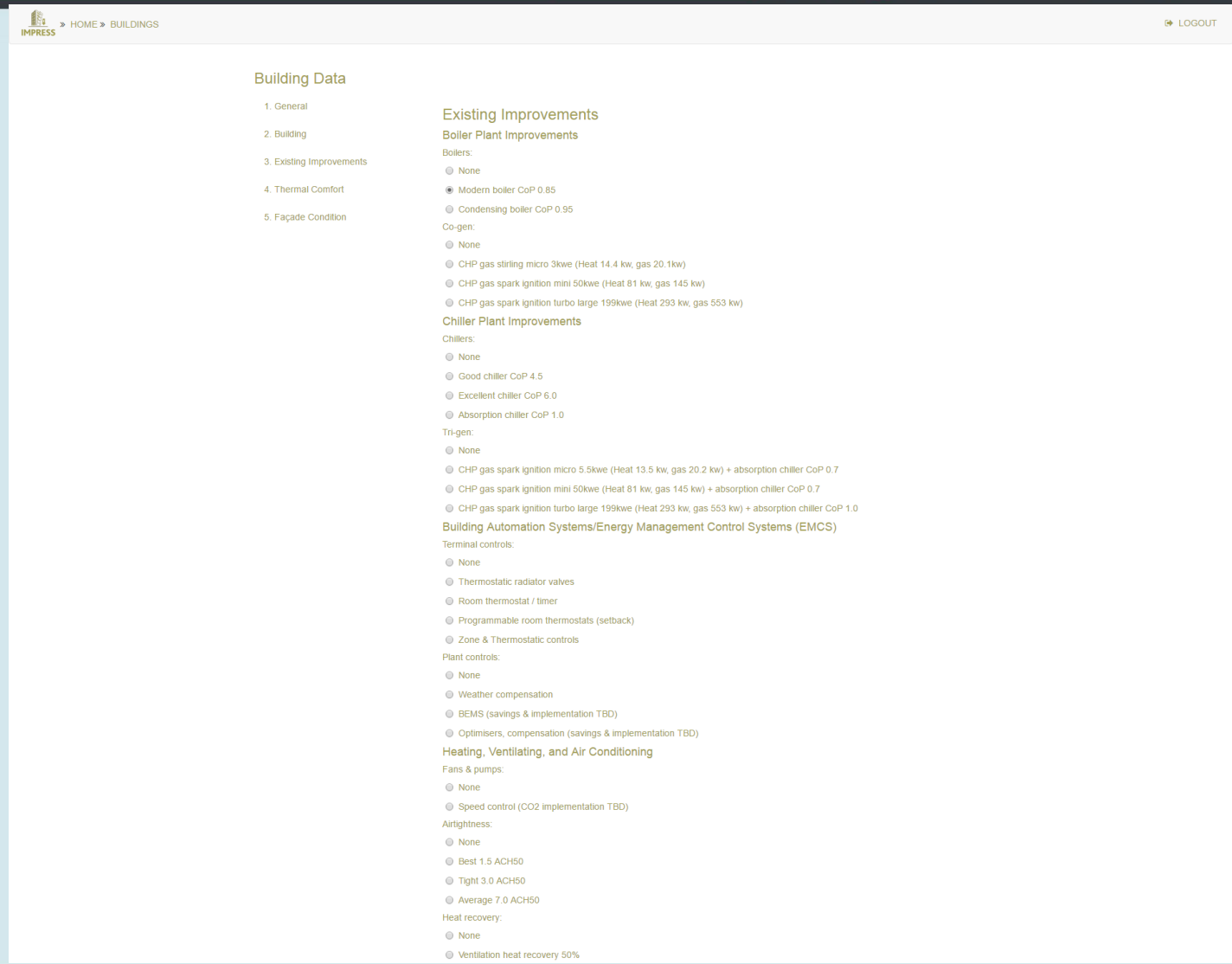
DSS: Survey

- Add relevant information about any existing improvements.
  - Boiler upgrades
  - Co-generation
  - Chillers COPs
  - Room thermostats;
  - Speed control;
  - Air tightness;
  - Heat recovery.



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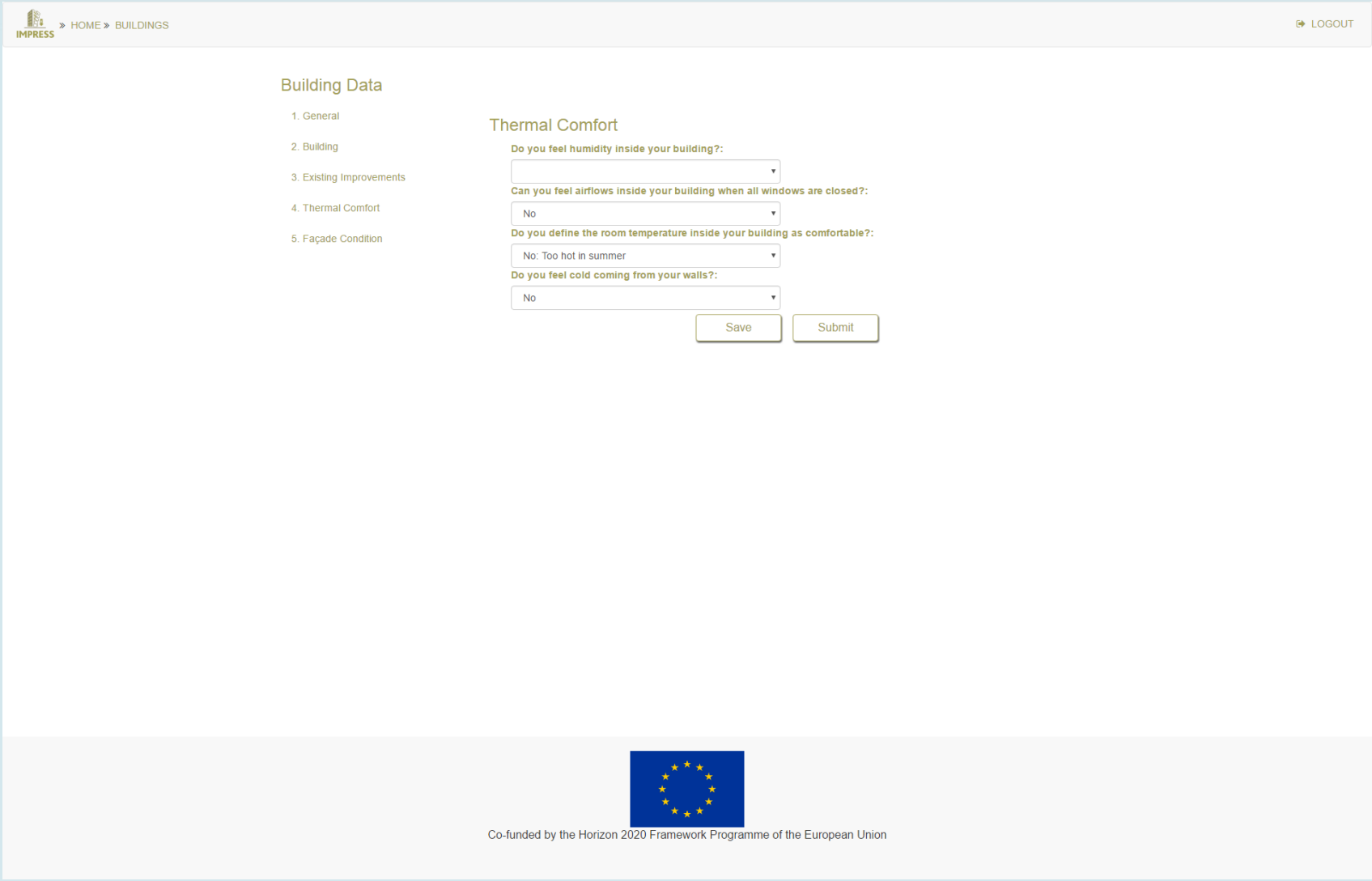
DSS: Survey

- Add relevant information about the thermal comfort in the building.
  - Humidity inside the building
  - Airflow inside the building;
  - Room temperature;
  - “Cold” coming from the wall.



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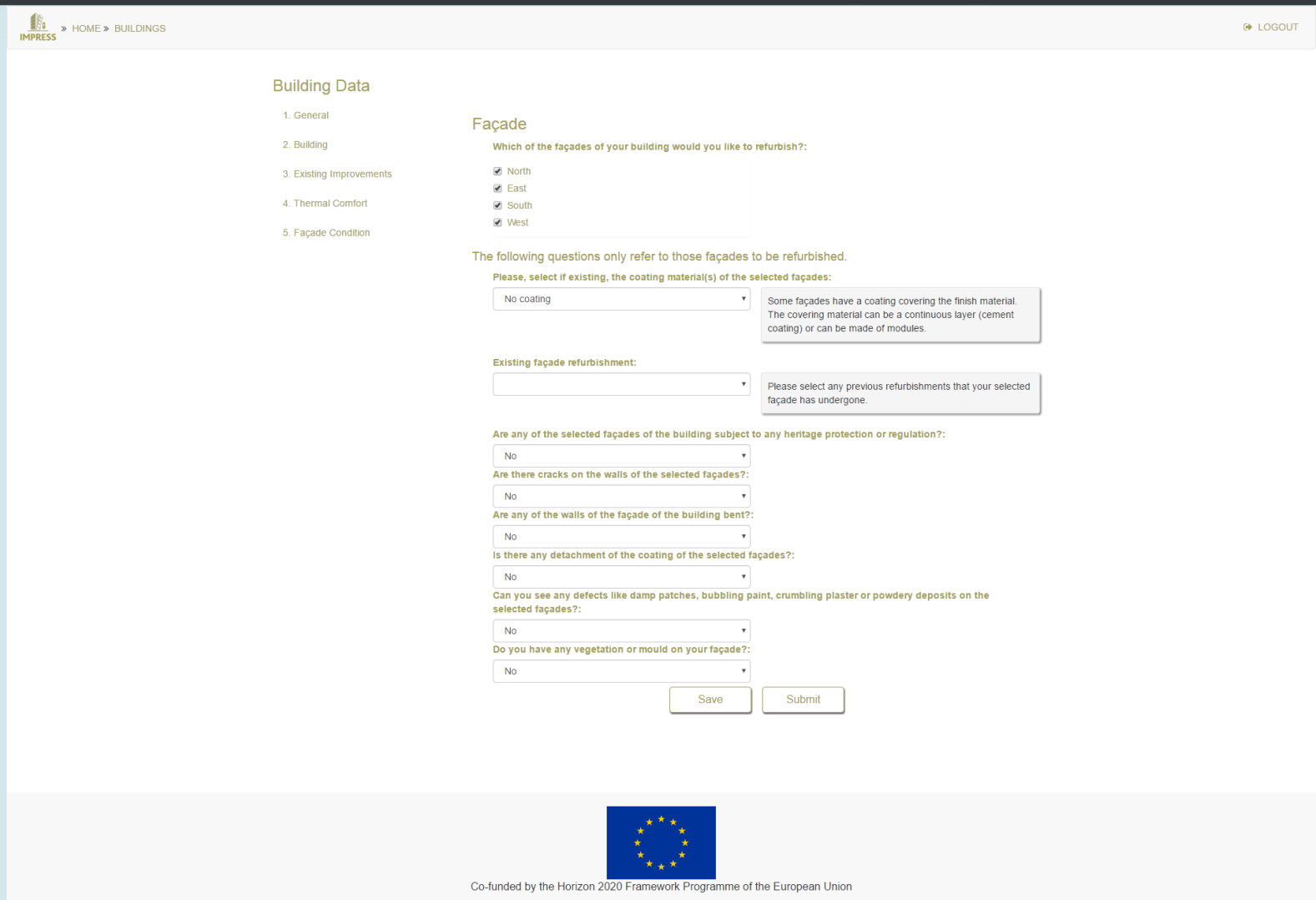
DSS: Survey

- Façade conditions
  - Orientation;
  - Existing coating materials;
  - Heritage protection;
  - Structural status;
  - Damp patches;
  - Vegetation and mould.



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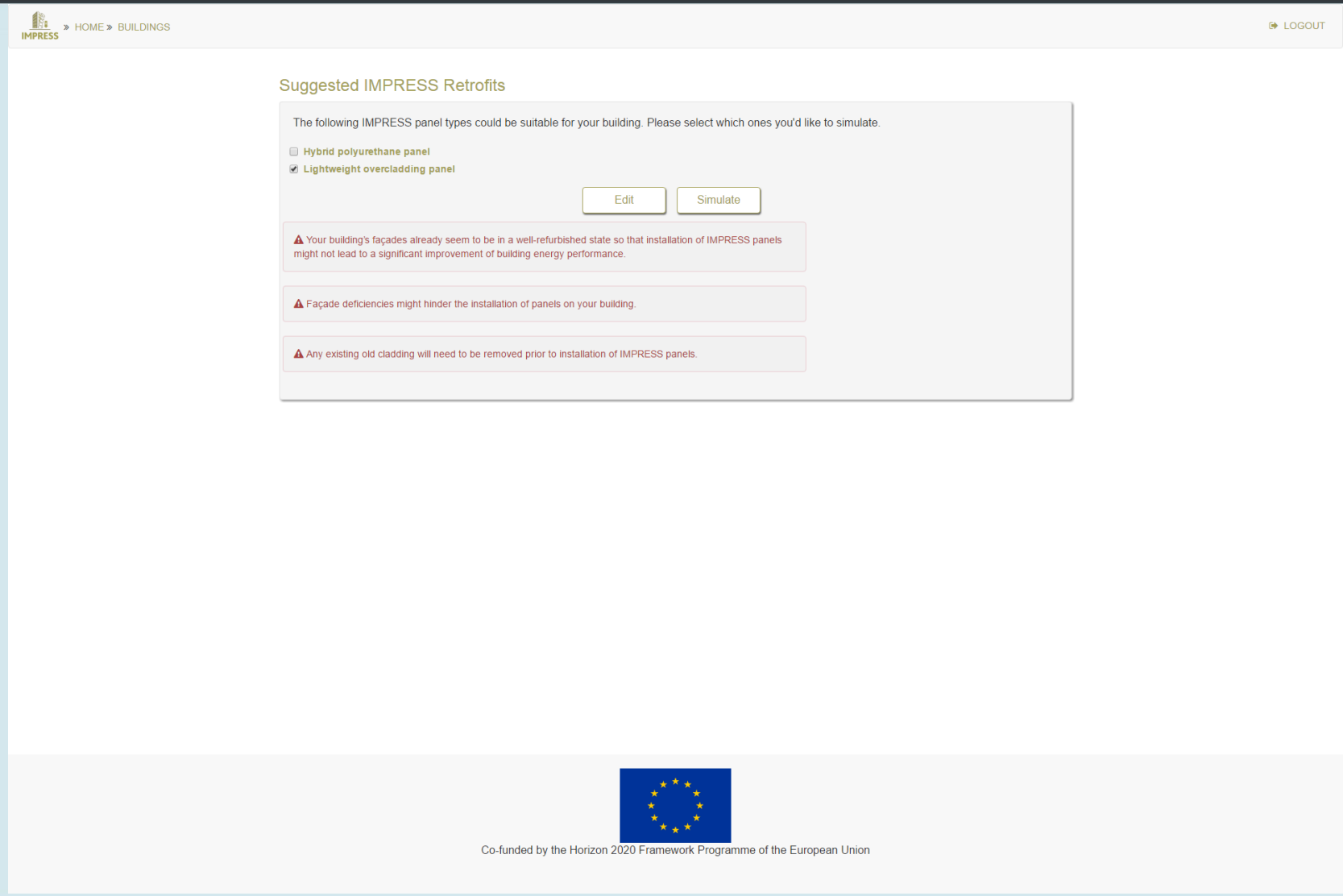
Suggested panels

- A list of applicable panels is displayed;
- Simulation will be carried out for these options.



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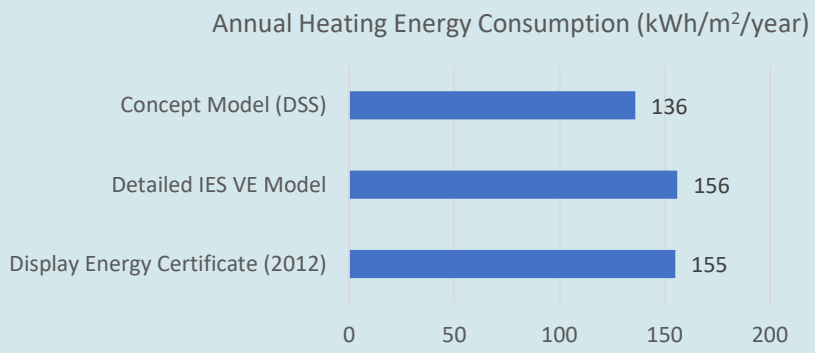
Early stage results

- Potential energy savings for each suggested panel;
- Validation of results against energy certificates and detailed models.



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Software – Online management platform (OMP)

Online management platform

- Interactive HTML based web application;
- Hosted on a secure web server;
- Predefined tasks according to the iterative methodology;
- Guidance attached to each task;
- Rolling feed and Gantt chart;

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IMPRESS
Online Management Platform

- Manage Projects
- Global Feed
- Manage Files
- Comments
- Projects

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HOME / PROJECTS / LITTLE HEATH PRIMARY SCHOOL

Project - Little Heath Primary School

Retrofit of the Little Heath Primary School using prefabricated concrete panels

Start Date: 1st Apr 2017
Deadline: 30th Sep 2017
Completion Date:

Edit Project | Project Team Members

Stages

Add Stage +

- Stage I - Initiation and Viability
- Stage II - Detailed Design
- Stage III - Manufacturing
- Stage IV - Installation
- Stage V - Operation and Maintenance

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IMPRESS
Online Management Platform

- Projects
- Little Heath Primary School
  - Feed
  - Tasks
  - Progress
  - Guidance
  - Shared Files

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HOME / PROJECTS / LITTLE HEATH PRIMARY SCHOOL / METHODOLOGY

Little Heath Primary School

Retrofit of the Little Heath Primary School using prefabricated concrete panels

IMPRESS Methodology

Stage I - Initiation and Viability → Stage II - Detailed Design → Stage III - Manufacturing → Stage IV - Installation → Stage V - Operation and Maintenance

II.1 Implement QHSEE Management Policy and Procedures	9 items
II.2 Undertake 3rd Party Consultation- Site Development Issues	10 items
II.3 3D Building Survey	0 items
II.4 Generate BIM model	0 items
II.5 Develop Panel Design and Structural Support System	0 items
II.6 Energy Performance Simulation	0 items
II.7 Complete and Approve Construction Design Documents	0 items

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The project description goes here.

Tasks

Show All | Not Started | In Progress | Blocked | Completed | Verified Complete | Out | In | View All Tasks | View My Tasks

Duration Shown: 166 days

2nd Jan 2017 — 16th Jun 2017

- I - INITIATION AND VIABILITY
- 1. IDENTIFICATION OF NEED AND AWARENESS OF POSSIBLE SOLUTIONS
- 2. USE IMPRESS WEBSITE AND DECISION SUPPORT SOFTWARE
- 3. CONTACTED BY IMPRESS COMMERCIAL SERVICE
- 4. BUILDING SURVEY/ ASSESSMENT
- STAGE 1, TASK 1, SUB TASK 1
- LEVEL 4
- 123
- TEST_MO
- STAGE 1, TASK 1, SUB TASK 2
- 5. AGREE PROJECT PERFORMANCE BRIEF
- 6. EVALUATE AND COST PROJECT RESOURCE REQUIREMENTS
- 7. ESTABLISH AN IN-HOUSE PROJECT TEAM
- 8. PROVIDE COSTED OPTIONS BASED ON OPTIMISED INTEGRATED DESIGN PROCESS
- 9. AGREE AND SIGN CONTRACT WITH IMPRESS COMMERCIAL SERVICE
- II - DETAILED DESIGN
- IMPLEMENT QHSEE MANAGEMENT POLICY AND PROCEDURES
- III - MANUFACTURING
- IV - INSTALLATION
- V - OPERATION AND MAINTENANCE

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IMPRESS
Online Management Platform

- Manage Projects
- Global Feed
- Manage Files
- Comments
- Projects
- OMP demonstration
  - Feed
  - Tasks
  - Progress
  - Guidance
  - Shared Files

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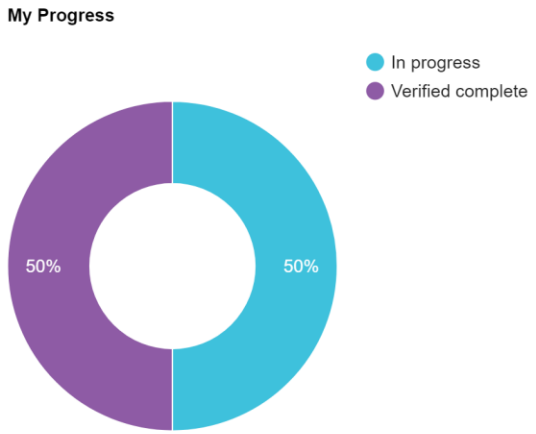
OMP demonstration

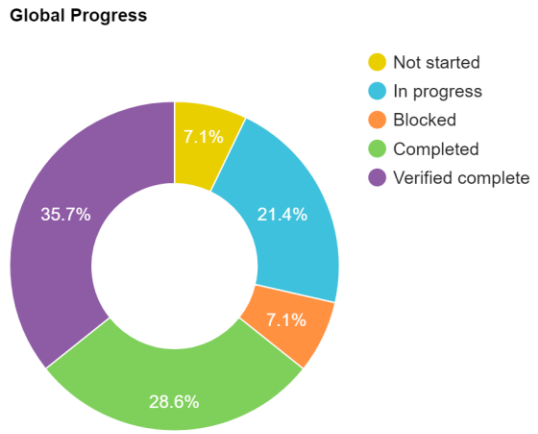
Project set up for demonstrations

Progress

My Progress



Global Progress



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Online management platform

- Central repository of shared files;
- Status and version control of uploads as suggested by BIM Level 2 guidance

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IMPRESS
Online Management Platform

- Projects
- Impress OMP
  - Feed
  - Tasks
  - Progress
  - Guidance
  - Shared Files

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HOME / PROJECTS / IMPRESS OMP

Impress OMP

The project description goes here.

Downloads

	IMPRESS Project Overview	25th Apr 2017 14:22	[pptx]	2 MiB	IMPRESS Project Overview v1.pptx	D1 Issued for Costing
	IES lockscreen	26th Apr 2017 14:36	[jpg]	540 KiB	lockscreen.jpg	S1 Issued for Coordination
	IES BIKE Ride	26th Apr 2017 14:44	[jpg]	3 MiB	IMG_2425.JPG	S3 Issued for Internal Review
	Added by admin	27th Apr 2017 15:57	[rar]	87 bytes	test.rar	S3 Issued for Internal Review
	Also added by admin	27th Apr 2017 15:57	[pdf]	144 KiB	Sample Document 3.pdf	S2 Issued for Information
	Test 1 - MO	5th May 2017 15:46	[txt]	0 bytes	Test 1.txt	S1 Issued for Coordination

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BIM GATHERING

Software - Interoperable Data Exchange Server

IMPRESS

Welcome to IMPRESS

This is the Interoperable Data Exchange Server

Login to your account

Username

Password

login

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IMPRESS

Hello, admin@ides.com

Manage Users

Manage Projects

Logout

Naples Project Members

Go Back

Users

Name	Email	Group	Description		
Alice	alice@iesve.com	Information Manager	Project Leader		
Bob	bob@iesve.com	Expert	Architect		
Claire	claire@iesve.com	Expert	Energy Consultant		
Peter	peter@iesve.com	Expert	Architect		

Add Team Member

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IMPRESS

Hello admin@ides.com, welcome to the IMPRESS IDES

Please select a project

Naples | Severin | Coventry

Add Project

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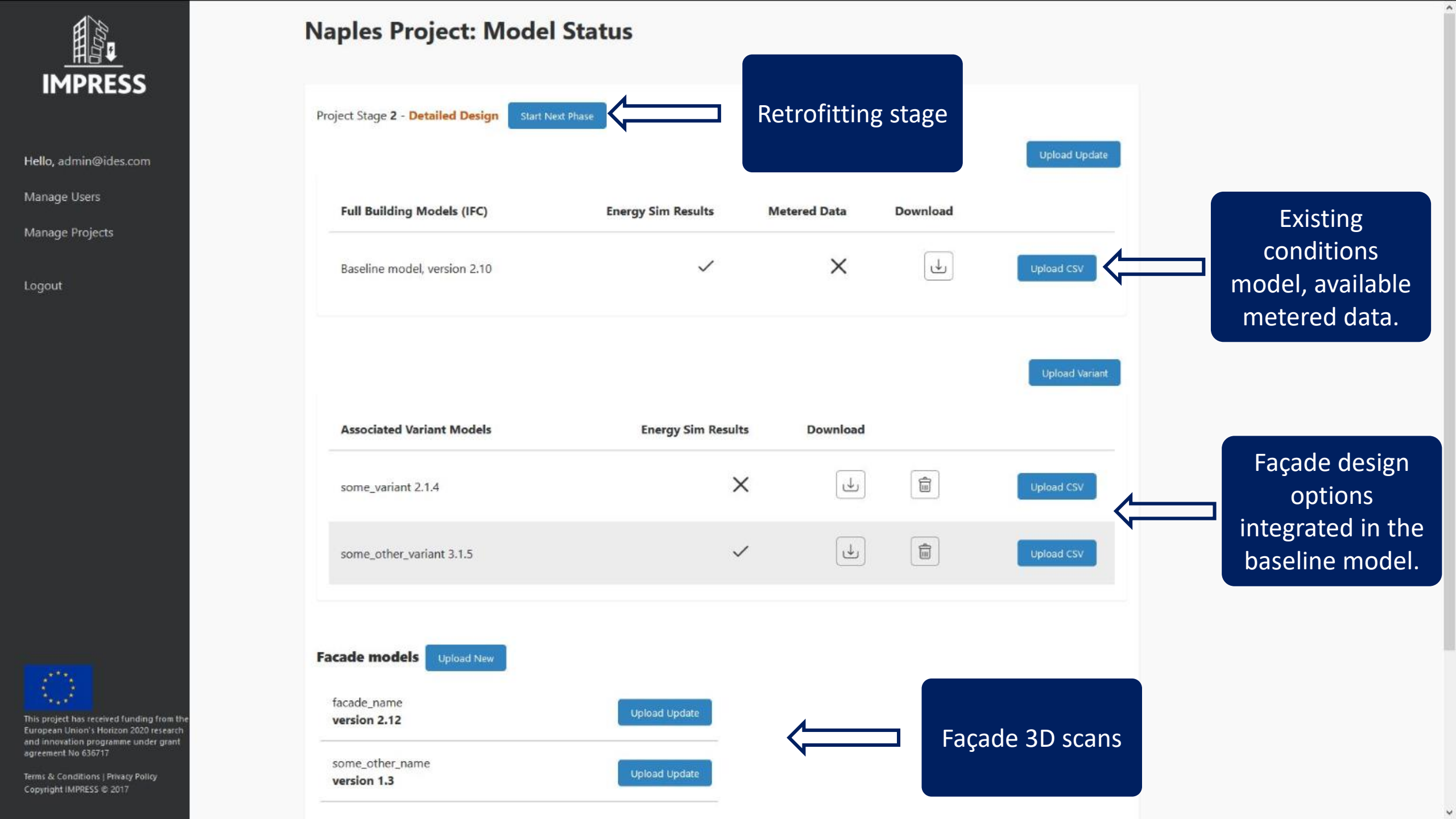
IMPRESS
Hello, admin@ides.com
Manage Users
Manage Projects
Logout
Naples Project: Model Status
Project Stage 2 - Detailed Design
Start Next Phase
Retrofitting stage
Upload Update
Full Building Models (IFC)
Energy Sim Results
Metered Data
Download
Baseline model, version 2.10
Upload CSV
Existing conditions model, available metered data.
Upload Variant
Associated Variant Models
Energy Sim Results
Download
some_variant 2.1.4
Upload CSV
some_other_variant 3.1.5
Upload CSV
Façade design options integrated in the baseline model.
Facade models
Upload New
facade_name
version 2.12
Upload Update
some_other_name
version 1.3
Upload Update
Façade 3D scans
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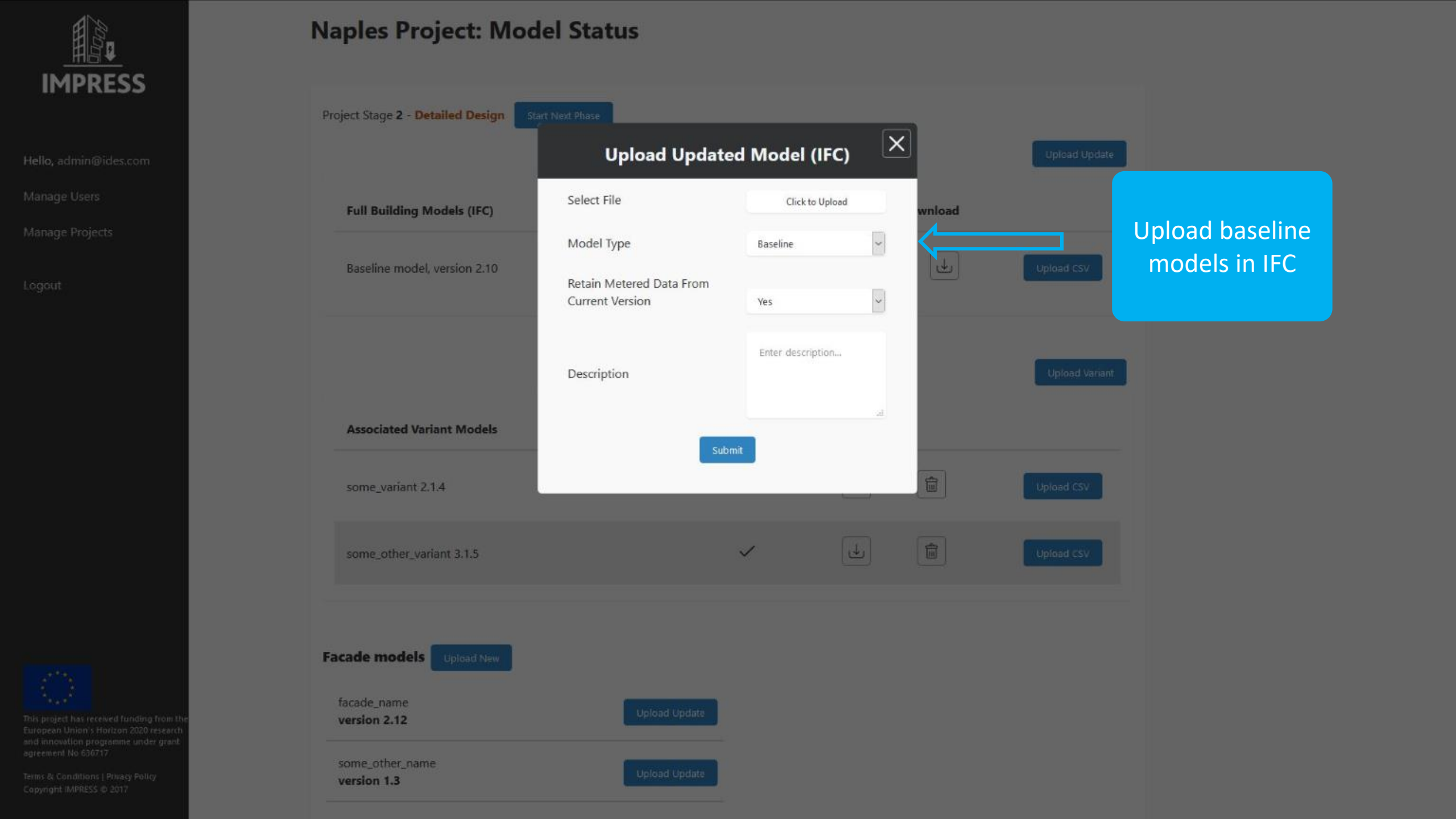
IMPRESS
Hello, admin@ides.com
Manage Users
Manage Projects
Logout
Naples Project: Model Status
Project Stage 2 - Detailed Design
Start Next Phase
Upload Updated Model (IFC)
Select File
Click to Upload
Model Type
Baseline
Retain Metered Data From Current Version
Yes
Description
Enter description...
Submit
Upload Update
Full Building Models (IFC)
Baseline model, version 2.10
Upload CSV
Upload Variant
Associated Variant Models
some_variant 2.1.4
Upload CSV
some_other_variant 3.1.5
Upload CSV
Facade models
Upload New
facade_name
version 2.12
Upload Update
some_other_name
version 1.3
Upload Update
Upload baseline models in IFC
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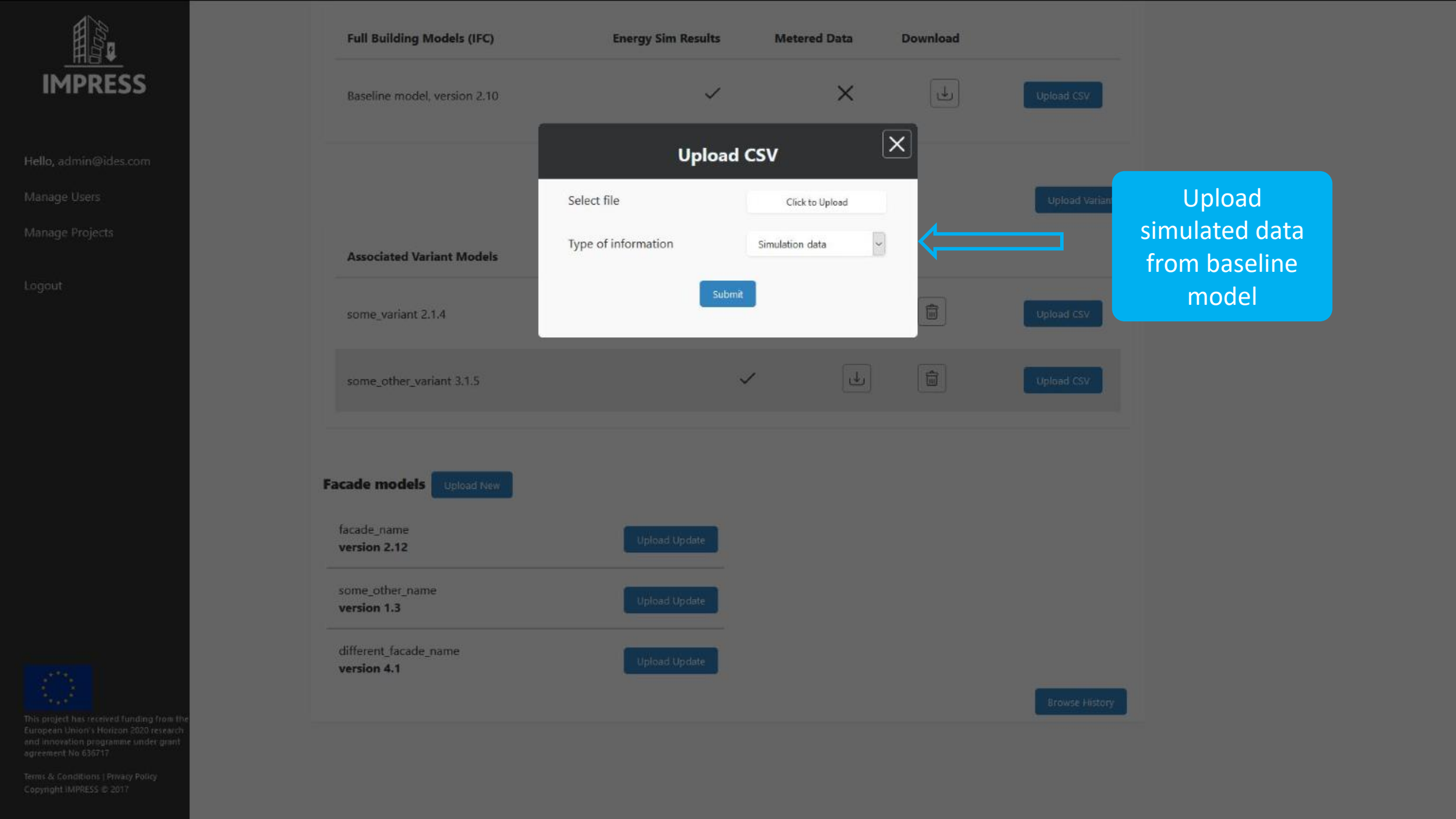
IMPRESS
Hello, admin@ides.com
Manage Users
Manage Projects
Logout
Full Building Models (IFC)
Energy Sim Results
Metered Data
Download
Baseline model, version 2.10
Upload CSV
Upload CSV
Select file
Click to Upload
Type of information
Simulation data
Submit
Upload Variant
Associated Variant Models
some_variant 2.1.4
Upload CSV
some_other_variant 3.1.5
Upload CSV
Facade models
Upload New
facade_name
version 2.12
Upload Update
some_other_name
version 1.3
Upload Update
different_facade_name
version 4.1
Upload Update
Browse History
Upload simulated data from baseline model
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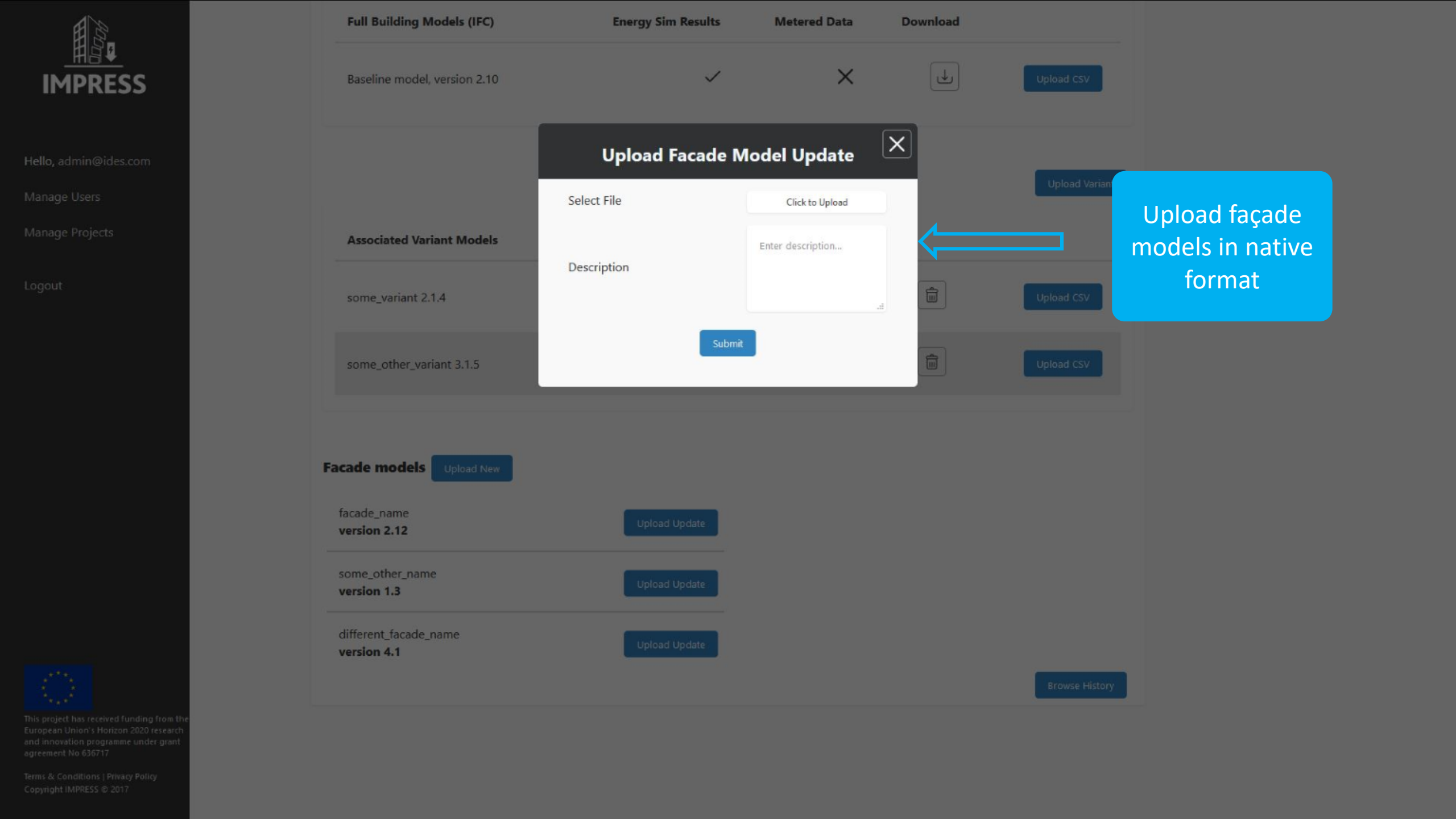
IMPRESS
Hello, admin@ides.com
Manage Users
Manage Projects
Logout
Full Building Models (IFC)
Energy Sim Results
Metered Data
Download
Baseline model, version 2.10
Upload CSV
Upload Facade Model Update
Select File
Click to Upload
Description
Enter description...
Submit
Upload Varian
Associated Variant Models
some_variant 2.1.4
Upload CSV
some_other_variant 3.1.5
Upload CSV
Facade models
Upload New
facade_name
version 2.12
Upload Update
some_other_name
version 1.3
Upload Update
different_facade_name
version 4.1
Upload Update
Browse History
Upload façade models in native format
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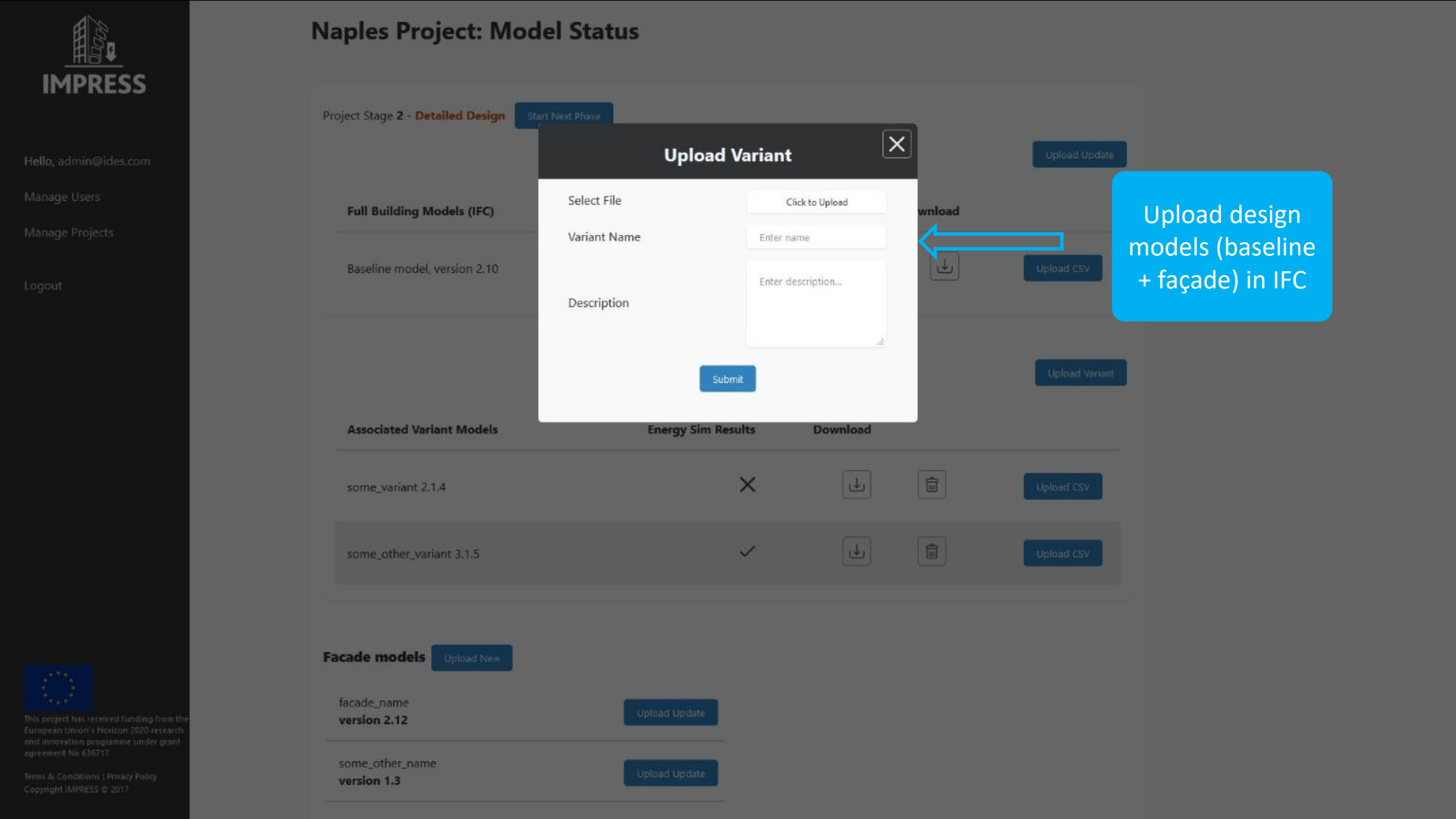
IMPRESS
Hello, admin@ides.com
Manage Users
Manage Projects
Logout
Naples Project: Model Status
Project Stage 2 - Detailed Design
Start Next Phase
Upload Update
Full Building Models (IFC)
Baseline model, version 2.10
Upload CSV
Upload Variant
Upload Variant
Select File
Click to Upload
Variant Name
Enter name
Description
Enter description...
Submit
Associated Variant Models
Energy Sim Results
Download
some_variant 2.1.4
some_other_variant 3.1.5
Upload CSV
Upload CSV
Facade models
Upload New
facade_name
version 2.12
Upload Update
some_other_name
version 1.3
Upload Update
Upload design models (baseline + façade) in IFC
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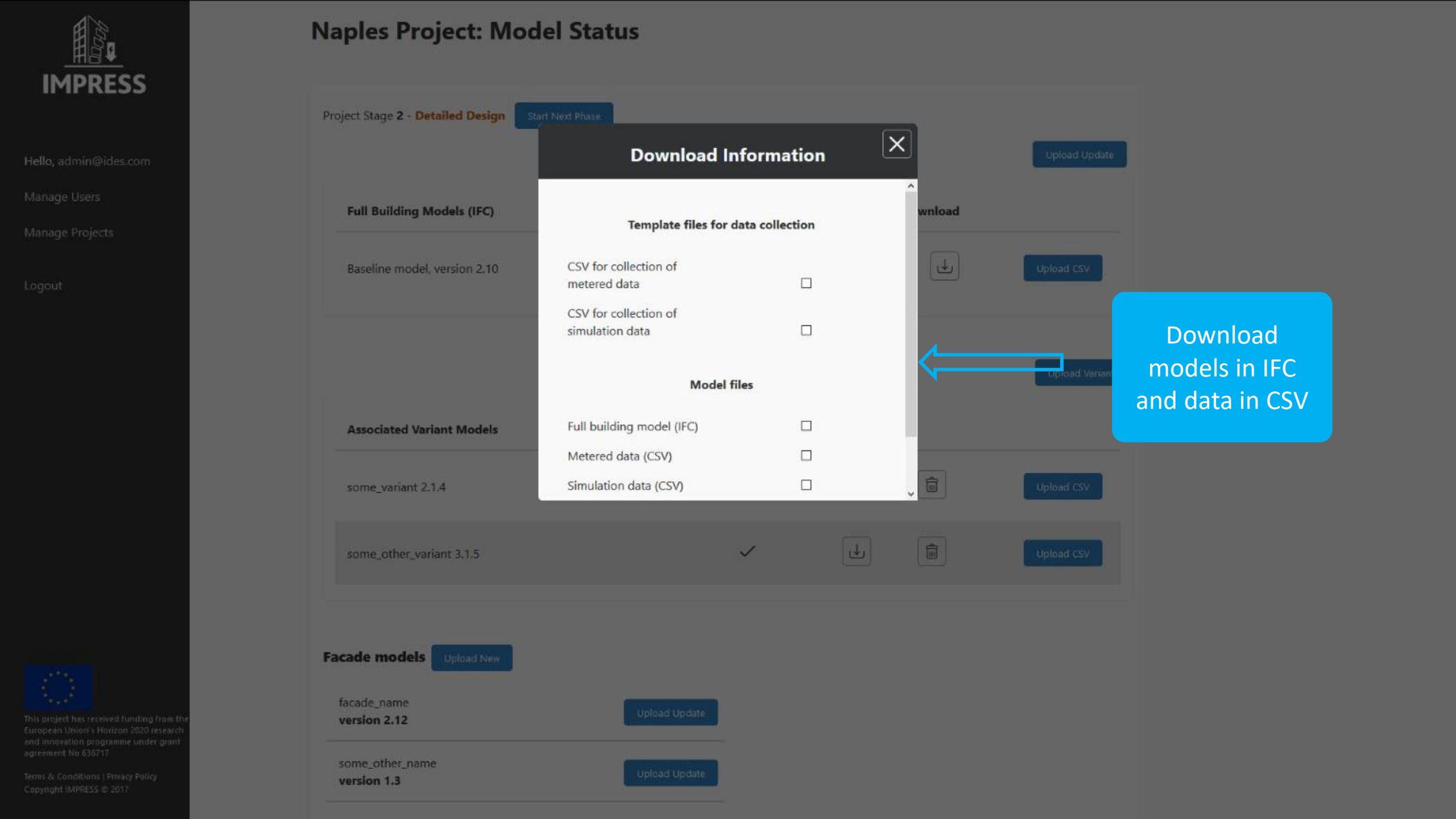
IMPRESS
Hello, admin@ides.com
Manage Users
Manage Projects
Logout
Naples Project: Model Status
Project Stage 2 - Detailed Design
Start Next Phase
Upload Update
Full Building Models (IFC)
Baseline model, version 2.10
Upload CSV
Download Information
Template files for data collection
CSV for collection of metered data
CSV for collection of simulation data
Model files
Full building model (IFC)
Metered data (CSV)
Simulation data (CSV)
Download models in IFC and data in CSV
Associated Variant Models
some_variant 2.1.4
Upload CSV
some_other_variant 3.1.5
Upload CSV
Facade models
Upload New
facade_name
version 2.12
Upload Update
some_other_name
version 1.3
Upload Update
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Conclusions

- The iterative design methodology is incremental, risk-focused, and model based decision-making;
- The DSS is an early stage energy simulation tool that help non-expert users to decide whether IMPRESS pre-fabricated panels are a suitable refurbishment option for their building, and when this is the case, the DSS creates a report with the potential energy savings for each panel;
- The OMP contains all the tasks from the Iterative design methodology allowing visualising and following up each of the required tasks. Also works as a file management platform.
- The IDES is a web-based tool that enables model based collaboration between different disciplines through federated models
- iBIMm consist on the seamless integration of the Iterative Design Methodology and three pieces of IMPRESS software that enable energy efficiency considerations in the early stage of the design process.
- During later stages of the project, further validation work on the two case-studies will be carried out to ensure that the iBIMm is taking full advantage of the developed web tools.

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Thank you

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