



BIM4ENERGY ERASMUS+

Erasmus+ Project ID: 2023-1-ES01-KA220-HED-000156652

BIM digital competencies to evaluate and improve the energy efficiency of European buildings.

A digital way towards positive energy districts

Good practices using BIM to determine the energy efficiency of buildings in Norway

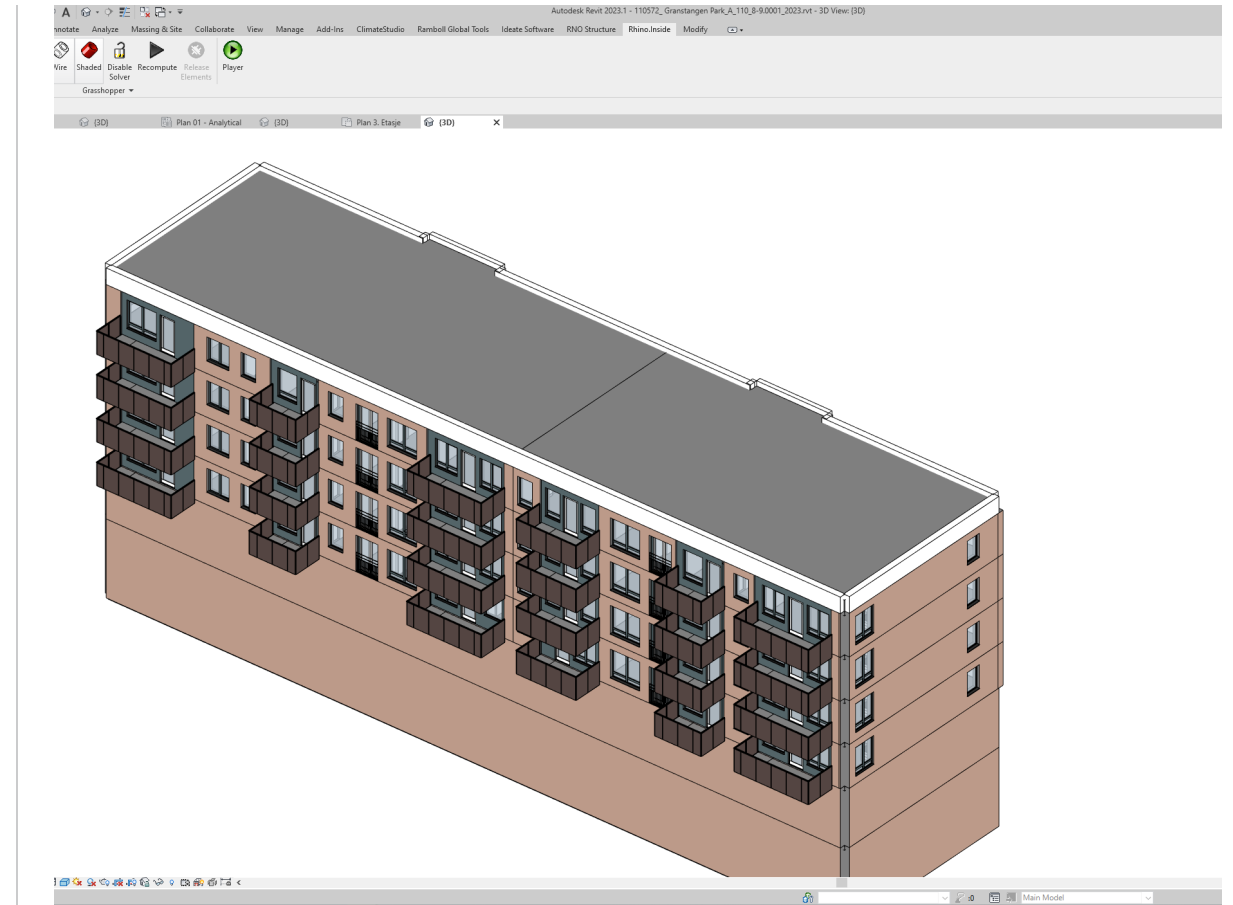
Speaker: Lucas van Laack, Head of Sustainability Buildings Norway

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Agenda

1. BIM use in Norway
2. BIM use in Rambøll / Henning Larsen
3. Workflow of BIM to Energy Modelling





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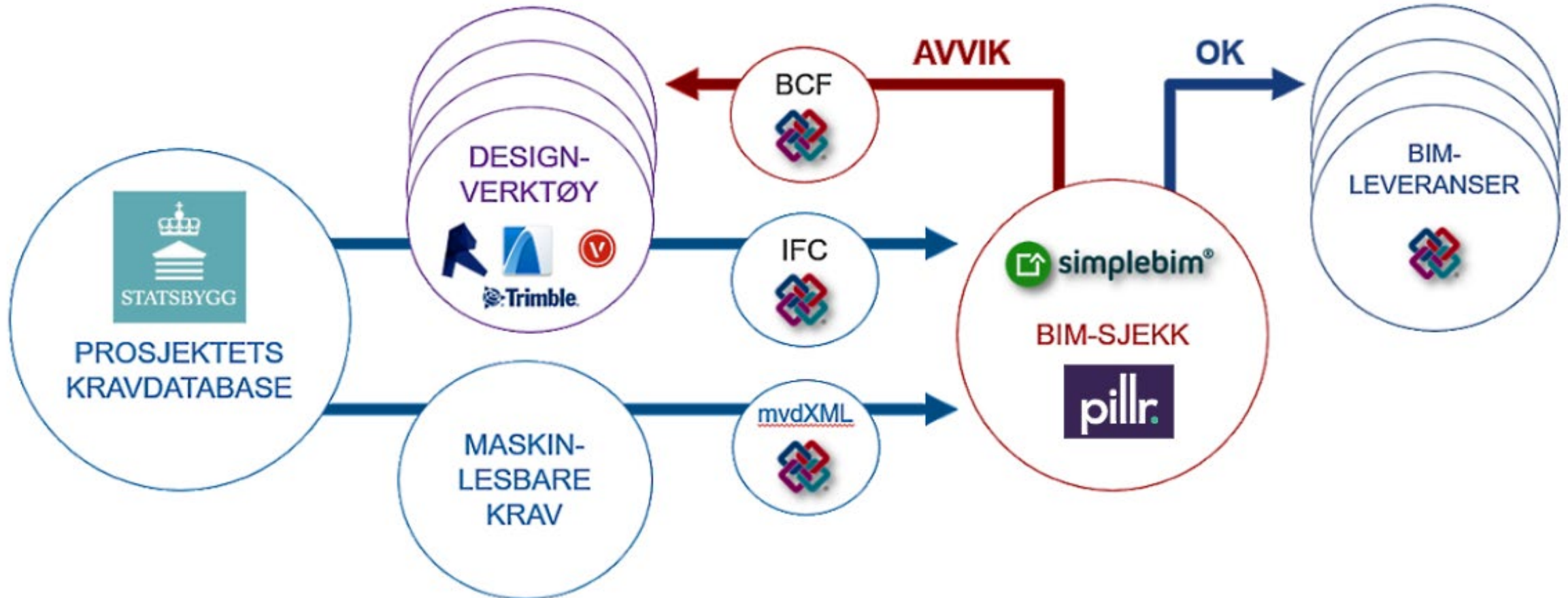


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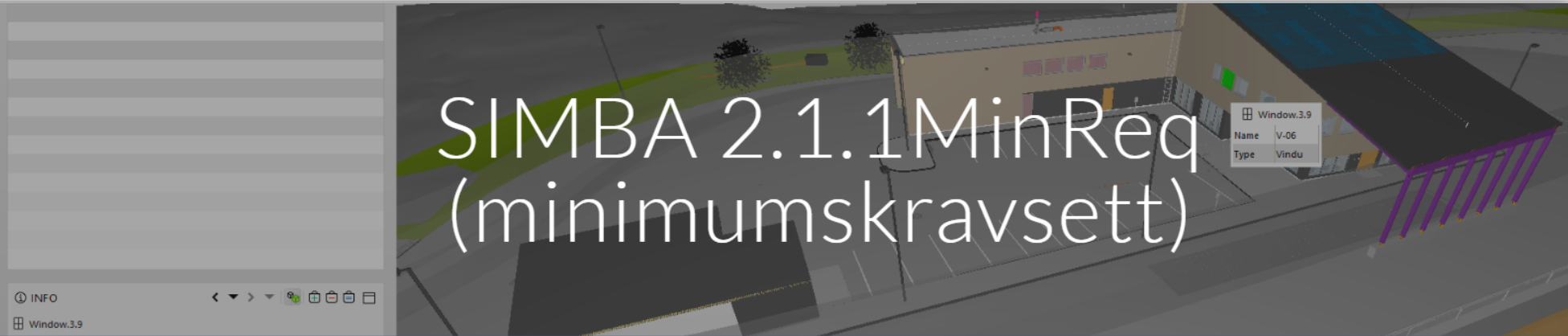


1- BIM use in Norway

BIM requirement for public projects in Norway



BIM requirement - SIMBA



SIMBA 2.1.1MinReq (minimumskravsett)

NB! Dette er ikke en generell, nyere utgave av SIMBA 2.1-kravsettmalene, men et "minimumskravsett" nedskalert vesentlig med utgangspunkt i SIMBA 2.1 kravsettmalene, og tenkt brukt primært på små/enkle prosjekter

Hva er SIMBA 2.1.1MinReq "minimumskravsett"?

«SIMBA minimumskravsett» («*SIMBA 2.1.1.MinReq*», heretter omtalt kun som «minimumskravsett») er et sett med krav til *egenskaper/attributter* ved ulike objekttyper (bygningdeler, komponenter) som utgjør et absolutt minimum av hva Statsbygg krever, vurdert ut fra generell bruk i små/enkle prosjekter og grunnleggende behov fra etterfølgende forvaltning (FDVU).

Kravsettet har tatt utgangspunkt i de vanlige SIMBA 2.1-kravsettmalene som ble utviklet ut fra forutsetningen om et «gjennomsnittlig næringsbygg», men det er i minimumskravsettet drastisk redusert hvilke egenskaper/attributter det stilles krav om, særlig rent *faglige* krav til objekter (f.eks. ytelser). De nødvendige faglige kravene forutsettes med bruk av minimumskravsettet ivare tatt ved innsamlet FDV-dokumentasjon, koblet via unike TFM-koder som skal inngå i BIM-ene.

De vanlige SIMBA 2.1-kravene i form av *generelle krav* (f.eks. filformat, modellhierarki, bruk av riktige objekttyper mv.) og *krav til detaljeringsgrad på geometrisk informasjon* gjelder i prinsippet uendret også for minimumskravsettet. I den grad disse omtaler forhold som ikke er relevante i minimumskravsettet faller de bort.

De gjenværende egenskapene/attributtene i minimumskravsettet består grovt sett av:

- Krav til **navngiving** av objekter (.Name-attributt)
- Krav til **unike TFM-koder** ved sluttleveransen av modeller, for alle relevante, fysiske bygningsdeler/komponenter som dekkes av TFM-systemet. Unike TFM-koder brukes både som nøkkel-ID for innsamling av FDV-dokumentasjon i byggeprosjektet (mest knyttet til *typen* objekt), og som nøkkel-ID for FDV-formål i forvaltnings-, vedlikeholds-, og driftsfasen (både knyttet til *forekomst* og *type* av objekter) samt ved avhending
- Krav til **IsExternal**-egenskap for relevante objekter som vegger, dører, vinduer mv., for å kunne skille mellom ytterkonstruksjoner (vender mot uteområde) fra innerkonstruksjoner



BIM template files (mvdxml)

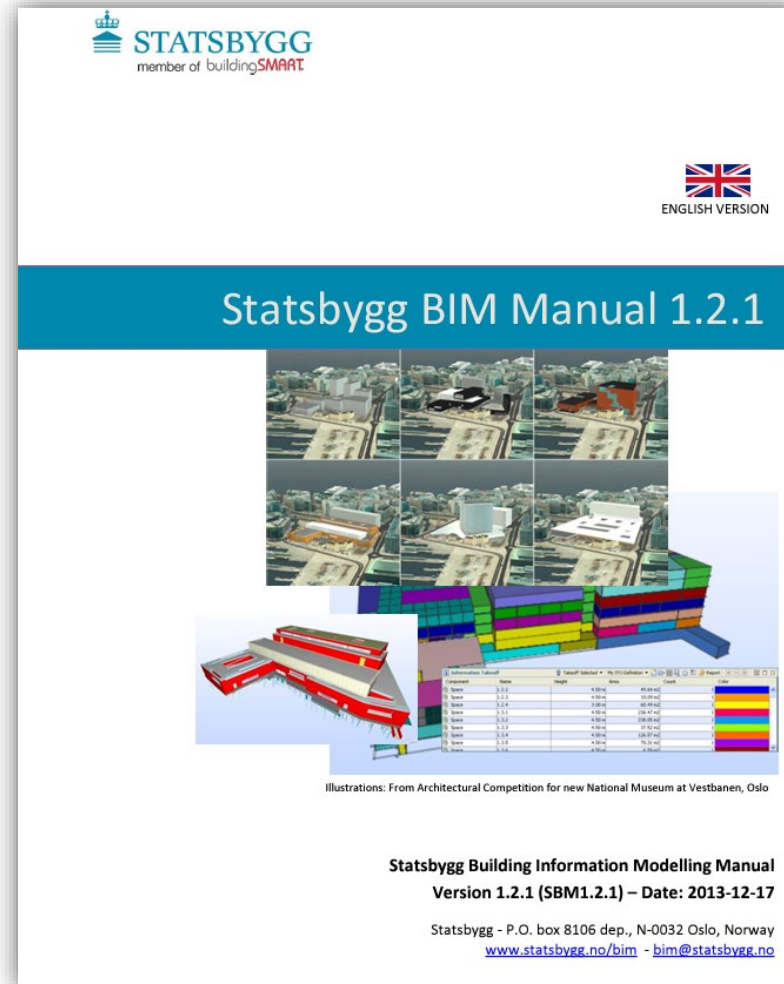
```
Name
statsbygg-template-simba-2-1-1-minimum-requirements-released-no-changes-allowed_ifc-4-add2_b3-1_architect-ark.mvdxml
statsbygg-template-simba-2-1-1-minimum-requirements-released-no-changes-allowed_ifc-4-add2_b3-1_electrical-engineer-rie.mvdxml
statsbygg-template-simba-2-1-1-minimum-requirements-released-no-changes-allowed_ifc-4-add2_b3-1_landscape-architect-lark.mvdxml
statsbygg-template-simba-2-1-1-minimum-requirements-released-no-changes-allowed_ifc-4-add2_b3-1_mechanical-and-plumbing-engineer-riv.mvdxml
statsbygg-template-simba-2-1-1-minimum-requirements-released-no-changes-allowed_ifc-4-add2_b3-1_structural-engineer-rib.mvdxml
statsbygg-template-simba-2-1-1-minimum-requirements-released-no-changes-allowed_ifc-4-add2_b3-2_architect-ark.mvdxml
statsbygg-template-simba-2-1-1-minimum-requirements-released-no-changes-allowed_ifc-4-add2_b3-2_electrical-engineer-rie.mvdxml
statsbygg-template-simba-2-1-1-minimum-requirements-released-no-changes-allowed_ifc-4-add2_b3-2_landscape-architect-lark.mvdxml
statsbygg-template-simba-2-1-1-minimum-requirements-released-no-changes-allowed_ifc-4-add2_b3-2_mechanical-and-plumbing-engineer-riv.mvdxml
statsbygg-template-simba-2-1-1-minimum-requirements-released-no-changes-allowed_ifc-4-add2_b3-2_structural-engineer-rib.mvdxml
statsbygg-template-simba-2-1-1-minimum-requirements-released-no-changes-allowed_ifc-4-add2_b4-1_architect-ark.mvdxml
statsbygg-template-simba-2-1-1-minimum-requirements-released-no-changes-allowed_ifc-4-add2_b4-1_electrical-engineer-rie.mvdxml
statsbygg-template-simba-2-1-1-minimum-requirements-released-no-changes-allowed_ifc-4-add2_b4-1_landscape-architect-lark.mvdxml
statsbygg-template-simba-2-1-1-minimum-requirements-released-no-changes-allowed_ifc-4-add2_b4-1_mechanical-and-plumbing-engineer-riv.mvdxml
statsbygg-template-simba-2-1-1-minimum-requirements-released-no-changes-allowed_ifc-4-add2_b4-1_structural-engineer-rib.mvdxml
statsbygg-template-simba-2-1-1-minimum-requirements-released-no-changes-allowed_ifc-4-add2_b5-1_architect-ark.mvdxml
statsbygg-template-simba-2-1-1-minimum-requirements-released-no-changes-allowed_ifc-4-add2_b5-1_electrical-engineer-rie.mvdxml
statsbygg-template-simba-2-1-1-minimum-requirements-released-no-changes-allowed_ifc-4-add2_b5-1_landscape-architect-lark.mvdxml
statsbygg-template-simba-2-1-1-minimum-requirements-released-no-changes-allowed_ifc-4-add2_b5-1_mechanical-and-plumbing-engineer-riv.mvdxml
statsbygg-template-simba-2-1-1-minimum-requirements-released-no-changes-allowed_ifc-4-add2_b5-1_structural-engineer-rib.mvdxml
```

BIM template files (xml)

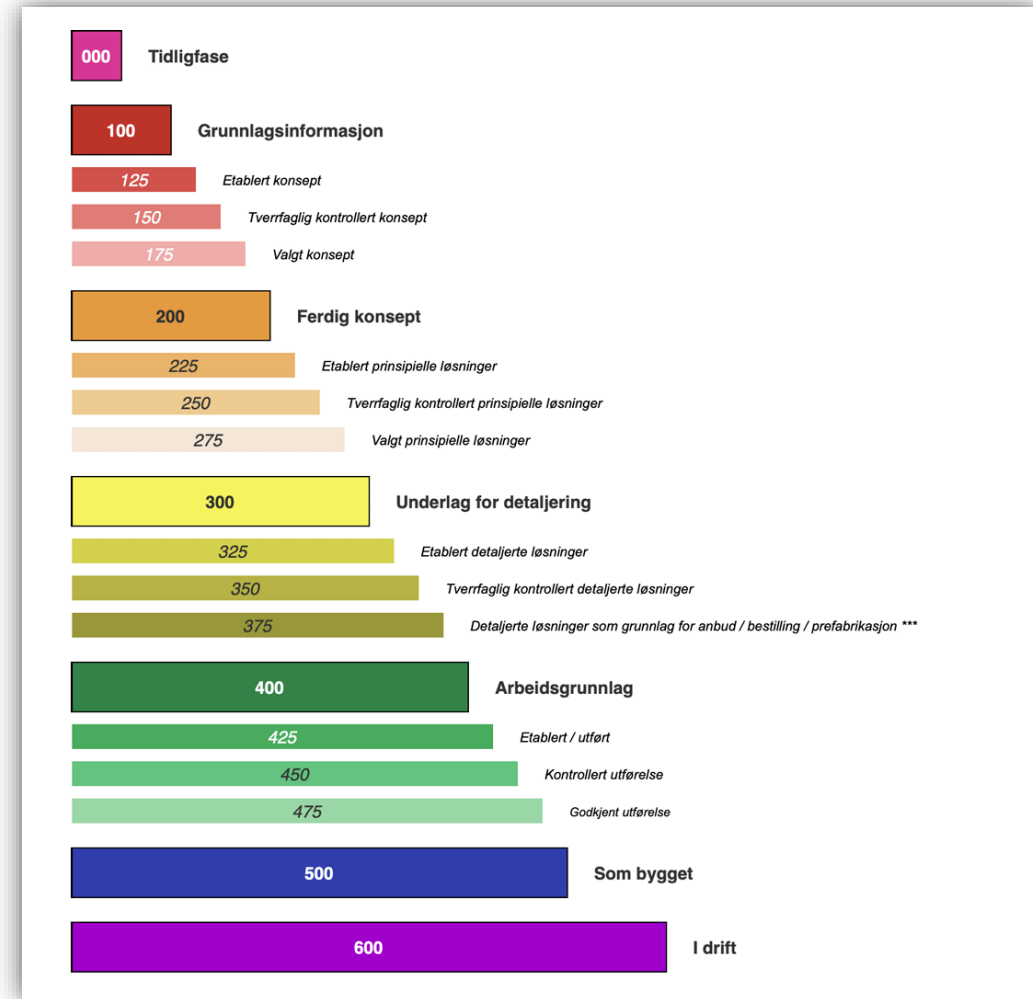
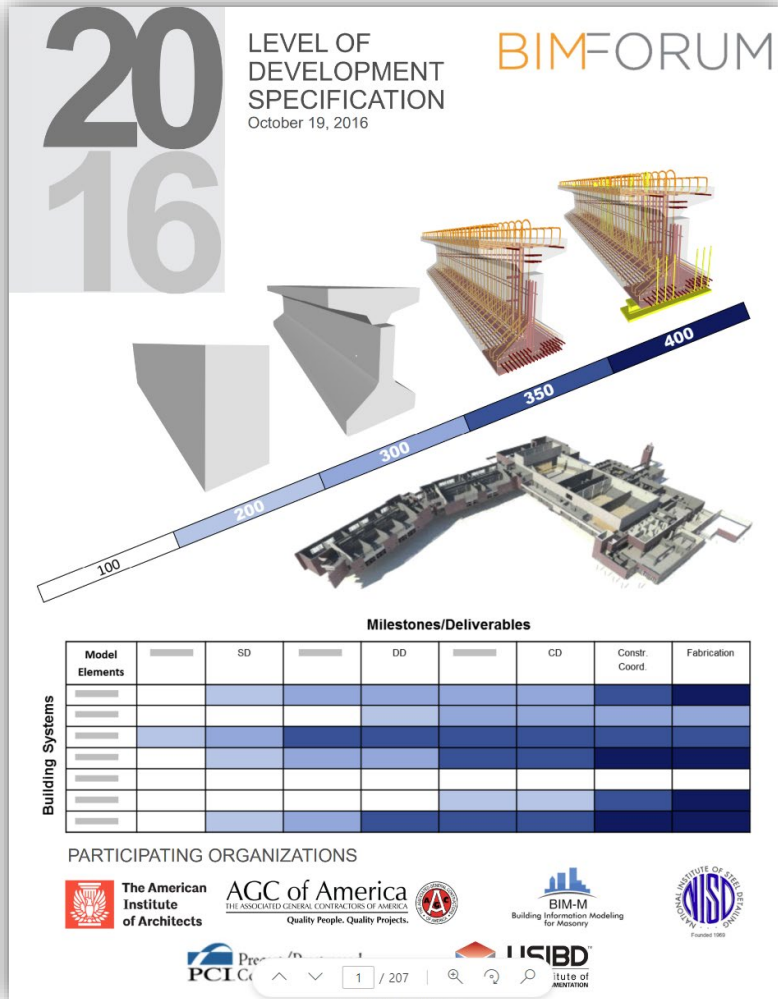
```
1 <?xml version="1.0"?>
2 <mvdXML xmlns:xsd="http://www.w3.org/2001/XMLSchema" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns="http://buildingsmart-t
3 <!-- 20.04.2022:
4     - create new template for using material in applicability (uuid="00000000-0000-0000-0001-000000000004") -->
5 <!-- 26.05.2021:
6     - ruleIDs PredefinedType and RelatingSystem added to Assignment to System template (uuid="00000000-7f2f-4af8-b574-24f353ddab1d")
7 <!-- 20.10.2020:
8     - ruleID ObjecType added to IfcRelDefinesByType template (uuid="10000000-0000-0000-0001-000000000002") -->
9 <!-- Templates section merged with IFC4_Add2_RC_Certification MVD (version from 16.August 2016) and BIM*Q templates for simplified syn
10 <!-- 22.11.2019:
11     - Fix guid for ConceptTemplate uuid="aa22fdd7-cd28-4ea7-8797-f6cf124ab3d6" name="Partial Templates from Default"
12     - Add ruleID ContextType and ContextIdentifier to Project Global Positioning template -> for checking georeferencing of body geometr
13 <!-- 7.05.2019: Template for IfcGroup added -->
14 <!-- 6.06.2019: Assignment to System added -->
15 <Templates>
16   <ConceptTemplate uuid="00000000-0000-0000-0001-000000000001" name="ProductConceptTemplate" applicableSchema="IFC4" applicableEntity=
17     <Definitions>
18       <Definition>
19         <Body lang="en"><![CDATA[Concept Template for any Product]]></Body>
20       </Definition>
21     </Definitions>
22     <Rules>
23       <AttributeRule RuleID="GlobalId" AttributeName="GlobalId"/>
24       <AttributeRule RuleID="Name" AttributeName="Name"/>
25       <AttributeRule RuleID="Description" AttributeName="Description"/>
26       <AttributeRule RuleID="Tag" AttributeName="Tag"/>
27       <AttributeRule RuleID="ContainedInStructure" AttributeName="ContainedInStructure"/>
28       <AttributeRule RuleID="Decomposes" AttributeName="Decomposes"/>
29       <AttributeRule RuleID="PredefinedType" AttributeName="PredefinedType"/>
30       <AttributeRule RuleID="ObjectType" AttributeName="ObjectType"/>
31       <AttributeRule RuleID="LongName" AttributeName="LongName"/>
32       <AttributeRule RuleID="LandTitleNumber" AttributeName="LandTitleNumber"/>
33       <AttributeRule RuleID="OperationType" AttributeName="OperationType"/>
34       <AttributeRule RuleID="OverallHeight" AttributeName="OverallHeight"/>
35       <AttributeRule RuleID="OverallWidth" AttributeName="OverallWidth"/>
36       <AttributeRule RuleID="PartitioningType" AttributeName="PartitioningType"/>
37       <AttributeRule AttributeName="IsDefinedBy">
```




BIM requirements – English manual



Level of Detail (LOD) or Model «Ripeness» Index (MMI)

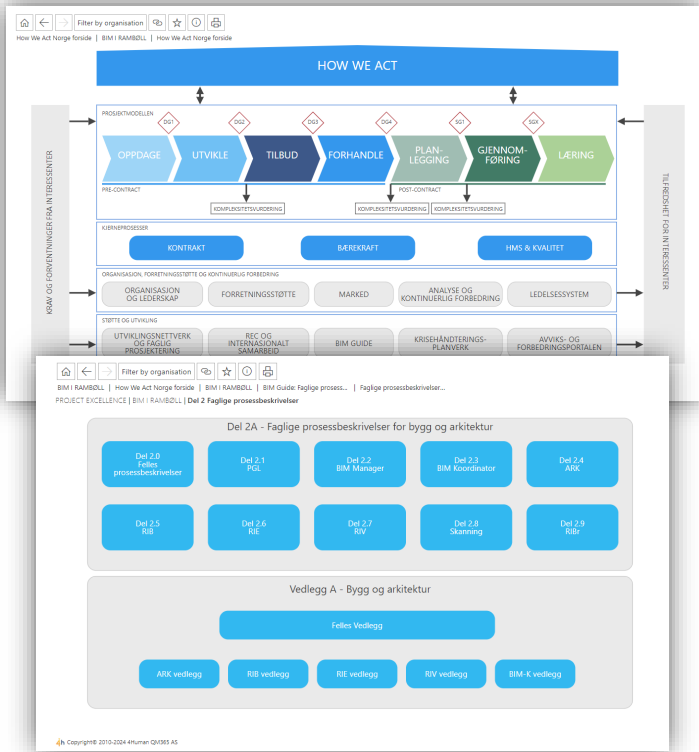


Source: <https://mmi-veilederen.no/wp-content/uploads/2022/10/MMI-veileder-2.0.pdf>

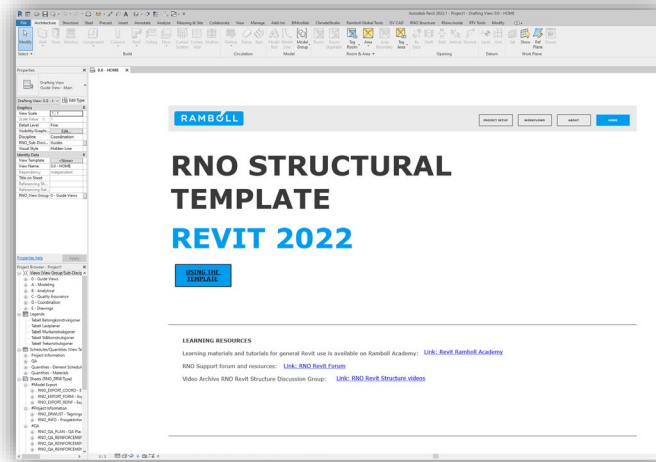


2- BIM use in Rambøll and Henning Larsen

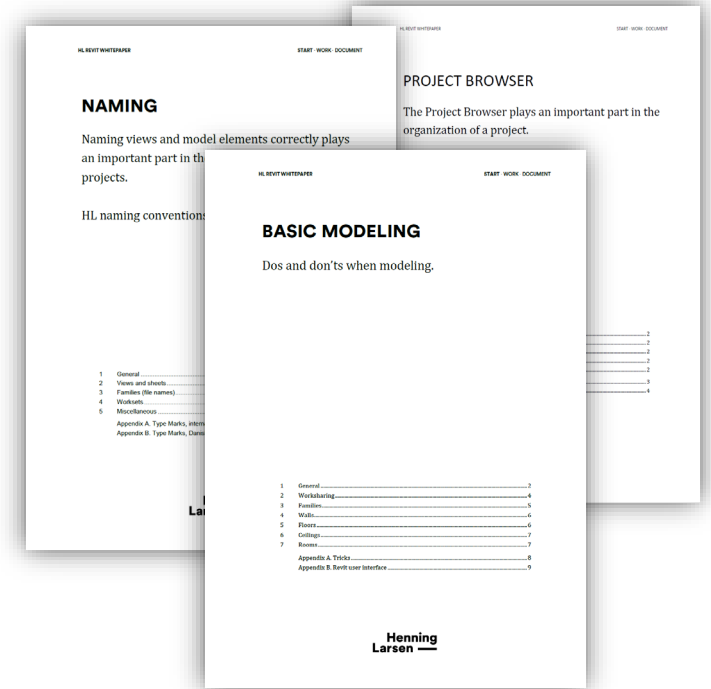
BIM procedures in Rambøll and Henning Larsen



BIM coordination on Intranet
Quality procedures that need to be followed



Templates in Revit
Each discipline has their own template/QA procedure



Modelling guides in PDF
Relevant guides for each discipline



Naming convention

Example: Good naming

- Detail Items
 - + Anno - Detail Cut
 - + Anno - Detail Cut - Inverted
 - + Filled region
 - + Insulation - Rigid
 - + Insulation - Soft
 - + Membrane
 - + People - Men
 - + People - Sports
 - + People - Wheelchair
 - + People - Women
 - + Planting - Elevation
 - + Planting - Plan
 - + Steel - Beam
 - + Vehicles - Elevation
 - + Vehicles - Plan

Example: Bad naming

- Detail Items
 - + Detail Cut
 - + Filled region
 - + Inverted Detail Cut
 - + Membrane
 - + Men Silhouettes
 - + Planting Silhouettes elevation
 - + Planting Silhouettes plan
 - + Rigid Insulation
 - + Soft Insulation
 - + Sports Silhouettes
 - + Steel Beam
 - + Vehicle Silhouettes elevation
 - + Vehicle Silhouettes plan
 - + Wheelchair Silhouettes
 - + Woman Silhouettes

IMPORTANT! All items within Revit should be named in English unless the project requirements require an alternate language is used.



Appendix A. Type Marks, international projects

Type Mark	Description
CSI	Concrete slab interior
CSE	Concrete slab exterior
F	Finish floor
CW	Concrete wall
SW	Stud wall
GW	Gypsum wall
BW	Block wall
G	Glass wall interior
GF	Glass façade
R	Roof
CI	Interior ceiling
CE	Exterior ceiling
DI	Interior door
DE	Exterior door
W	Window



Radish

The screenshot shows the Radish website interface. At the top, there is a navigation bar with 'Home' and 'Upload Solution' links, and a user greeting 'Hello Lucas van Laack'. Below the navigation bar is a search bar with the text 'Search solutions' and a 'Search' button. To the left of the search bar is a filter sidebar with sections for 'Filter by', 'PBU', 'Market & Discipline', 'My Content', 'Approved By', 'Type of File', and 'Tags'. The main content area displays a grid of search results for '391 items'. Each result card includes a thumbnail image, a title, a description, the uploader's name, the upload date, download and point counts, tags, and a 'More Info' button. The results are currently sorted by '10' items per page, and the first three items are visible on the page.

[RADISH \(ramboll.com\)](https://ramboll.com)



Solibri – Quantity Takeoff and clash detection

Solibri Office - Solibri_NEW OFFICE BUILDING

FILE MODEL CHECKING COMMUNICATION INFORMATION TAKEOFF BCF LIVE CONNECTOR SCORE + VIEWS

Spin Info

MODEL TREE

- Solibri_NEW OFFICE BUILDING
 - Default Site
 - Solibri Building
 - Ground floor
 - Column
 - Door
 - Door.0.1
 - Door.0.2
 - Door.0.3
 - Door.0.4
 - Door.0.5
 - Door.0.6
 - Door.0.7

INFO

Wall.3.6

BaseQuantities		Pset_WallCommon			
Hvperlinks	AC_Pset_Name	AC_Pset_RenovationAndPhasing			
Identification	Location	Quantities	Material	Relations	Classification
Property	Value				
Model	Solibri_NEW OFFICE BUILDING				
Discipline	Architectural				
Name	Wall-116				

Welcome to Solibri Office

Selected: 0

Carbon Emission accounting for structural elements

Autodesk Revit 2023.1 - 110572_Granstangen Park_A_110_8-9.0001_2023.rvt - 3D View: (3D)

File Architecture Structure Steel Precast Insert Annotate Analyze Massing & Site Collaborate View Manage Add-Ins ClimateStudio Ramboll Global Tools Ideate Software [N] Accelerate [N] Architecture RNO Structure Rhino.Inside RTV Tools Modify

Hide Category Custom Object Numbering ViewCreator SheetCreator Export Import Spaces SCORE Element Section Builder Smart Tag Info

DDC Tools Model Manager SCORE Section Tools Tag and Align Tools

Properties 3D View Edit Type

3D View: (3D) Edit Type

Graphics View Scale 1:100 Scale Value 1:100 Detail Level Fine Parts Visibility Show Original Visibility/Grap... Edit... Graphic Displ... Edit... Discipline Coordination Show Hidden ... By Discipline Default Analy... None Show Grids Edit... Sun Path Extents Crop View Crop Region ...

Project Browser - 110572_Granstange... Views (all) Floor Plans Hav Plan 1. Etasje Plan 2. Etasje Plan 3. Etasje Plan 4. Etasje Plan 5. Etasje Plan 6. Etasje Plan Tak 3D Views (3D) Elevations (Building Elevation East North South West Legends Schedules/Quantities (all) Sheets (all) Families

RAMBOLL - SCO₂RE - Structures CO₂ Report

Project Info Material Distribution Category Distribution Database Settings Import from Excel Results About

Location Settings RNO

Project Name Test Lucas

Maconomy Number

New Building or Rehab.

Project Type

Location

Address + Postcode

Town/City Oslo

Project Phase

Year of Construction 2020

Component of Building

GFA of superstructure (m²) 10000

GFA of substructure (m²) 8000 Total: 18000

No. of floors for chosen component

Has it been used more than 50 % generic material/product data:

What would you say is the level of detail of your model? Medium

Materials & Categories CO₂ distribution

ECI Kg/m²

Total CO₂ Tonnes CO₂-eq

Ramboll Target 130

Submit link: Reports with Project Results

link: Video Tutorial

RAMBOLL

v.2.1.4 OK

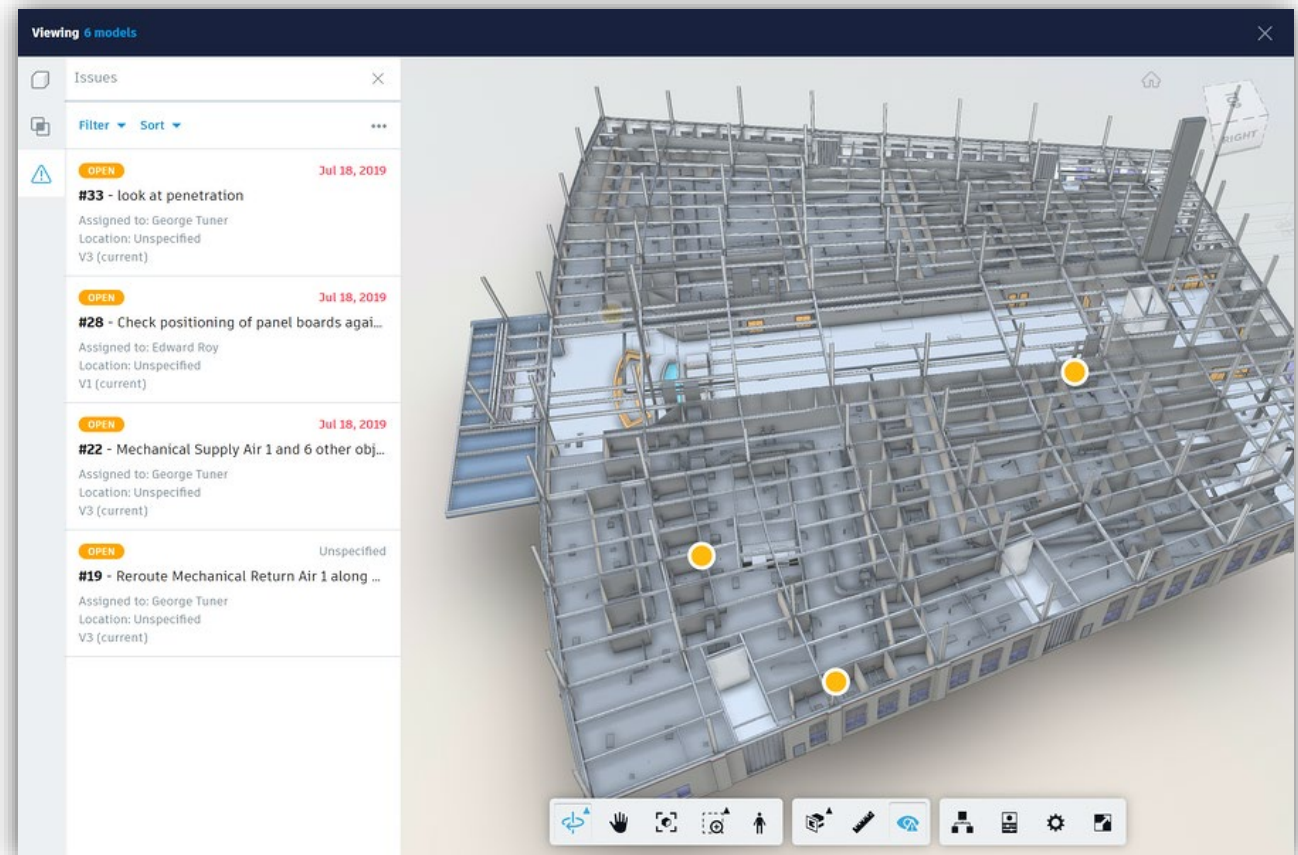
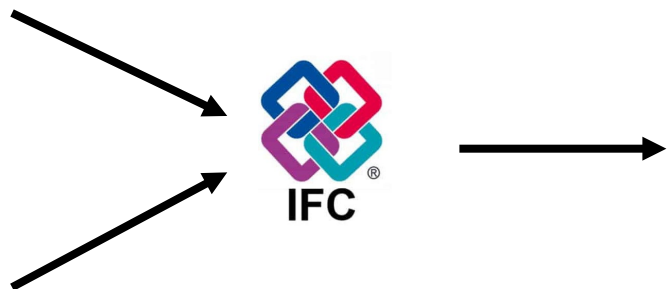
1:100 Main Model

Click to select, TAB for alternates, CTRL adds, SHIFT unselects.

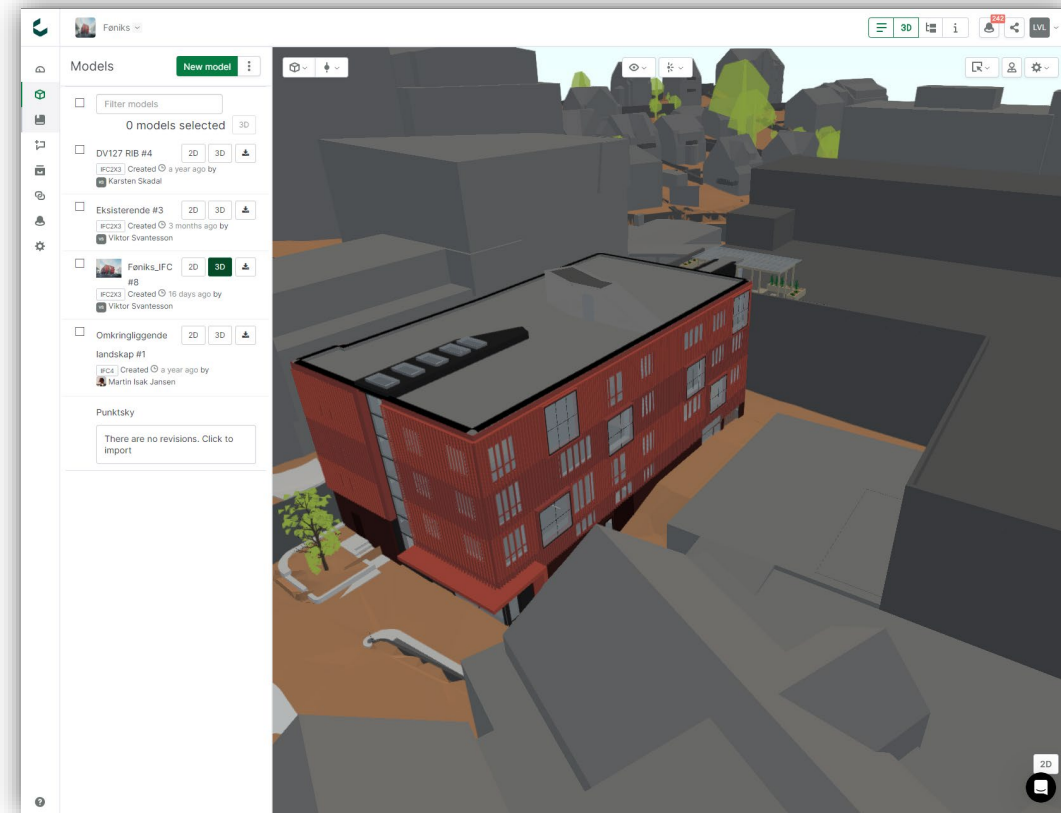
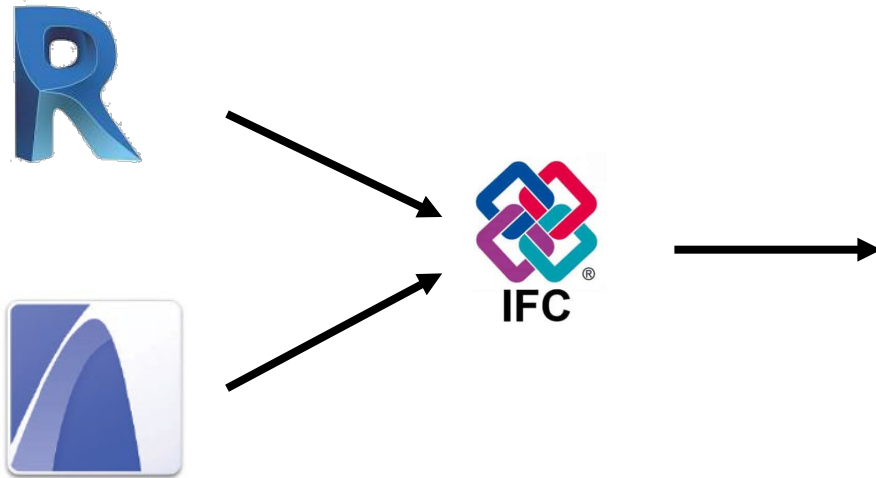


3- Workflow of BIM to Energy Modelling

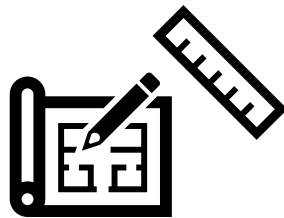
Providers of BIM environments «Webhotel»



Providers of BIM environments «Webhotel»



«Traditional» workflow of energy modelling



SIMIEN



Bredde (inkludert kam og ramme) [m]:

1,15

Høyde (inkludert kam og ramme) [m]:

1,28

Arealandel kam og ramme:

0,20

Bredde/høyde kam+ramme [m]:

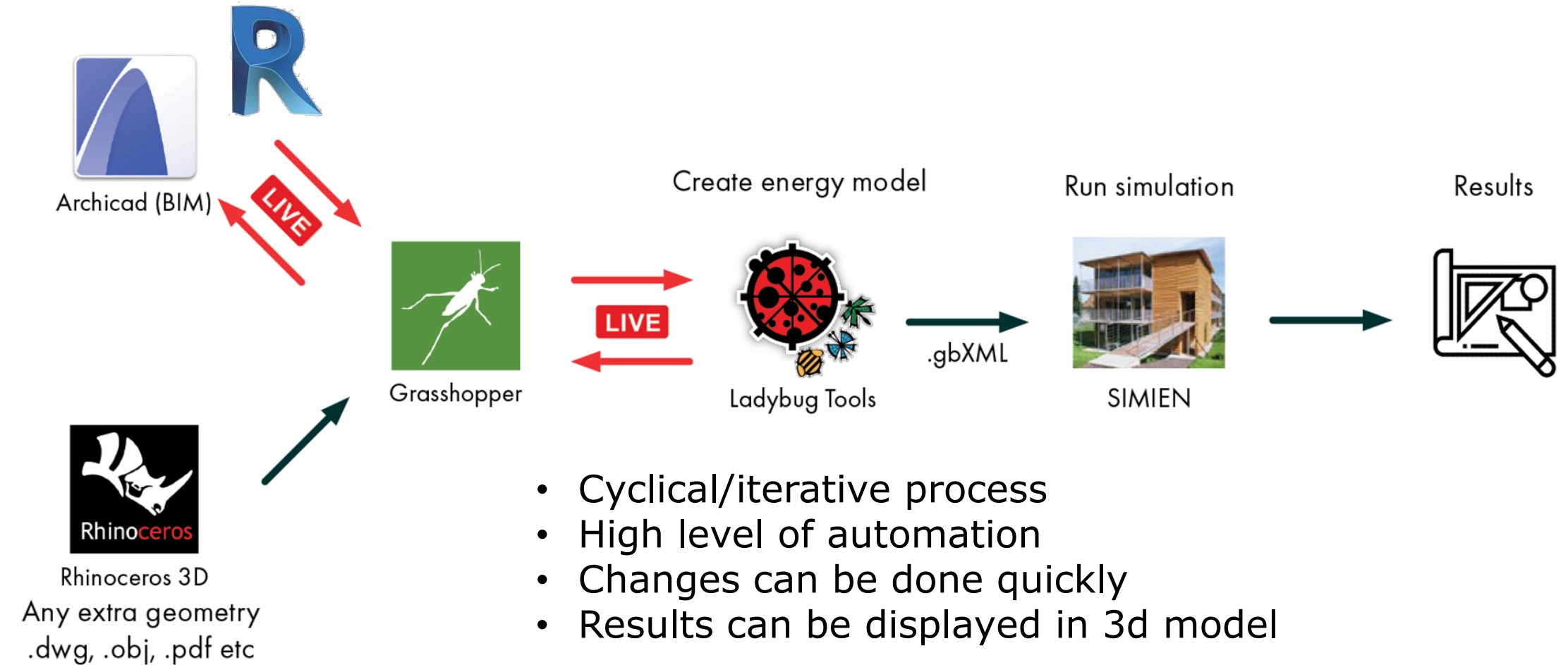
0,08



- Linear process
- A lot of time spent on manual measurements and inputs
- Changes in model are costly

«Computational» workflow of energy modelling

Geometry for analysis



Rhinoceros 3D

Any extra geometry
.dwg, .obj, .pdf etc



Autodesk Revit 2023.1 - 110572_Granstangen Park_A_110_8-9.0001_2023.rvt - 3D View: (3D)

File Architecture Structure Steel Precast Insert Annotate Analyze Massing & Site Collaborate View Manage Add-Ins ClimateStudio Ramboll Global Tools Ideate Software RNO Structure Rhino.Inside Modify

Rhino Open Viewport Preview Python Editor Grasshopper Off Wire Shaded Disable Solver Recompute Release Elements Player

Properties 0.0 - HOME (3D) Plan 01 - Analytical (3D) Plan 3. Etasje (3D)

3D View: (3D) Edit Type

Graphics

- View Scale: 1:100
- Scale Value: 1: 100
- Detail Level: Fine
- Parts Visibility: Show Original
- Visibility/Graphics: Edit...
- Graphic Display Op...: Edit...
- Discipline: Coordination
- Show Hidden Lines: By Discipline
- Default Analysis Dis...: None
- Show Grids: Edit...
- Sun Path:

Extents

- Crop View:
- Crop Region Visible:
- Annotation Crop:
- Far Clip Active:
- Far Clip Offset: 304800.0 mm
- Scope Box: None
- Section Box:

Camera

- Rendering Settings: Edit...
- Locked Orientation:
- Projection Mode: Orthographic
- Eye Elevation: 8375.6 mm

Project Browser - 110572_Granstangen Park_...

- Views (all)
 - Floor Plans
 - Hav
 - Plan 1. Etasje
 - Plan 2. Etasje
 - Plan 3. Etasje
 - Plan 4. Etasje
 - Plan 5. Etasje
 - Plan 6. Etasje
 - Plan Tak
 - 3D Views
 - (3D)
 - Elevations (Building Elevation)
 - East
 - North
 - South
 - West
 - Legends
 - Schedules/Quantities (all)
 - Sheets (all)
 - Families
 - Groups
 - Revit Links

1: 100 Main Model



Untitled - Rhino.Inside 7 Commercial - [Perspective]

File Edit View Curve Surface SubD Solid Mesh Dimension Transform Tools Analyze Render Panels Help

Command: Show
Showing 2 hidden objects.

Command: |

Standard CPlanes Set View Display Select Viewport Layout Visibility Transform Curve Tools Surface Tools Solid Tools SubD Tools Mesh Tools Render Tools Drafting New in V7 Ramboll

Perspective

Layers

Layer	Material	Linetype	Print Width
Default		Continuous	◆ Default
▼ Main file		Continuous	◆ Default
Struc...		Continuous	◆ Default
Walls		Continuous	◆ Default
Wind...		Continuous	◆ Default
Gene...		Continuous	◆ Default
Railin...		Continuous	◆ Default

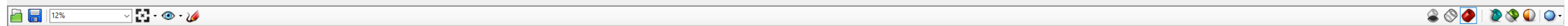
Perspective Top Front Right

End Near Point Mid Cen Int Perp Tan Quad Knot Vertex Project Disable
 CPlane x: -195290 y: 357396 z: 0 Millimeters Default Grid Snap Ortho Planar Osnap SmartTrack Gumball Record History Filter Minutes from last save: 45



Grasshopper - Export to Rhino_Views_Categories and no links*

File Edit View Display Solution Help eleFront eleFront Export to Rhino_Views_Categories and no links*



EXPORTING GEOMETRY FROM REVIT TO RHINO FROM REVIT VIEWS AND CLASSIFYING IT INTO LAYERS NAMED AFTER REVIT CATEGORIES

DESCRIPTION: Script to export the elements visible in a view in Revit and organize them in Rhino in layers named after the corresponding categories.
DATE: 2 November 2022
LATEST UPDATE: 30 October 2023

The geometry is exported into layers that will contain a series of sublayers named after the categories.
 The primary layers are named after the corresponding links or an "Main file" if the geometry comes from the main Revit file.
 The geometry will always be exported with the "True North" orientation.
 The geometry is exported placing the survey point in the Rhino origin so that the values of the coordinates in Rhino match the coordinates in Revit.
 This correction of the survey point needs to be done because by default the Internal Origin of Revit is set to match the Internal Origin of Rhino.

If the "Reveal Hidden Elements" option is activated in Revit, all hidden elements from the main file and the links will get exported to Rhino.

To import the links it is important that they all contain the default 3D view, if they do not contain this view, the links will not be exported.
 If for some reason these links should not have the default 3D view, write the name of any view that is common to all links in this section.

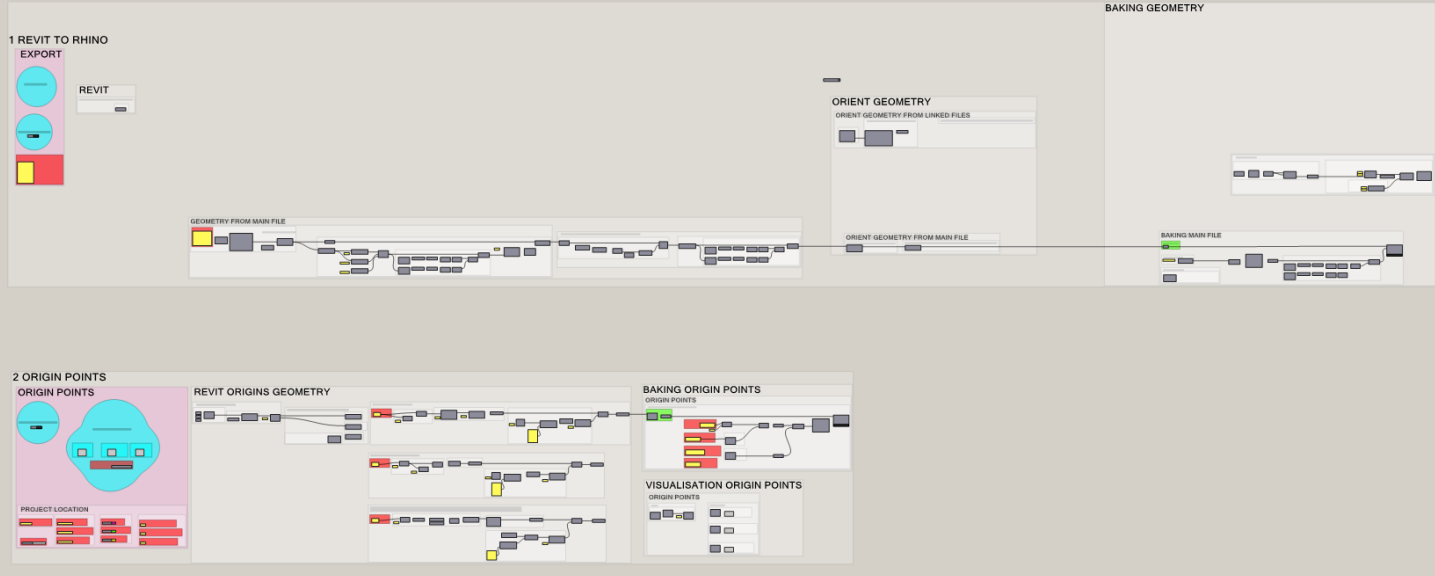
1 Revit to Rhino -> Export geometry -> Geometry from linked files -> Filtering hidden links in view -> Geometry of links -> Name of the common view in all links

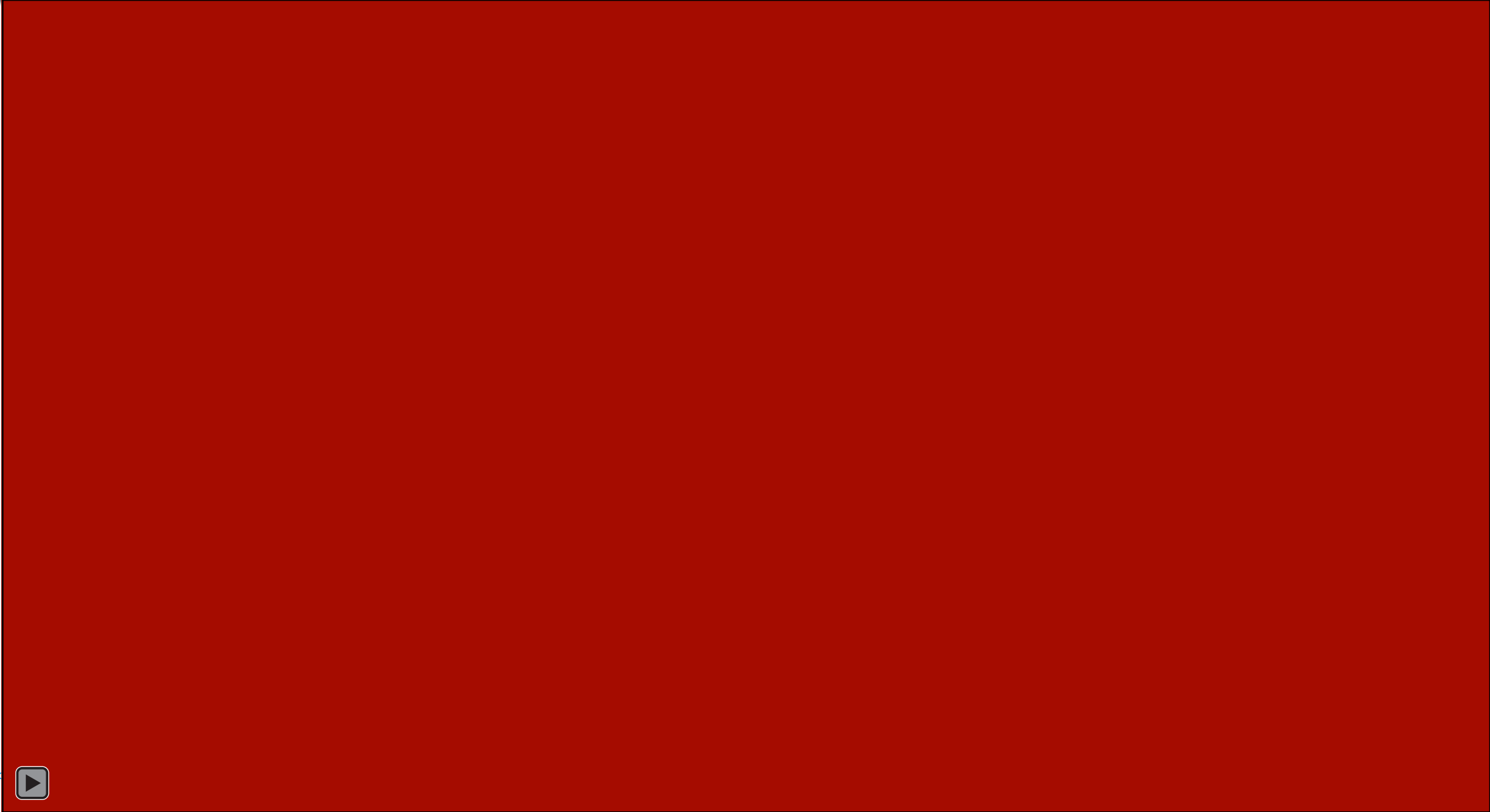
INSTRUCTIONS: 1 Revit to Rhino
 1 - Choose the view whose geometry you want to export to Rhino.
 2 - Click on visible view if once you have opened the script in Revit, you then open another view. It does not get refreshed automatically.
 3 - In Export, click on the bake button.

INSTRUCTIONS: 2 Origin Points
 1 - Bake the Origin Points (this will only bake the geometry).
 2 - Bake manually the test tags for the origins. Due to limitations of Grasshopper, once baked these tags have to be manually reassigned to their correct layer.

To make this script fully work it is required to install the Elefront plugin:
<http://www.food4rhino.com/app/elefront>

COLOR CODE





Selecting the climate

Valg av klimasted

Oslo

Oslo

Data for valgt klimasted:	
Breddegrad [°]:	59° 55'
Lengdegrad [°]:	10° 45'
Midlere temp. dim. sommer [°C]:	21,5
Midlere temp. dim. vinter [°C]:	-20,0
Årsmiddeltemperatur [°C]:	6,3
Midlere horisontal solflux [W/m²]:	110,0
Årsmiddel relativ luftfuktighet [%]:	72,8
Årsmiddel vindhastighet [m/s]:	2,2

Setting up the building type

Prosjektdata og bygningskategori

<< Forrige side Neste side >>

Navn bygning/soner:

Simuleringene er utført av:

Bygningskategori:

- Boligblokker (selected)
- Småhus
- Barnehager
- Kontorbygg
- Skolebygg
- Universitets- og høyskolebygg
- Sykehus
- Sykehjem
- Hoteller
- Idrettsbygg
- Forretningsbygg
- Kulturbygg
- Lett industri, verksteder

Effekt belysning [W/m ²]:	1,95
Effekt utstyr [W/m ²]:	3,00
Ventilasjon [m ³ /m ² h]:	1,2-1,7
Effekt tappevann [W/m ²]:	3,4
Varmeavg. personer [W/m ²]:	1,5
Romtemperatur [°C]:	21/19
Driftstid intermlaster:	16/7/52
Arbeidstid personer:	24/7/52
Driftstid ventilasjon:	24/7/52

Antall boenheter:

For å fastsette minste tillatte luftmengder i boliger og boligblokker må antall boenheter oppgis slik at midlere bruksareal pr enhet kan beregnes.

Setting up the energy sources

The screenshot shows a software interface for setting up energy sources in a building simulation. The interface is divided into two main sections: a project tree on the left and a configuration panel on the right.

Project Tree (Left):

- Oslo
- Building_1
 - Energiforsyning
 - Zone_10
 - Internlaster
 - Oppvarming
 - NV
 - Sonekobling_Zone10_Ceiling
 - Sonekobling_Zone10_Interior
 - Sonekobling_Zone10_Interior
 - Sonekobling_Zone10_Ceiling
 - Sonekobling_Zone10_Interior
 - Sonekobling_Zone10_Interior
 - Zone10_ExteriorWall_22.4m2
 - FixedWindow_1.5m2_Dir
 - Zone10_ExteriorWall_26.0m2
 - Zone10_ExteriorWall_22.1m2
 - Zone_1
 - Zone_2
 - Zone_3
 - Zone_4
 - Zone_5
 - Zone_6
 - Zone_7
 - Zone_8

Configuration Panel (Right):

Inndata for energikilder

Navigation: << Forrige side | Neste side >>

Aktive energikilder

- Elektrisitet
- Gass
- Biobrensel
- Sol
- Olje
- Fjernvarme
- Varmepumpe
- Annen

El. | Olje | Gass | Fjernvarme | Biobrensel | Varmepumpe | Sol | Annen

Data energikilde | Dekningsgrad energibehov | Kommentar

Systemvirkningsgrad romoppvarming:	0,81	Beregning av systemvirkningsgrad...
Systemvirkningsgrad vamt vann:	0,98	Beregning av systemvirkningsgrad...
Systemvirkningsgrad varmebatterier:	0,88	Beregning av systemvirkningsgrad...
Gjennomsnittlig kjølefaktor romkjøling:	2,50	Typiske kjølefaktor...
Gjennomsnittlig kjølefaktor kjølebatterier:	2,50	
CO2-faktor (CO2-ekv.) [g/kWh]:	130	
Energi pris [kr/kWh]:	0,80	

Setting up thermal zones

E44_nyvinduer_etterisolert.smi - SIMIEN

File Rediger Legg inn Vis Hjelp

Oslo

Building_1

- Energiforsyning
- Zone_10
 - Internlaster
 - Oppvarming
 - NV
 - Sonekobling_Zone10_Ceiling
 - Sonekobling_Zone10_Interior
 - Sonekobling_Zone10_Interior
 - Sonekobling_Zone10_Ceiling
 - Sonekobling_Zone10_Interior
 - Sonekobling_Zone10_Interior
 - Zone10_ExteriorWall_22.4m2
 - FixedWindow_1.5m2_Dir
 - Zone10_ExteriorWall_26.0m2
 - Zone10_ExteriorWall_22.1m2
- Zone_1
- Zone_2
- Zone_3
- Zone_4
- Zone_5
- Zone_6
- Zone_7

Inndata for rom/soner

<< Forrige side Neste side >>

Navn: Zone_10

Størrelse

Oppvarmet bruksareal (BRA) [m²]: 71,0

Oppvarmet luftvolum [m³]: 195,0

Alle soner må gis et navn før du kan simulere

Infiltrasjon Møbler/interiør Driftsdager Kuldebroer Kommentar

Luftskifte ved 50Pa

Lekkasjetall (N50) [1/h]: 0,40

Luftskifte ved normaltillstand

Infiltrasjon [oms/h]: 0,03

Lekkasjetallet angir antall luftskifter med en trykkforskjell på 50 Pa over klimaskjemen.

Infiltrasjonen beregnes ut fra lekkasjetall, skjemingsklasse og fasadesituasjon. Avtrekksventilasjon og ubalanserte luftmengder vil også påvirke infiltrasjonen.

Skjemingsklasse

- Ingen skjeming; bygninger i åpent landskap, høyblokker i bysentre
- Moderat skjeming; bygninger på landet med trær eller andre bygninger rundt, forsteder
- Høy skjeming; bygninger av middels høyde i bysentre, bygninger i skogsområder

Fasadesituasjon

- Fasadesituasjon

Setting up internal loads

E44_nyvinduer_etterisolert.smi - SIMIEN

File Rediger Legg inn Vis Hjelp

Oslo

- Building_1
 - Energiforsyning
 - Zone_10
 - Internlaster
 - Oppvarming
 - NV
 - Sonekobling_Zone10_Ceiling
 - Sonekobling_Zone10_Interior
 - Sonekobling_Zone10_Interior
 - Sonekobling_Zone10_Ceiling
 - Sonekobling_Zone10_Interior
 - Sonekobling_Zone10_Interior
 - Zone10_ExteriorWall_22.4m2
 - FixedWindow_1.5m2_Dir
 - Zone10_ExteriorWall_26.0m2
 - Zone10_ExteriorWall_22.1m2
 - Zone_1
 - Zone_2
 - Zone_3
 - Zone_4
 - Zone_5
 - Zone_6
 - Zone_7
 - Zone_8

Inndata for internlaster (belysning og teknisk utstyr)

Navn: Internlaster

Belysning Tappevann
 Teknisk utstyr Personer

Belysning | Teknisk utstyr | Tappevann | Varmetilskudd personer | Kommentar

Separate verdier for hver enkelt måned

	Midlere effekt [W/m ²]	Varmetilskudd [%]	
I driftstiden:	6.40	100.00	Varmetilsk. med gitt sonestørrelse: 454 W
Utenfor driftstiden:	0.00	100.00	Varmetilsk. med gitt sonestørrelse: 0 W
Helg/fridager:	0.00	100.00	Varmetilsk. med gitt sonestørrelse: 0 W

AM PM

Driftsmønster settes ved å klikke på ringen rundt klokken. Brun markering angir driftstiden. Den innerste ringen setter hele timer, den midterste...

Setting up heating

The screenshot shows a software interface for setting up heating. The title bar reads "E44_nyvinduer_etterisolert.smi - SIMIEN". The menu bar includes "Fil", "Rediger", "Legg inn", "Vis", and "Hjelp". The toolbar contains various icons for file operations and simulation settings.

The left sidebar shows a project tree for "Oslo" under "Building_1". The tree includes "Energiforsyning", "Zone_10", "Internlaster", "Oppvarming" (highlighted), "NV", and several "Sonekobling" (zone connection) items for Zone 10. Below these are "Zone10_ExteriorWall" and "FixedWindow" items, followed by "Zone_1" through "Zone_9", and "Evaluering".

The main panel is titled "Inndata for oppvarmingsanlegg" (Input for heating system). It has navigation buttons "<< Forrige side" and "Neste side >>".

The "Inndata for oppvarmingsanlegg" panel contains the following fields and options:

- Navn: Oppvarming
- Annen driftsstrategi i sommernånder
- Kapasitet oppvarmingsystem: Driftsstrategi, Driftsstrategi sommer, Kommentar
- Maksimal avgitt effekt [W/m²]: 50,0
- Maksimal effekt med gitt gulvareal: 3550 W
- Konvektiv andel avgitt effekt: 0,8
- Oppvarming med vannbærent distribusjonsanlegg
- Turtemperatur [°C]: 38,0
- Returtemperatur [°C]: 32,0
- Spesifikk pumpeeffekt (SPP) [kW/(l/s)]: 0,50

Setting up ventilation/cooling

E44_nyvinduer_etterisolert.smi - SIMIEN

File Rediger Legg inn Vis Hjelp

Oslo

Building_1

- Energiforsyning
- Zone_10
 - Internlaster
 - Oppvarming
 - NV
 - Sonekobling_Zone10_Ceiling
 - Sonekobling_Zone10_Interior
 - Sonekobling_Zone10_Ceiling
 - Sonekobling_Zone10_Interior
 - Sonekobling_Zone10_Ceiling
 - Sonekobling_Zone10_Interior
 - Zone10_ExteriorWall_22.4m2
 - FixedWindow_1.5m2_Dir
 - Zone10_ExteriorWall_26.0m2
 - Zone10_ExteriorWall_22.1m2
- Zone_1
- Zone_2
- Zone_3
- Zone_4
- Zone_5
- Zone_6
- Zone_7
- Zone_8
- Zone_9
- Evaluering
- Energimerke

<< Forrige side Inndata for ventilasjon (avtrekk eller balansert) Neste side >>

Navn: Ventilasjon

Type:
 Balansert ventilasjon
 Avtrekksventilasjon
 Naturlig ventilasjon

Luftmengde	Tilluftstemp.	Driftstid	Komponenter	Avtrekksvp.	Nattkjøling	Kommentar
Tilluft i driftstiden [m ³ /hm ²]:		1,70				Luftmengde ved gitt gulvareal: 121 m ³ /h
Tilluft utenfor driftstiden [m ³ /hm ²]:		1,70				Luftmengde ved gitt gulvareal: 121 m ³ /h
Tilluft helg/ferie [m ³ /hm ²]:		1,70				Luftmengde ved gitt gulvareal: 121 m ³ /h
Avtrekk i driftstiden [m ³ /hm ²]:		1,70				Luftmengde ved gitt gulvareal: 121 m ³ /h
Avtrekk utenfor driftstiden [m ³ /hm ²]:		1,70				Luftmengde ved gitt gulvareal: 121 m ³ /h
Avtrekk helg/ferie [m ³ /hm ²]:		1,70				Luftmengde ved gitt gulvareal: 121 m ³ /h
<input type="checkbox"/> Redusert luftmengde når utetemperaturen er under [°C]:		-10,0				
Redusert tilluftsmengde [m ³ /hm ²]:	0,85					Luftmengde ved gitt gulvareal: 60 m ³ /h
Redusert avtrekksmengde [m ³ /hm ²]:	0,85					Luftmengde ved gitt gulvareal: 60 m ³ /h
<input type="checkbox"/> Separate luftmengder og SFP-faktor for bruk under evaluering og energimerking						
Luftmengde i driftstiden [m ³ /hm ²]:		1,49				Driftstiden for ventilasjonsanlegg er nomert ved evaluering. Luftmengdene skal være antatte gjennomsnittsverdier i og utenfor driftstiden..
Luftmengde utenfor driftstiden		1,49				Dersom antatt luftmengde er lavere enn min. luftmengde (gitt i tabell A6 i NS3031) skal min.
SFP-faktor i driftstiden [W/(m ³ /s)]:		2,50				

Setting up walls and slabs

The screenshot shows a software interface for setting up walls and slabs. The main window is titled "E44_nyvinduer_etterisolert.smi - SIMIEN". The interface includes a menu bar (Fil, Rediger, Legg inn, Vis, Hjelp) and a toolbar with various icons. The left sidebar shows a project tree with the following structure:

- Oslo
- Building_1
 - Energiforsyning
 - Zone_10
 - Internlaster
 - Oppvarming
 - NV
 - Ventilasjon
 - Sonekobling_Zone10_Ceiling
 - Sonekobling_Zone10_Interior
 - Sonekobling_Zone10_Interior
 - Sonekobling_Zone10_Ceiling
 - Sonekobling_Zone10_Interior
 - Sonekobling_Zone10_Interior
 - Zone10_ExteriorWall_22.4m2 (selected)
 - FixedWindow_1.5m2_Dir
 - Zone10_ExteriorWall_26.0m2
 - Zone10_ExteriorWall_22.1m2
 - Zone_1
 - Zone_2
 - Zone_3
 - Zone_4
 - Zone_5
 - Zone_6

The right panel is titled "Inndata for en fasade (yttervegg)" and contains the following configuration options:

- Navigation: << Forrige side, Neste side >>
- Form fields:
 - Navn: Zone10_ExteriorWall_22.4m2_Dir0_L8.0_H3.0
 - Størrelse: Totalt areal inkl. vinduer [m²]: 22.4
- Tabbed interface: Inndata konstruksjon (selected), Himmelretning/horisont, Kommentar
- Konstruksjon section:
 - Dropdown: 36mm bindingsverk, 200mm isolasjon
 - Egendefinert konstruksjon
 - Uverdi [W/m²K]: 0.21
 - Solutsatt fasade (tar hensyn til absorbert solvarme i fasaden)
 - Utvendig absorpsjonskoeffisient: 0.80
- Vamelagring i innvendig sjikt section:
 - Dropdown: Lett vegg
 - Egendefinert sjikt:
 - Effektiv varmekapasitet [Wh/m²K]: 3.0

Setting up the window

E44_nyvinduer_etterisolert.smi - SIMIEN

Fil Rediger Legg inn Vis Hjelp

Oslo

- Building_1
 - Energiforsyning
 - Zone_10
 - Internlaster
 - Oppvarming
 - NV
 - Ventilasjon
 - Sonekobling_Zone10_Ceiling
 - Sonekobling_Zone10_Interior
 - Sonekobling_Zone10_Interior
 - Sonekobling_Zone10_Ceiling
 - Sonekobling_Zone10_Interior
 - Sonekobling_Zone10_Interior
 - Sonekobling_Zone10_Interior
 - Zone10_ExteriorWall_22.4m2
 - FixedWindow_1.5m2_Dir0**
 - Zone10_ExteriorWall_26.0m2
 - Zone10_ExteriorWall_22.1m2
 - Zone_1
 - Zone_2
 - Zone_3
 - Zone_4
 - Zone_5
 - Zone_6

Inndata for ett eller flere vinduer

<< Forrige side Neste side >>

Navn: FixedWindow_1.5m2_Dir0 Antall (like) vinduer: 1

Størrelse	Vametapsegenskaper	Vametilskuddsegenskaper	Bygningsutspring	Kommentar
	Bredde (inkludert kam og ramme) [m]:	1,15		
	Høyde (inkludert kam og ramme) [m]:	1,28		
	Arealandel kam og ramme:	0,20		
	<input type="checkbox"/> Bredde/høyde kam+ramme [m]:	0,08		

Setting up simulation parameters & run simulation

The screenshot shows the SIMIEN software interface for setting up a simulation. The left sidebar displays a project tree for 'Oslo Building_1' with various components like 'Energiforsyning', 'Zone_10', 'Internlaster', 'Oppvarming', 'NV', 'Ventilasjon', and several 'Sonekobling' and 'Zone' elements. The main window is titled 'E44_nyvinduer_etterisolert.smi - SIMIEN' and features a menu bar (Fil, Rediger, Legg inn, Vis, Hjelp) and a toolbar. The 'Simulering av et helt år' dialog is open, showing the following configuration:

- Navigation: << Forrige side, Simulering av et helt år, Neste side >>
- Navn: Arssimulering
- Sti til resultatfil: C:\Grasshopper\Ekrv44\aarssimulering.smo
- Simuleringsdata tabs: Resultater, Dokumentasjon av inndataverdier, Feil, Kommentar
- Lagre resultater i en tekstfil (timebaserte verdier)
- Sti til tekstfil: C:\Grasshopper\Ekrv44\timeverdier.txt
- Verdier som skal være med i tekstfilen:
 - Utetemperatur
 - Romlufttemperatur
 - Operativ temperatur
 - Tilluftstemperatur
 - Effekt romoppvarming
 - Effekt romkjøling (lokal kjøling)
 - Effekt ventilasjonsvarme (varebatterier)
 - Effekt ventilasjonskjøling (kjølebatterier)
- Buttons: Start simulering..., Hjelp

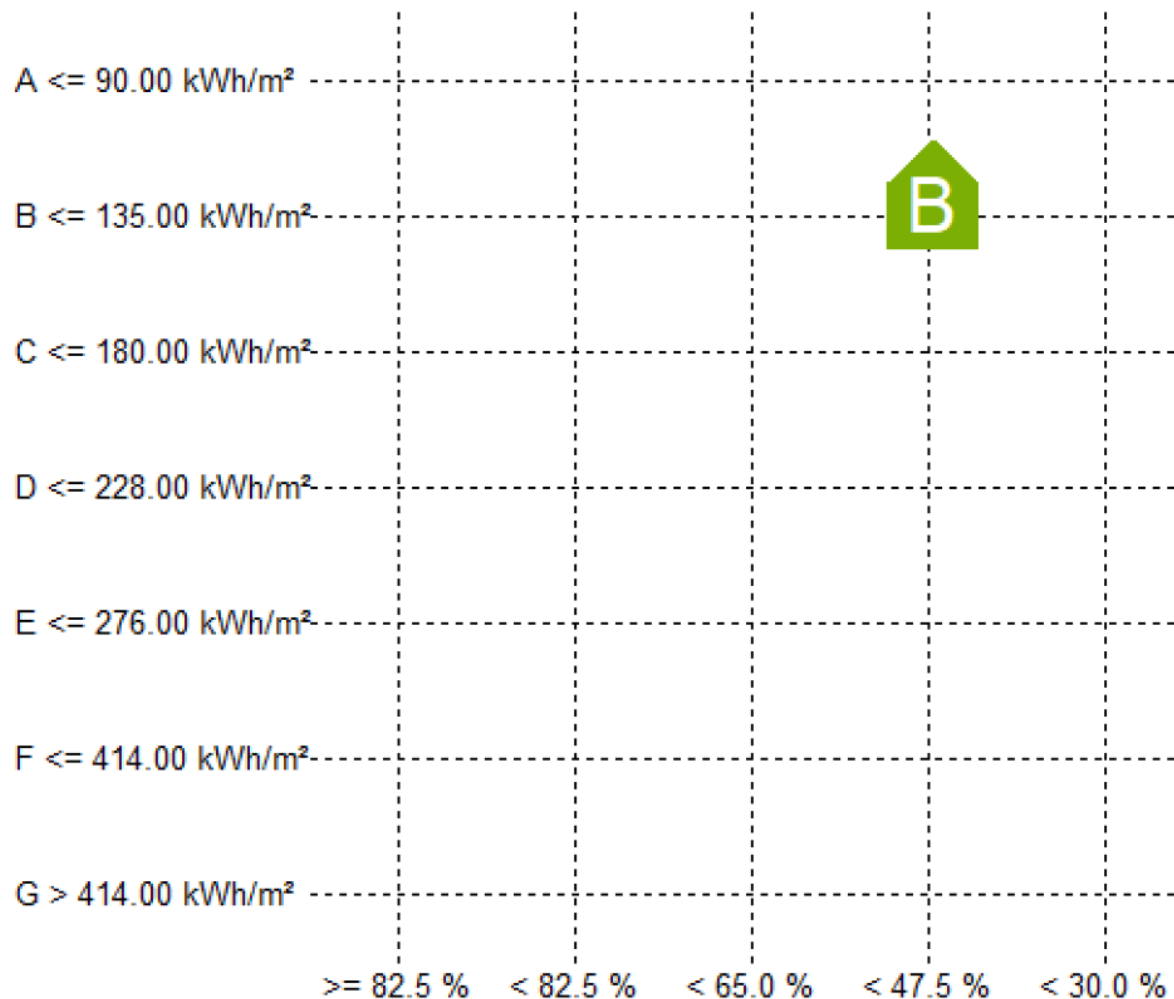
Results from energy simulation

Energibudsjett			
Energipost	Energibehov	Spesifikt energibehov	
1a Romoppvarming	303133 kWh	29,6 kWh/m ²	
1b Ventilasjonsvarme (varmebatterier)	991014 kWh	96,9 kWh/m ²	
2 Varmtvann (tappevann)	304517 kWh	29,8 kWh/m ²	
3a Vifter	447643 kWh	43,8 kWh/m ²	
3b Pumper	40579 kWh	4,0 kWh/m ²	
4 Belysning	358132 kWh	35,0 kWh/m ²	
5 Teknisk utstyr	59708 kWh	5,8 kWh/m ²	
6a Romkjøling	35903 kWh	3,5 kWh/m ²	
6b Ventilasjonskjøling (kjølebatterier)	145957 kWh	14,3 kWh/m ²	
Totalt netto energibehov, sum 1-6	2686586 kWh	262,8 kWh/m²	

Levert energi til bygningen (beregnet)			
Energivare	Levert energi	Spesifikk levert energi	
1a Direkte el.	1278884 kWh	125,1 kWh/m ²	
1b El. til varmepumpesystem	0 kWh	0,0 kWh/m ²	
1c El. til solfangersystem	0 kWh	0,0 kWh/m ²	
2 Olje	0 kWh	0,0 kWh/m ²	
3 Gass	0 kWh	0,0 kWh/m ²	
4 Fjernvarme	1685731 kWh	164,9 kWh/m ²	
5 Biobrensel	0 kWh	0,0 kWh/m ²	
6. Annen energikilde	0 kWh	0,0 kWh/m ²	
7. Solstrøm til egenbruk	-0 kWh	-0,0 kWh/m ²	
Totalt levert energi, sum 1-7	2964615 kWh	290,0 kWh/m²	
Solstrøm til eksport	-0 kWh	-0,0 kWh/m ²	
Netto levert energi	2964615 kWh	290,0 kWh/m²	

Energikarakter

ENERGIMERKE





Bright
ideas.
Sustainable
change.

RAMBOLL