How to Automate Heating Design in Revit

Ben Roberts

BIM Delivery Leader, Hoare Lea
@androgynusvegan

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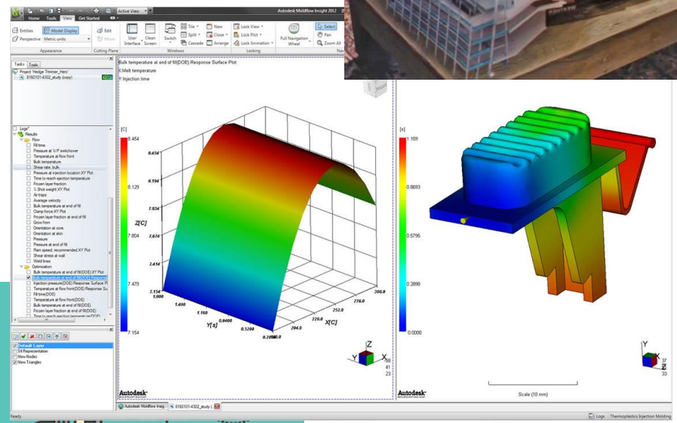
Ultimate Vision

- Instant feedback on design decisions
- Optimise building models rather than testing them
- Spend less time on repetitive routine tasks…
- …and more time designing



Class summary

Using the heating system design process as an example, I will show you some techniques for automating current methods and saving huge amounts of time.

This includes:

- Core Revit functionality
- Dynamo
- Custom Add-ins

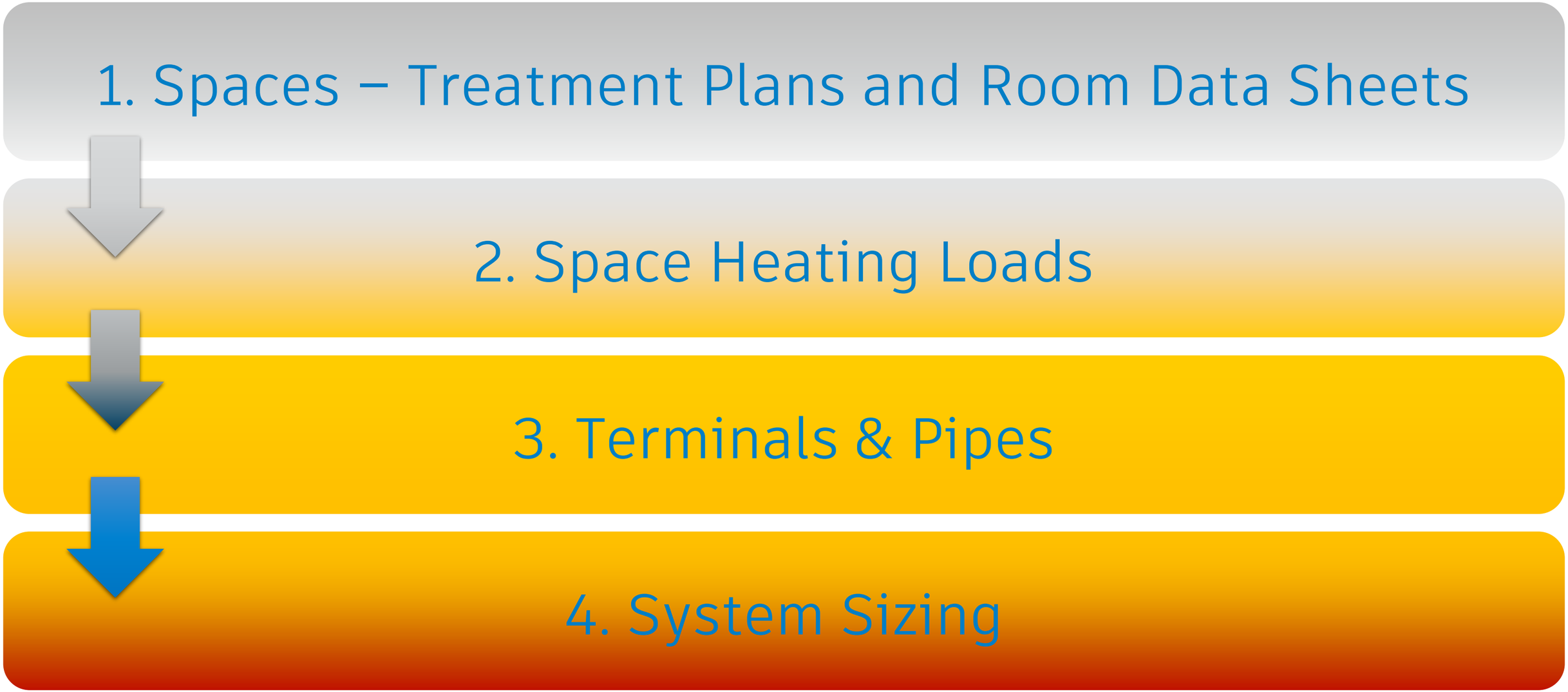
Key learning objectives

At the end of this class, you will be able to:

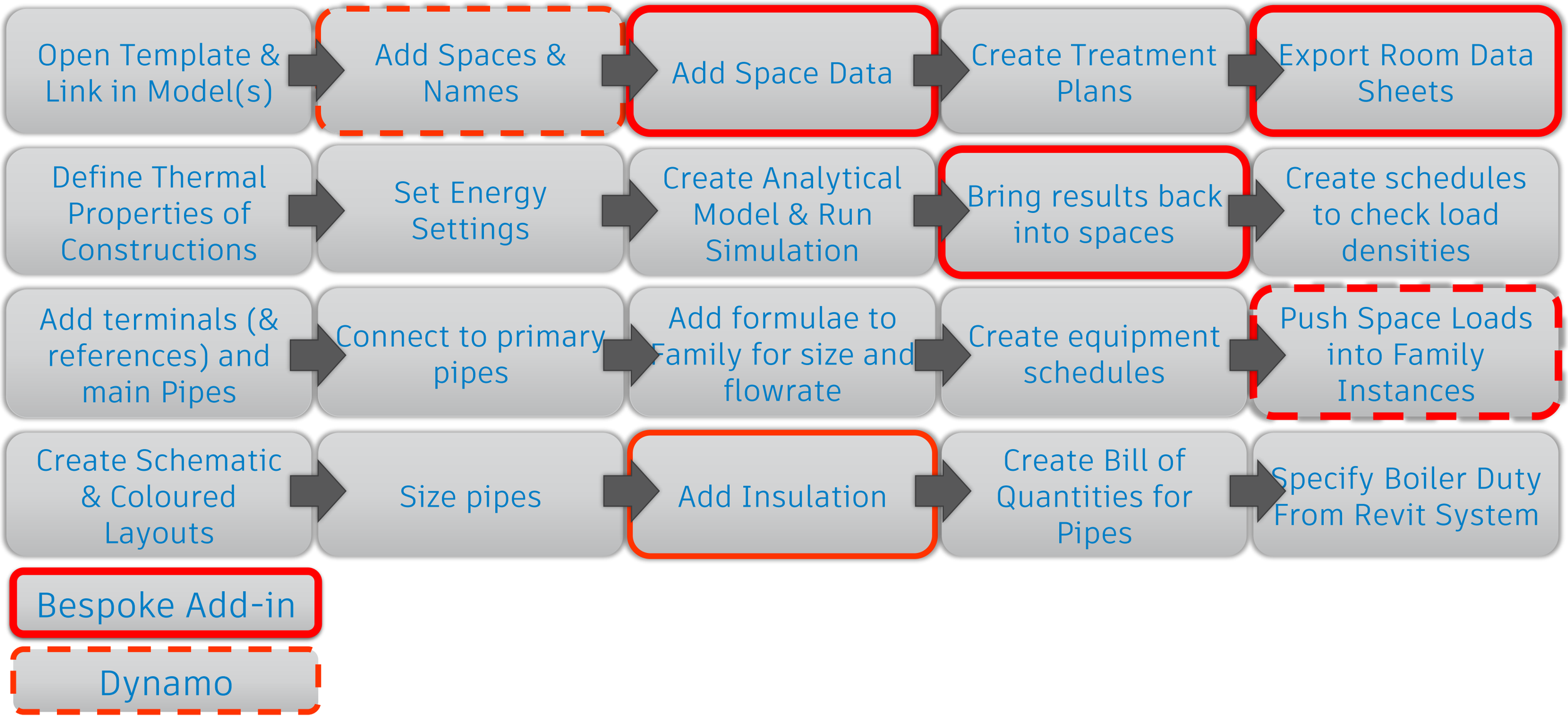
- Learn how to carry out mechanical calculations in Revit
- Get a good idea of how dynamo can help mechanical engineers
- See how Revit can be used at early design stages for significant time savings
- Learn tips and tricks to get the best out of Revit (old and new features)

Heating Design Workflow

Heating Design Workflow - Overview

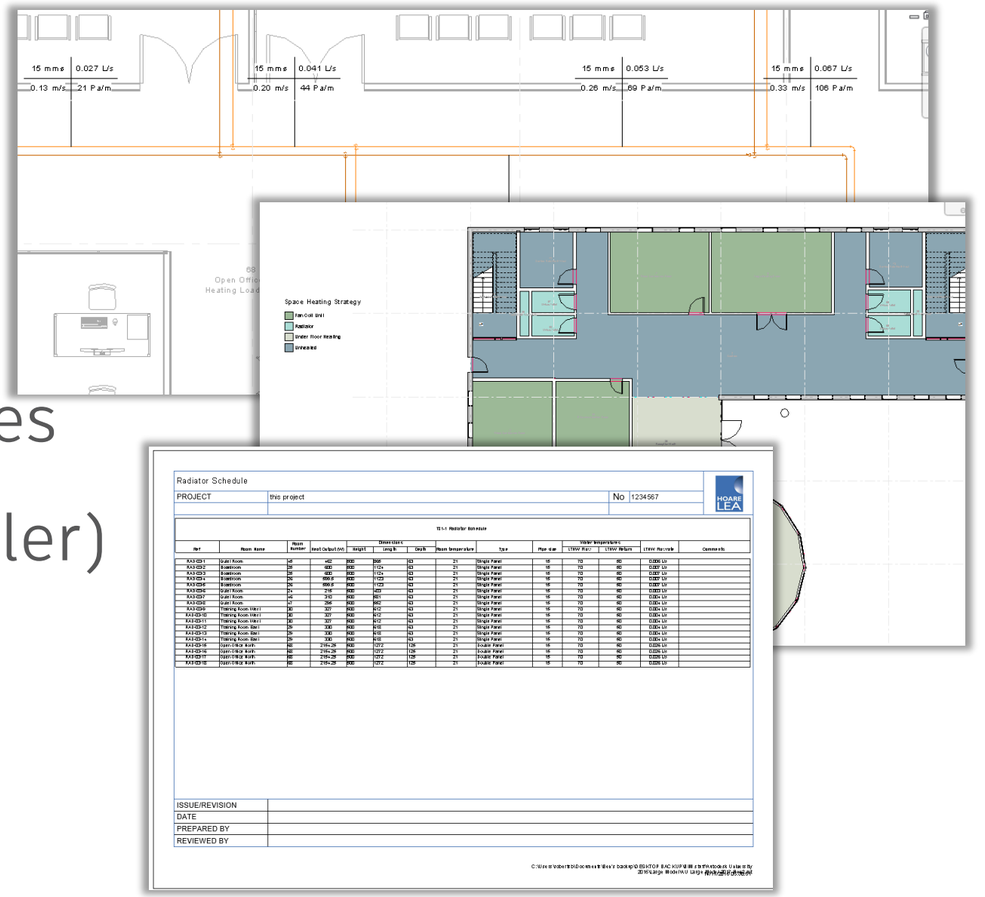


Heating Design Workflow – Overview



Heating Design Workflow - Outputs

- Model with equipment (with sizes & duties) and pipes (sized and insulated),
- Room Data Sheets
- Treatment Plans
- Pipework Layouts
- Pipework “Schematic Layouts” & Colour Schemes
- Equipment Schedules (radiators, pump and boiler)
- Bill of Quantities & Pipe Schedule

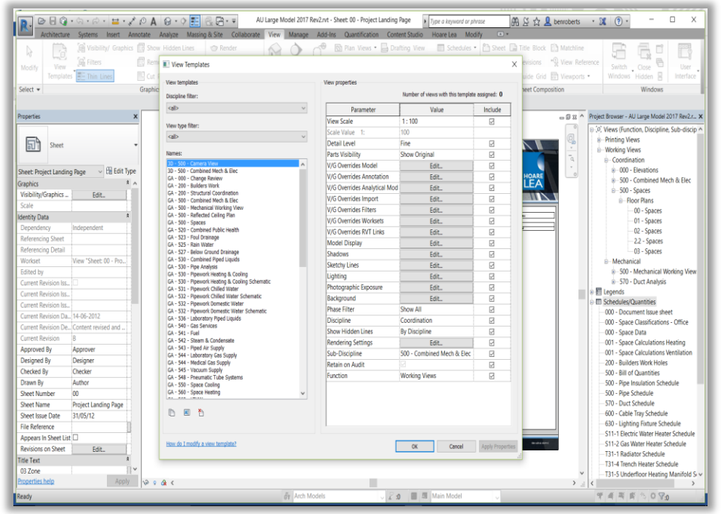


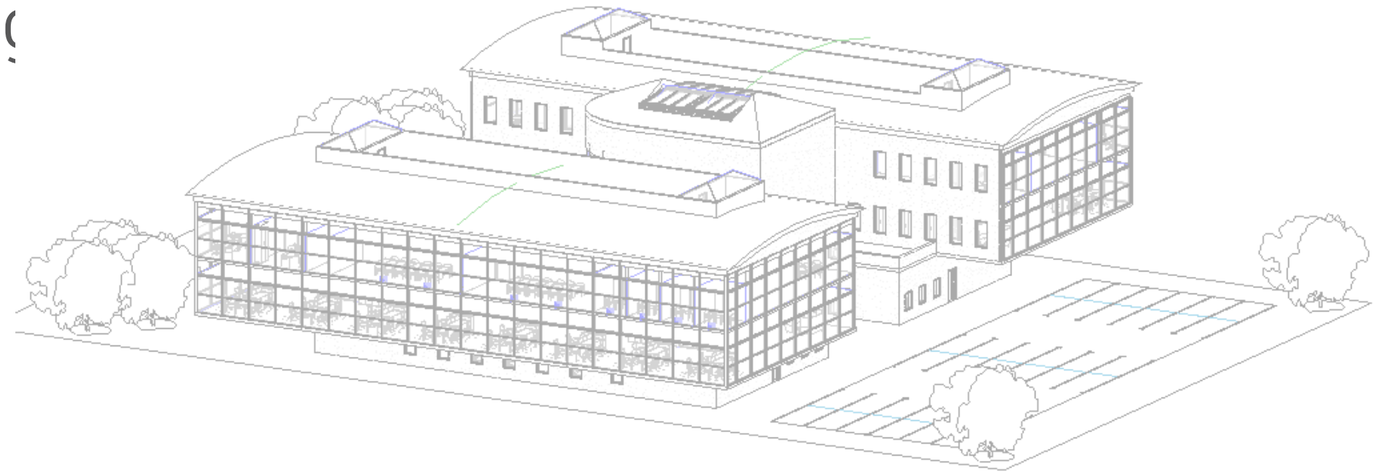
Part 1: Spaces

Heating Design Workflow – Part 1: Spaces

Preparation:

- Open new model from template
- Link in architectural model
- Acquire coordinates
- Set to room-bounding
- Align levels

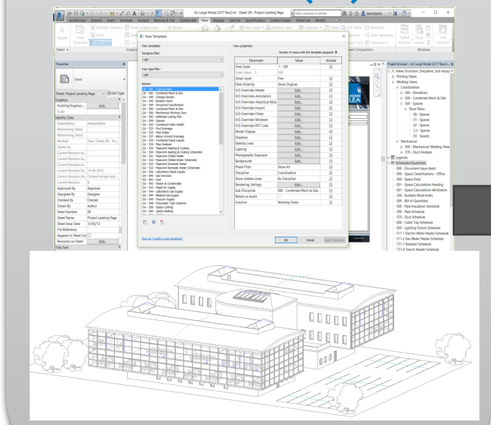




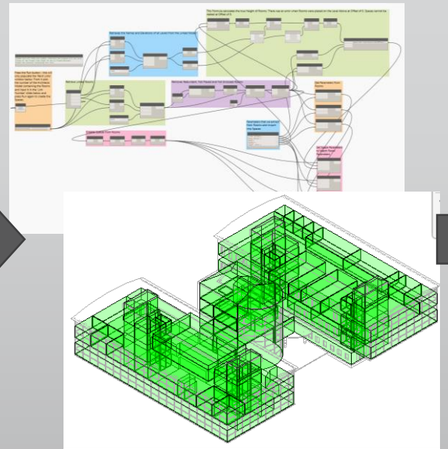
Heating Design Workflow – Part 1: Spaces

Spaces – Treatment Plans and Room Data Sheets

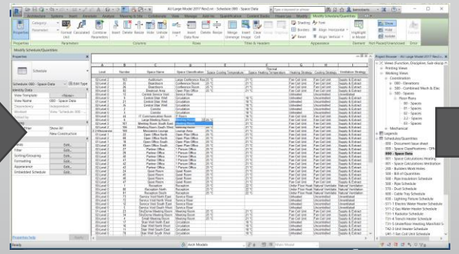
Open Template & Link in Model(s)



Add Spaces & Names

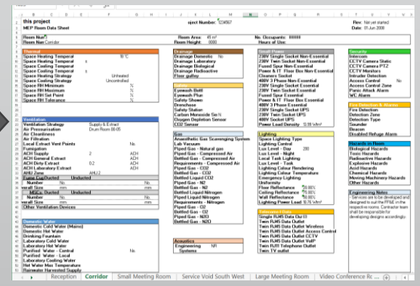


Add Space Data



Create Treatment Plans

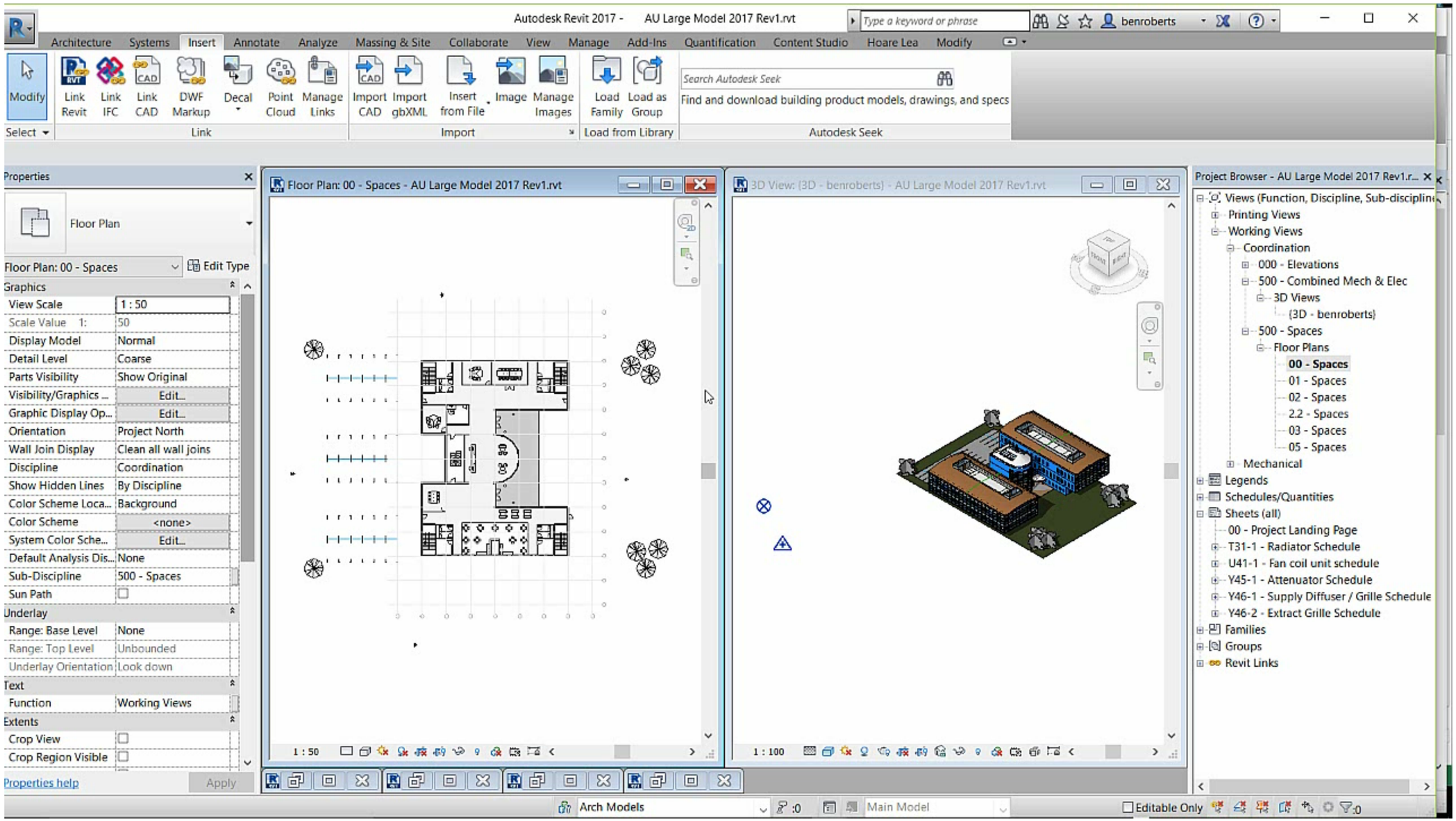
Export Room Data Sheets

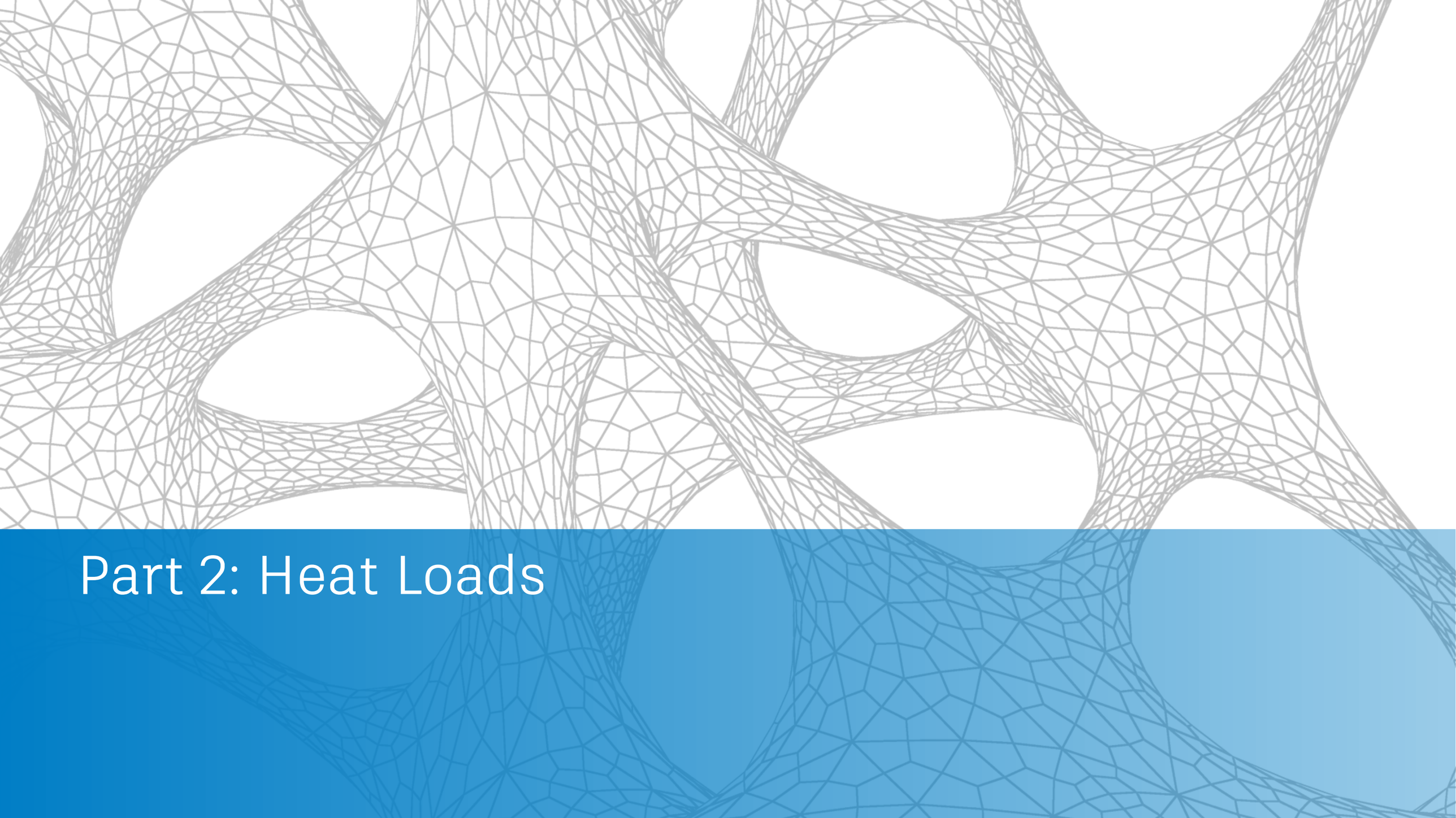


Bespoke Add-in

Dynamo

Heating Design Workflow – Part 1: Spaces



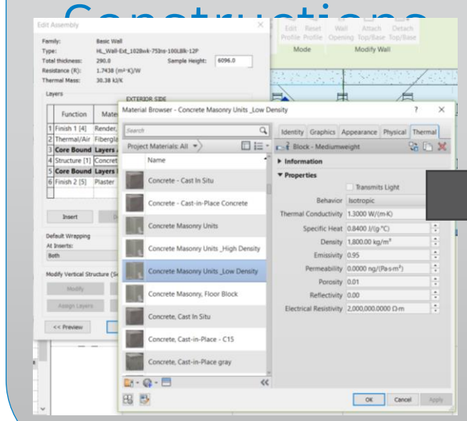


Part 2: Heat Loads

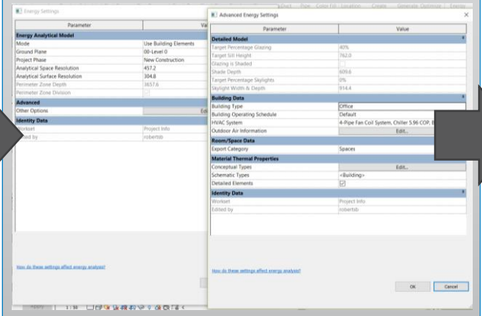
Heating Design Workflow – Part 2: Heating Loads

Heating Loads

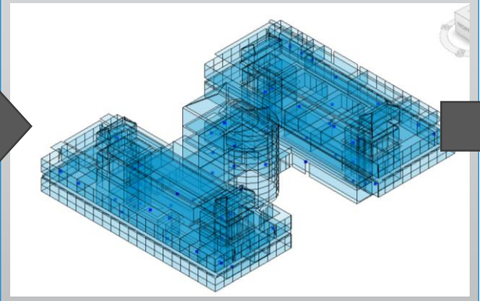
Define Thermal Properties of Constructions



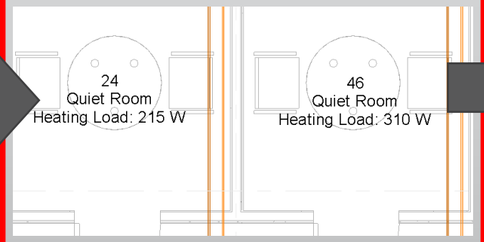
Set Energy Settings



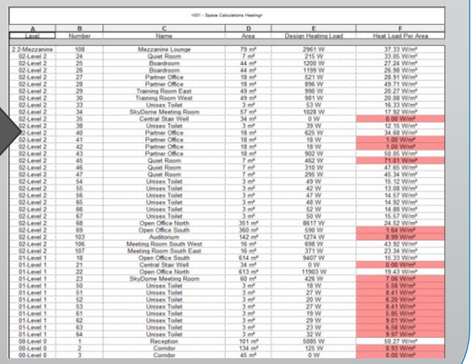
Create Analytical Model & Run Simulation



Bring results back into spaces



Create schedules to check load densities

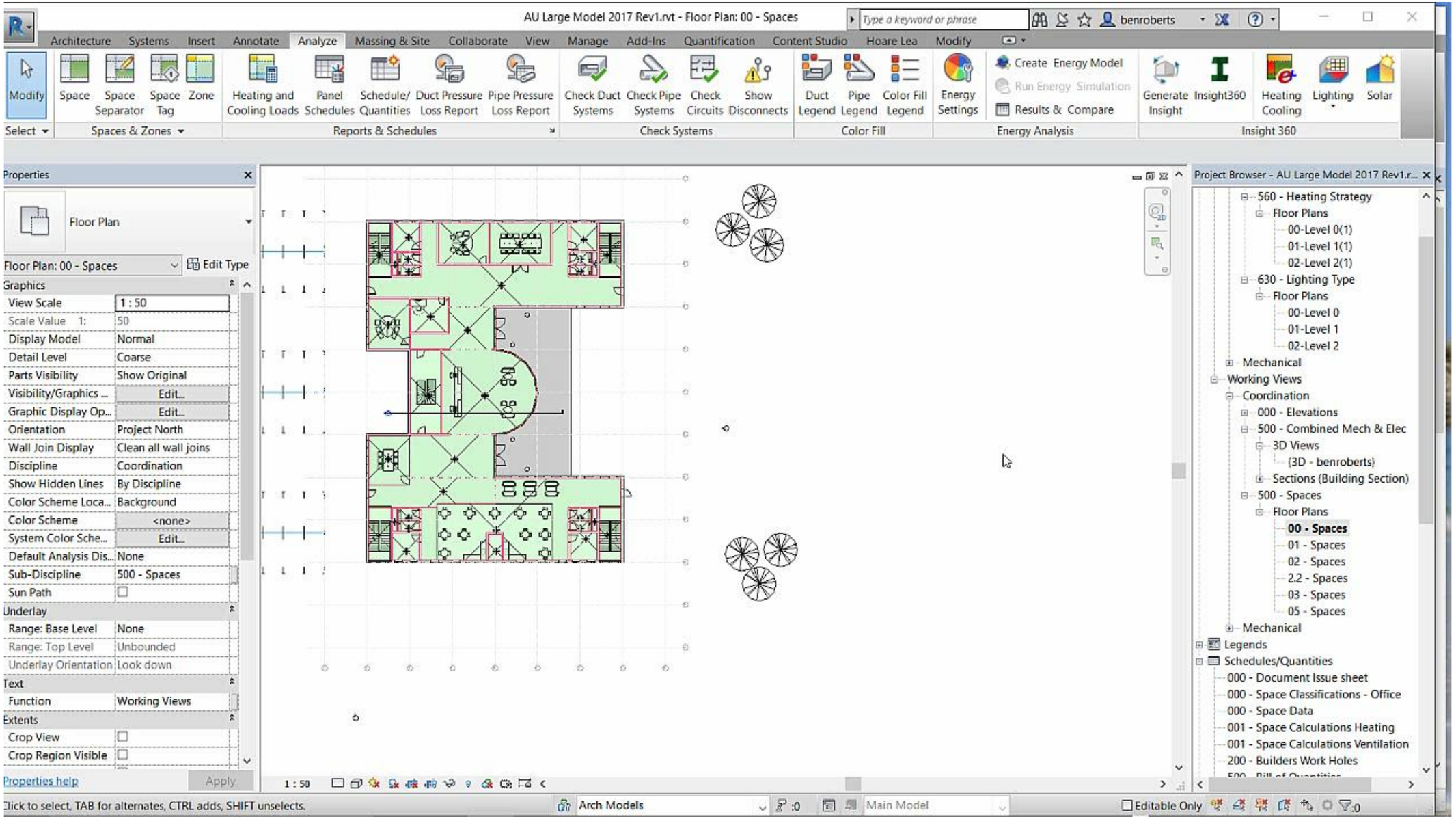


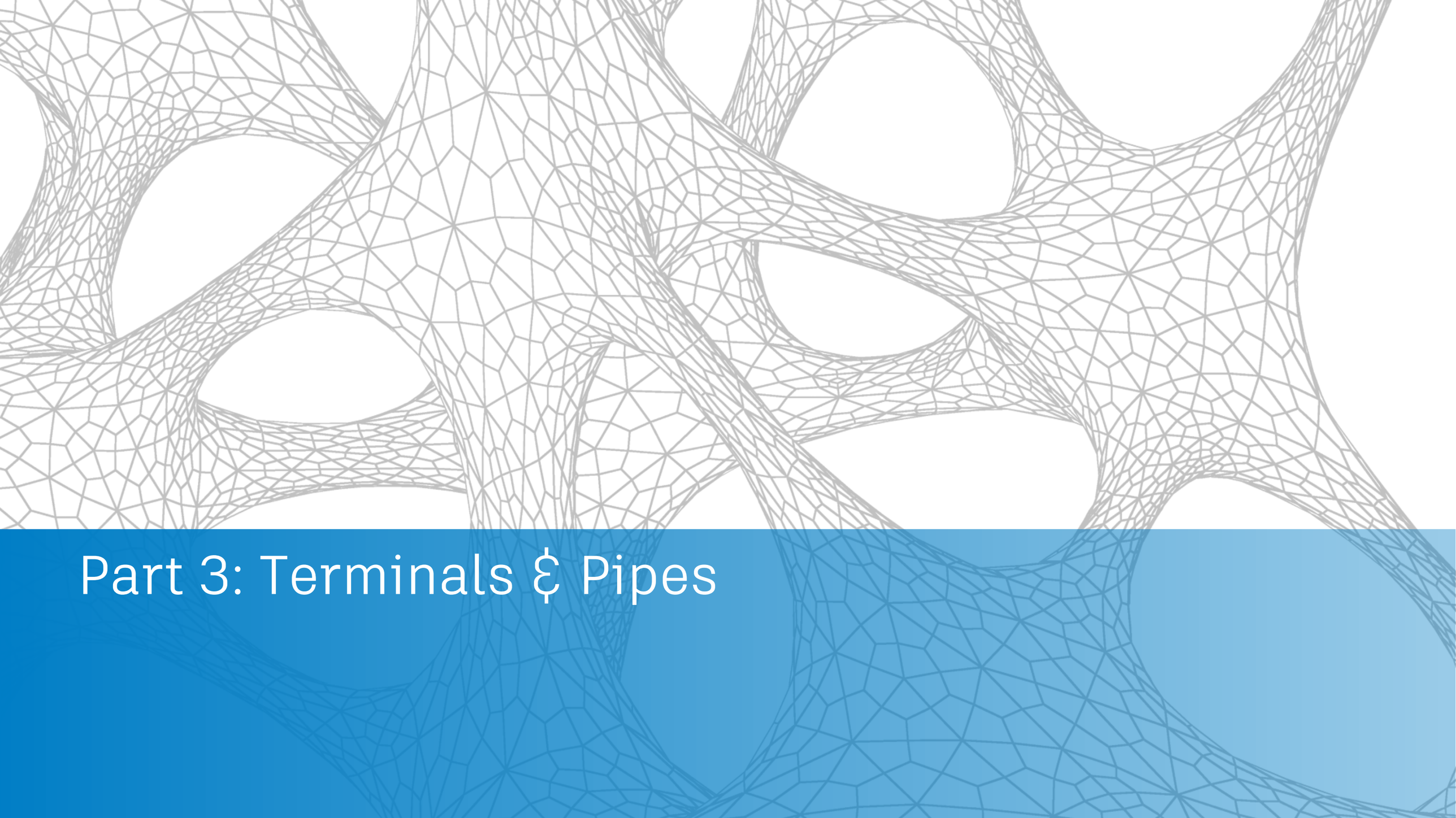
A Level	B Number	C Name	D Area	E Design Heating Load	F Heat Load Per Area
2 2-Mezzanine	108	Mezzanine Lounge	79 m²	2961 W	37.33 W/m²
02-Level 2	24	Quiet Room	7 m²	215 W	33.05 W/m²
02-Level 2	25	Boardroom	44 m²	1200 W	27.24 W/m²
02-Level 2	26	Boardroom	44 m²	1199 W	26.98 W/m²
02-Level 2	27	Partner Office	18 m²	521 W	28.91 W/m²
02-Level 2	28	Partner Office	18 m²	896 W	49.71 W/m²
02-Level 2	29	Training Room East	49 m²	995 W	20.27 W/m²
02-Level 2	30	Training Room West	49 m²	981 W	20.08 W/m²
02-Level 2	33	Unisex Toilet	3 m²	53 W	16.33 W/m²
02-Level 2	34	SkyDome Meeting Room	57 m²	1029 W	17.92 W/m²
02-Level 2	35	Central Stair Well	34 m²	0 W	0.00 W/m²
02-Level 2	38	Unisex Toilet	3 m²	39 W	12.15 W/m²
02-Level 2	40	Partner Office	18 m²	625 W	34.69 W/m²
02-Level 2	41	Partner Office	18 m²	18 W	1.00 W/m²
02-Level 2	42	Partner Office	18 m²	18 W	1.00 W/m²
02-Level 2	43	Partner Office	18 m²	902 W	50.05 W/m²
02-Level 2	45	Quiet Room	7 m²	492 W	71.81 W/m²
02-Level 2	46	Quiet Room	7 m²	310 W	47.65 W/m²
02-Level 2	47	Quiet Room	7 m²	295 W	45.34 W/m²
02-Level 2	54	Unisex Toilet	3 m²	49 W	15.12 W/m²
02-Level 2	55	Unisex Toilet	3 m²	42 W	13.98 W/m²
02-Level 2	56	Unisex Toilet	3 m²	47 W	14.57 W/m²
02-Level 2	65	Unisex Toilet	3 m²	49 W	14.92 W/m²
02-Level 2	66	Unisex Toilet	3 m²	52 W	14.88 W/m²
02-Level 2	67	Unisex Toilet	3 m²	51 W	14.57 W/m²
02-Level 2	68	Open Office North	351 m²	8617 W	24.52 W/m²
02-Level 2	69	Open Office South	560 m²	9477 W	16.91 W/m²
02-Level 2	103	Auditorium	142 m²	1374 W	9.68 W/m²
02-Level 2	106	Meeting Room South West	16 m²	694 W	43.92 W/m²
02-Level 2	107	Meeting Room South East	16 m²	371 W	23.34 W/m²
01-Level 1	18	Open Office South	614 m²	9477 W	15.43 W/m²
01-Level 1	21	Central Stair Well	34 m²	0 W	0.00 W/m²
01-Level 1	22	Open Office North	613 m²	11903 W	19.43 W/m²
01-Level 1	23	SkyDome Meeting Room	60 m²	426 W	7.06 W/m²
01-Level 1	50	Unisex Toilet	3 m²	18 W	5.66 W/m²
01-Level 1	51	Unisex Toilet	3 m²	27 W	8.41 W/m²
01-Level 1	52	Unisex Toilet	3 m²	20 W	6.20 W/m²
01-Level 1	53	Unisex Toilet	3 m²	27 W	8.41 W/m²
01-Level 1	61	Unisex Toilet	3 m²	19 W	5.85 W/m²
01-Level 1	62	Unisex Toilet	3 m²	29 W	9.01 W/m²
01-Level 1	63	Unisex Toilet	3 m²	21 W	6.58 W/m²
01-Level 1	64	Unisex Toilet	3 m²	32 W	9.97 W/m²
00-Level 0	1	Reception	101 m²	5085 W	50.27 W/m²
00-Level 0	2	Corridor	134 m²	125 W	0.93 W/m²
00-Level 0	3	Corridor	45 m²	0 W	0.00 W/m²

Bespoke Add-in

Dynamo

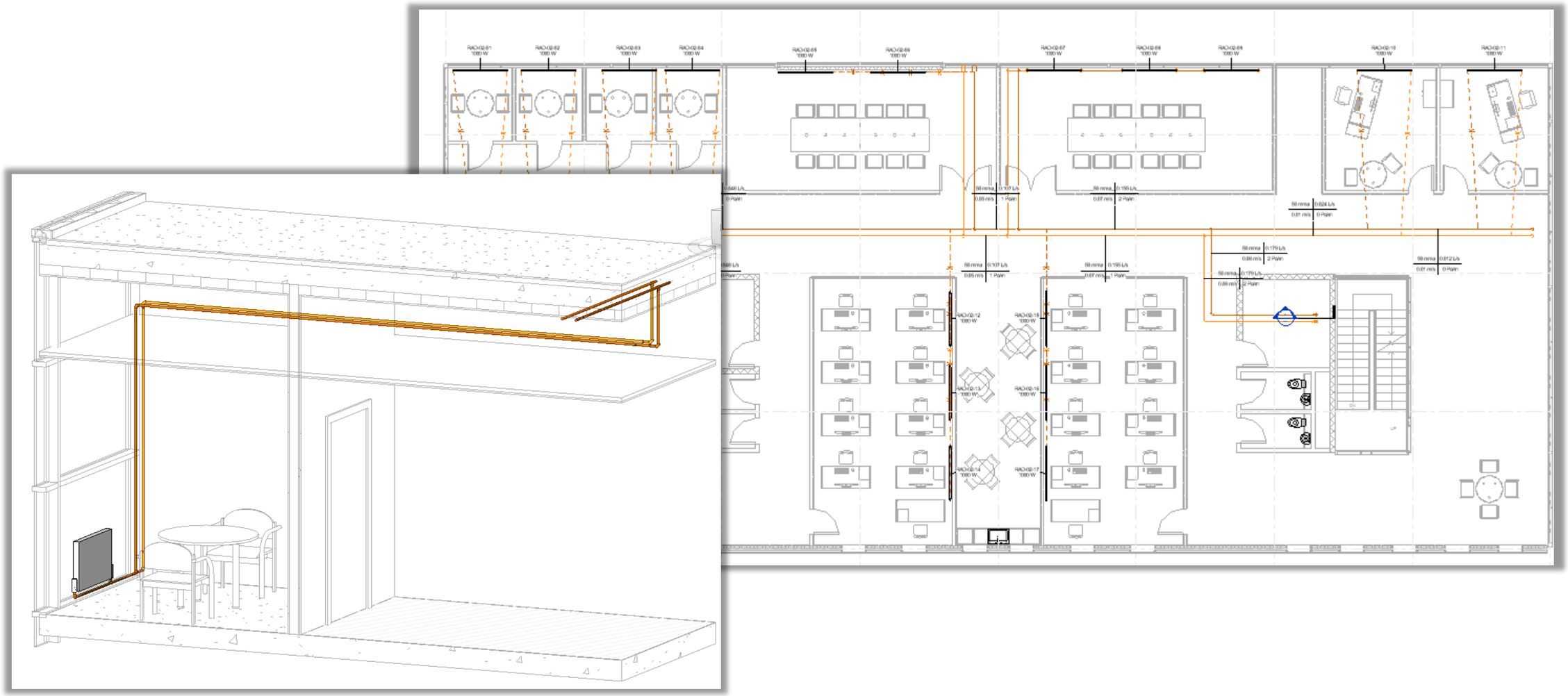
Heating Design Workflow – Part 2: Heating Loads





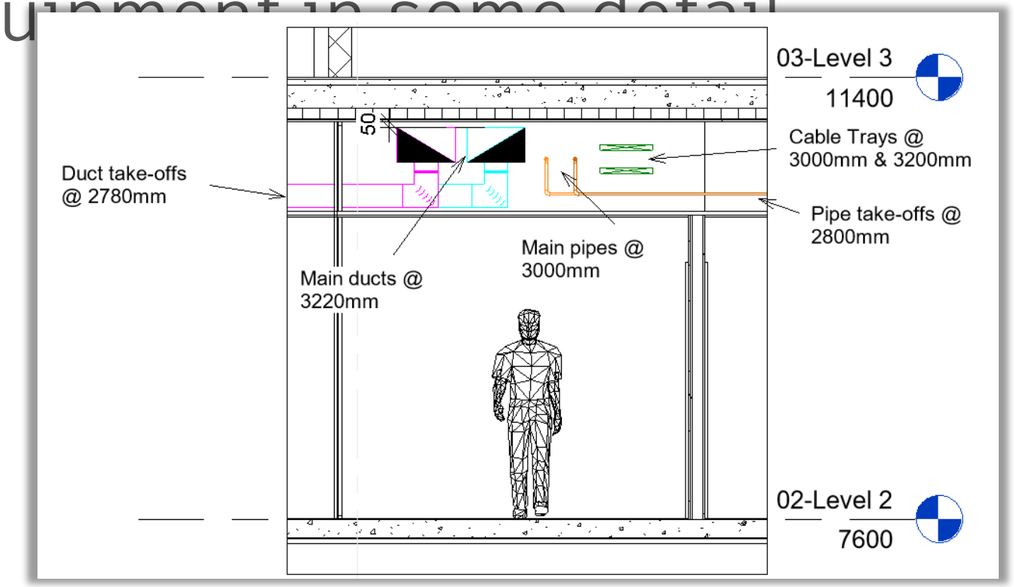
Part 3: Terminals & Pipes

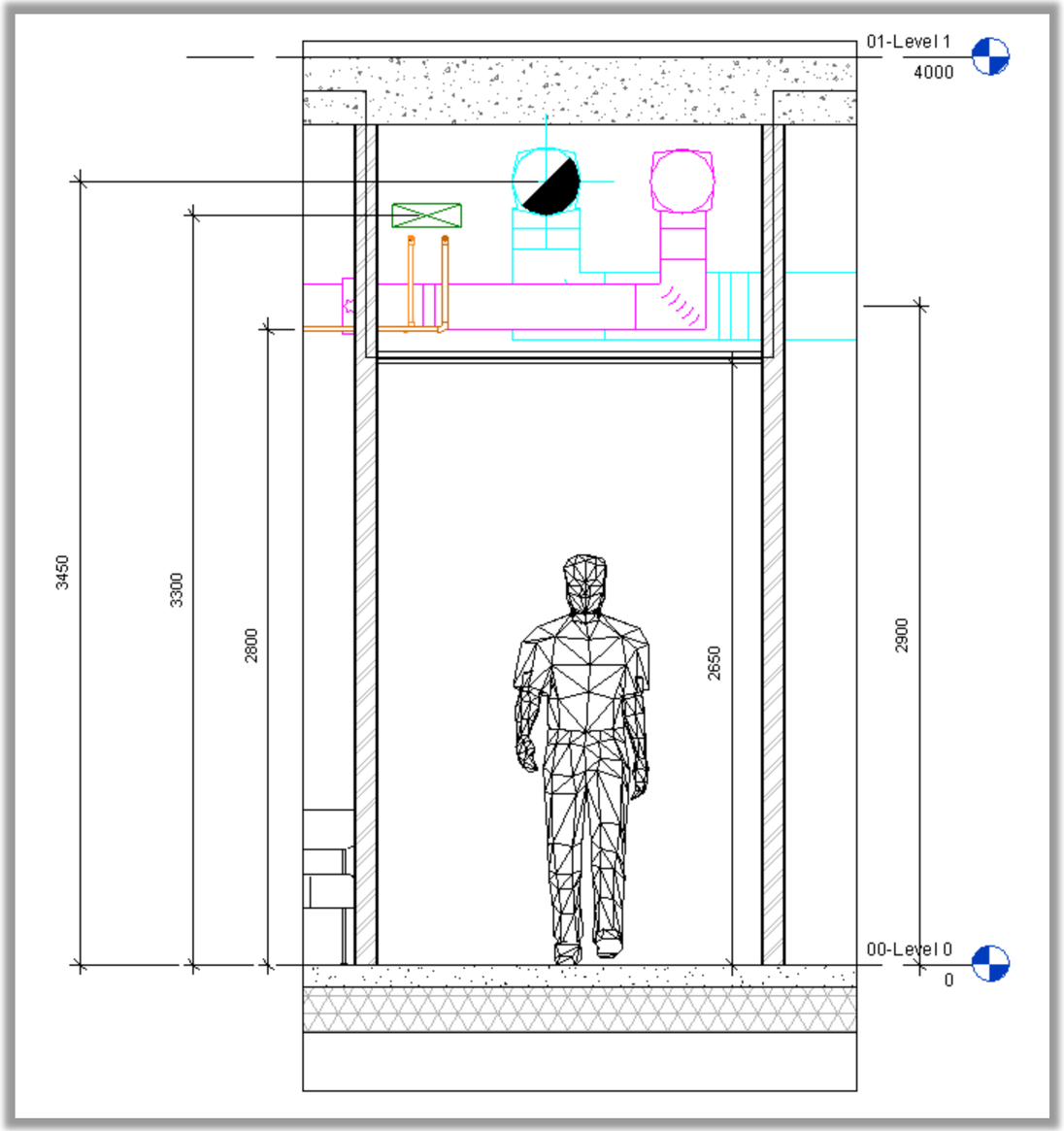
Heating Design Workflow – Part 3: Terminals & Pipes



Heating Design Workflow – Part 3: Terminals & Pipes

- Plan coordination in advance
- Note offset heights for each service
- Do typical connections to equipment in some detail



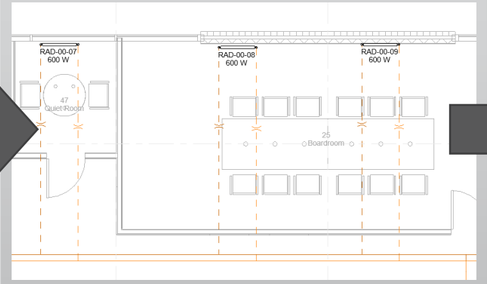


Heating Design Workflow – Part 3: Terminals & Pipes

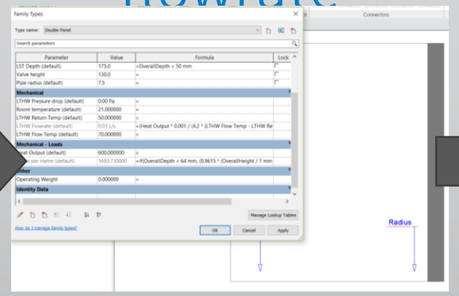
Terminals & Pipes

Add terminals (& references) and main Pipes

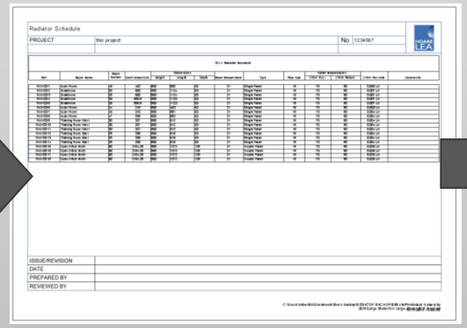
Connect to primary pipes – use analytical pipe



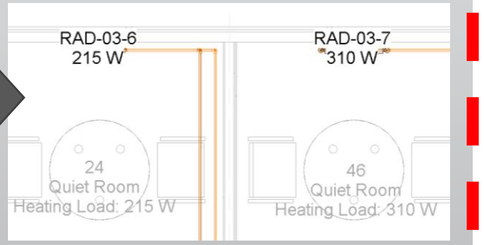
Add formulae to Family for size and flowrate



Create equipment schedules



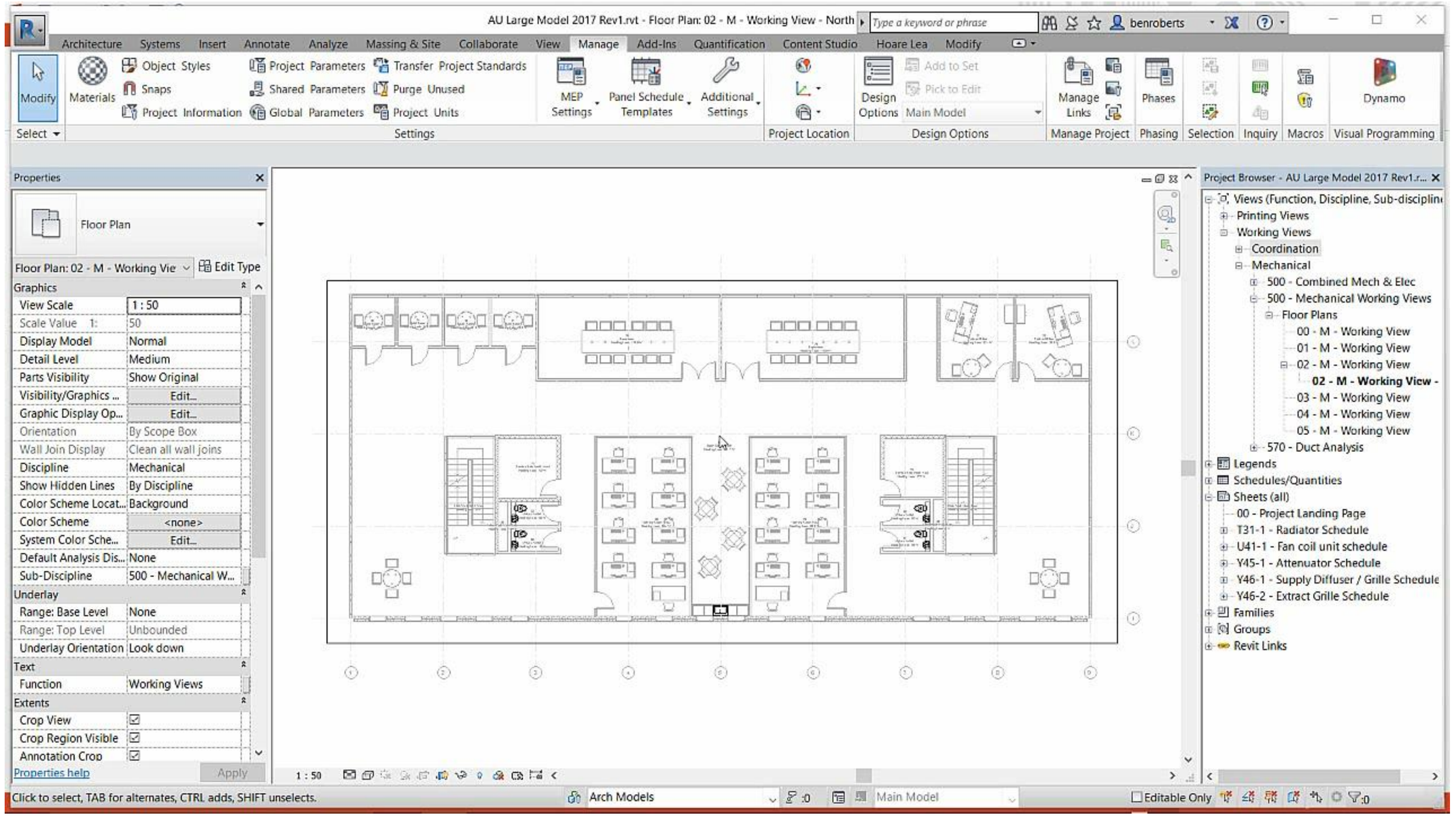
Push Space Loads into Family Instances

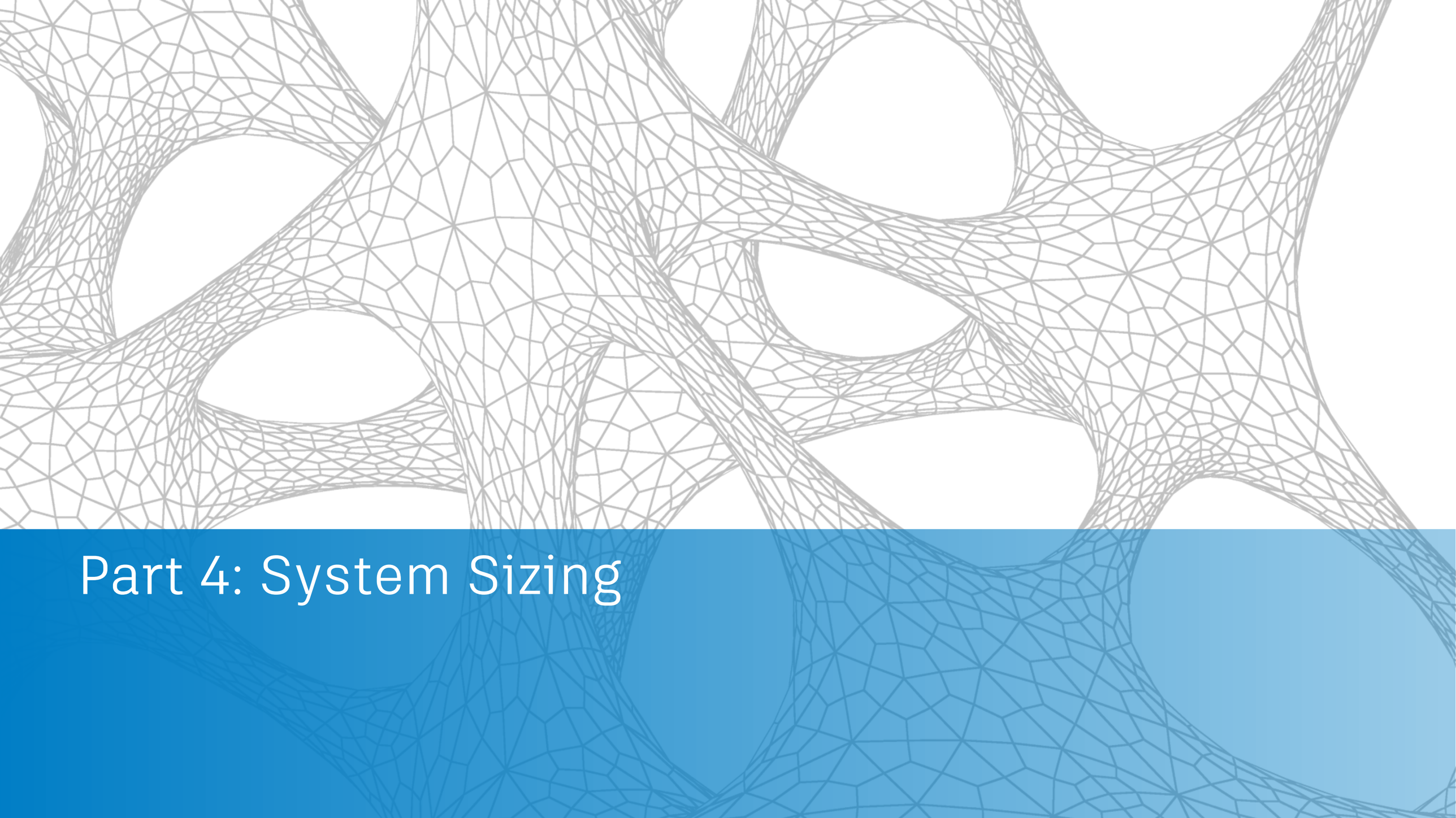


Bespoke Add-in

Dynamo

Heating Design Workflow – Part 3: Terminals & Pipes



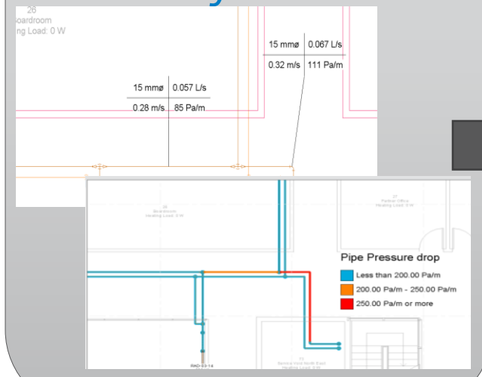


Part 4: System Sizing

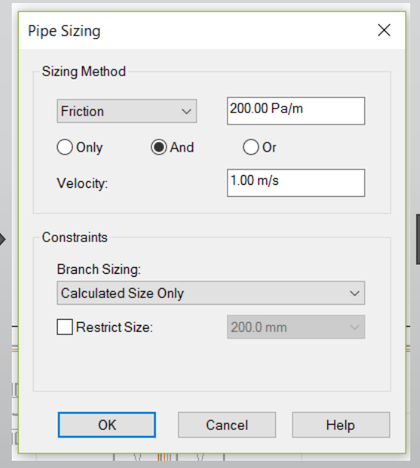
Heating Design Workflow – Part 4: System Sizing

System Sizing

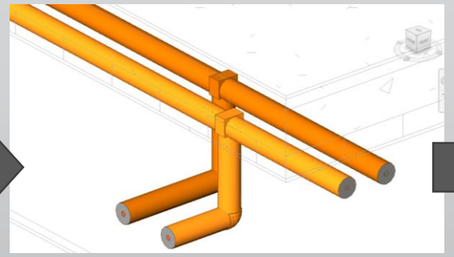
Create Schematic & Coloured Layouts



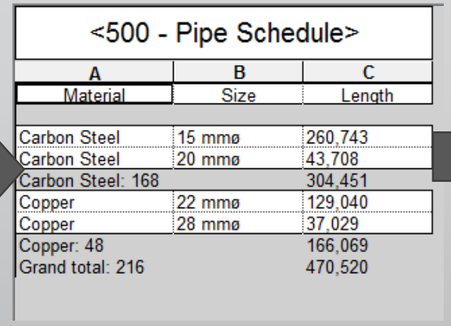
Size pipes



Add Insulation



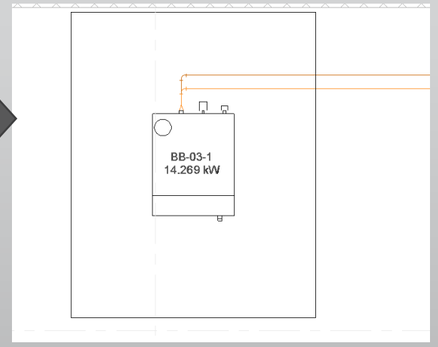
Create Bill of Quantities for Pipes



<500 - Pipe Schedule>

A	B	C
Material	Size	Length
Carbon Steel	15 mmø	260,743
Carbon Steel	20 mmø	43,708
Carbon Steel: 168		304,451
Copper	22 mmø	129,040
Copper	28 mmø	37,029
Copper: 48		166,069
Grand total: 216		470,520

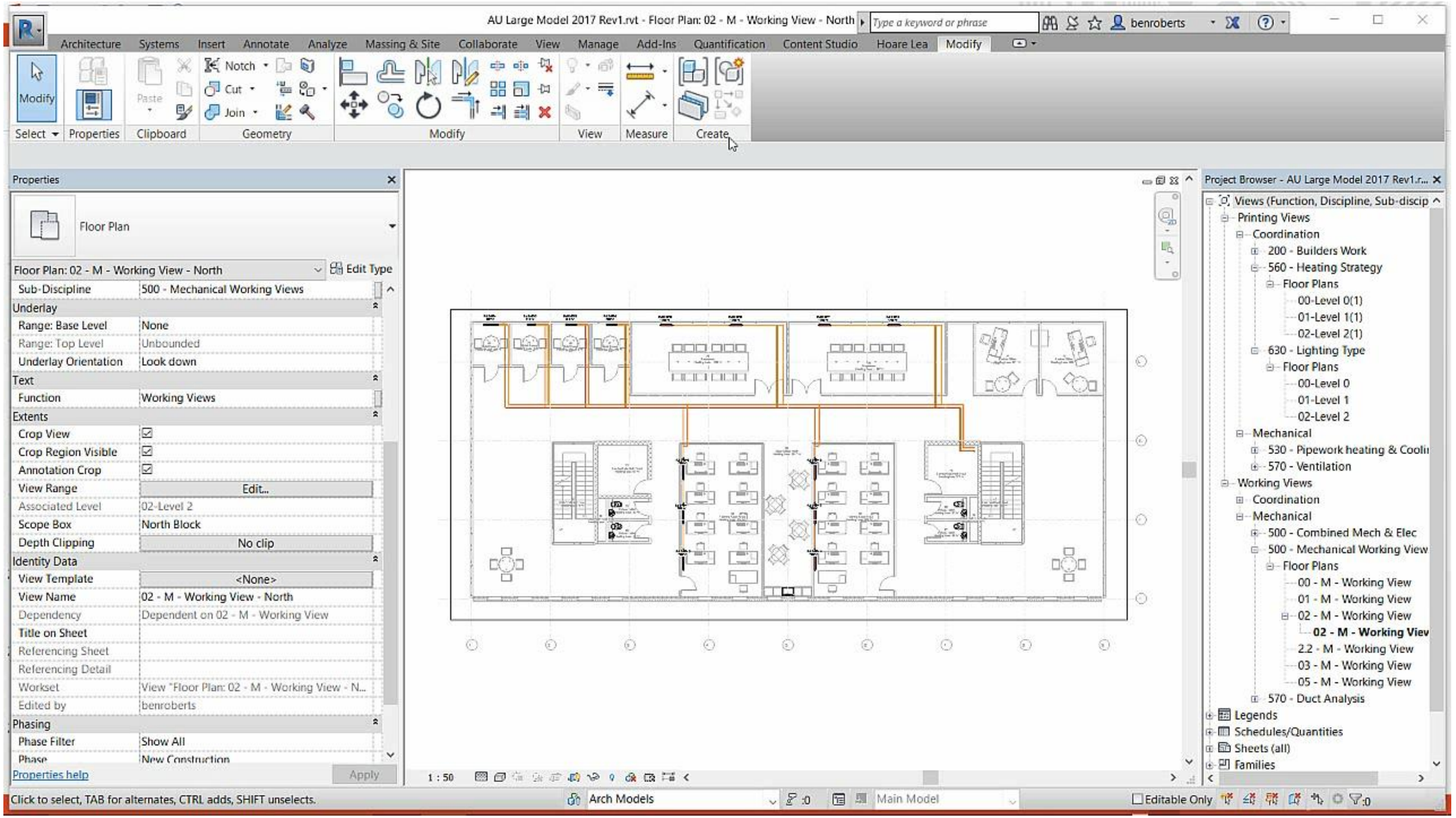
Specify Boiler Duty From Revit System



Bespoke Add-in

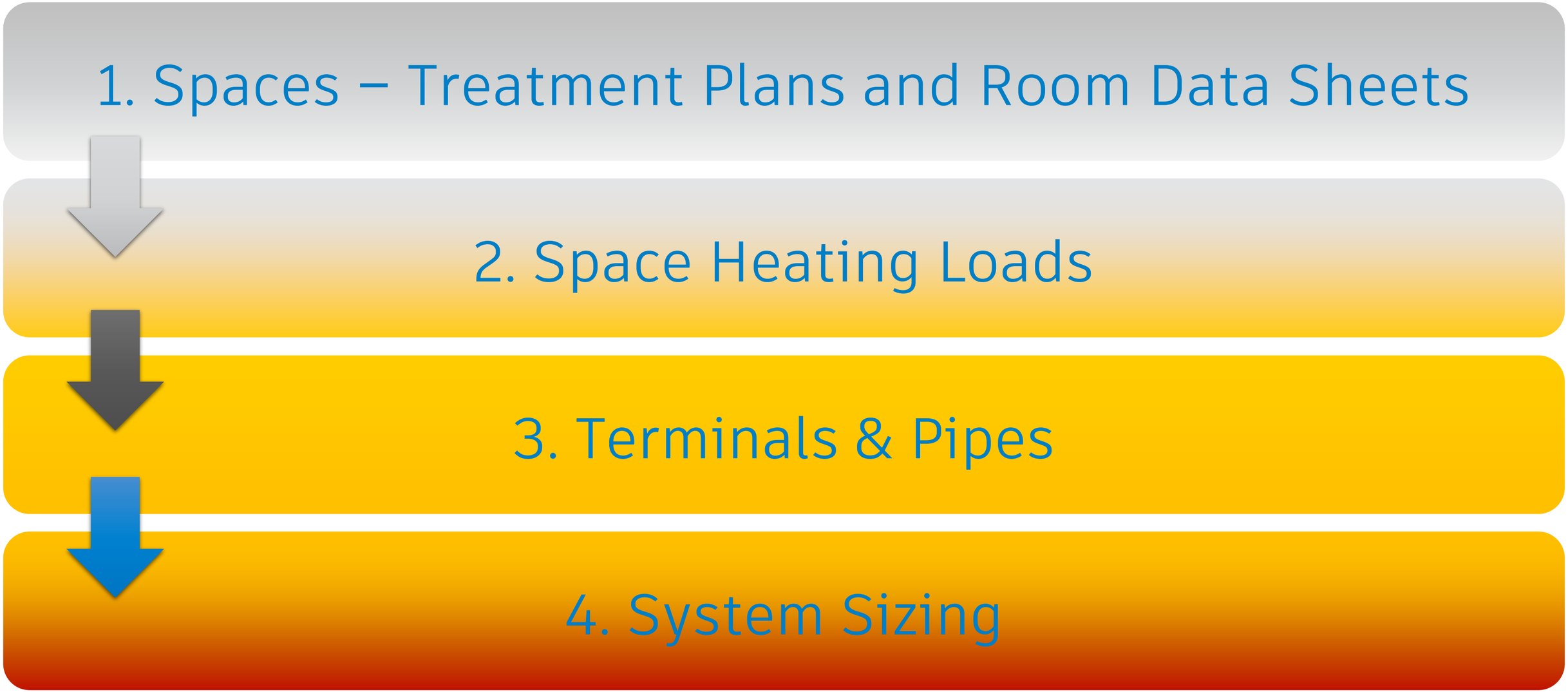
Dynamo

Heating Design Workflow – Part 4: System Sizing



Summary

Heating Design Workflow - Summary

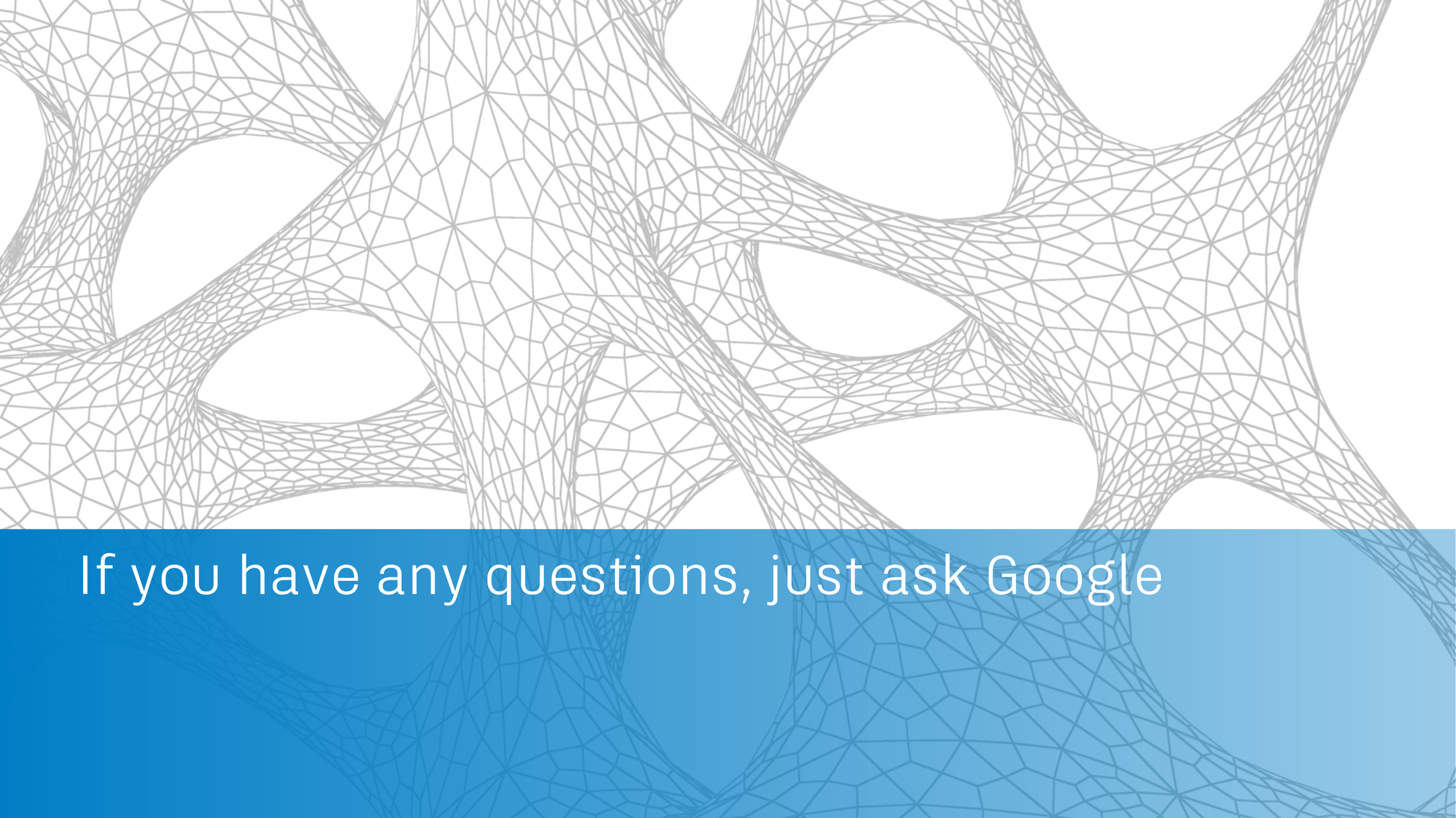


How Can We Optimise This Further?

- “New Model” interface: link in models, load families, apply standards, set up sheets, etc.
- “Generate spaces from rooms” feature inbuilt into Revit
- Use space classification (e.g. Uniclass / Omniclass) in rooms to automatically recognise space type
- Revit should include a “view & sheet manager” as standard. Or just don’t issue sheets…!?
- Automatically add equipment based on space data
- Improve auto-routing options
- Link space data into equipment in Revit
- Link system data into equipment in Revit
- Assign equipment to pipes without having to do final connections

Beta Testing Hydronic Piping with Autodesk

- Parallel pumps vs pumps in series
- Splitting systems into primary and secondary circuits
- Passing information between systems, spaces and elements
- Feedback on what is being developed for the next release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Make anything.

SPARE SLIDES

Main title can extend over one or two lines

Title and content slide (1 column)

- First-level bullet style text is set in black, single spaced, Artifakt ElementOfc 36pt font.
  - Second-level bullet style text is set in black, single spaced, Artifakt ElementOfc 36pt font.
    - Third-level bullet style text is set in black, single spaced, Artifakt ElementOfc 36pt font.
      - Fourth-level bullet style text is set in black, single spaced, Artifakt ElementOfc 36pt font.

Title and content slide (2 column)

- First column text is set in black, single spaced, Artifakt ElementOfc 36pt font.

- Second column bullet style text is set in black, single spaced, Artifakt ElementOfc 36pt font.
- Duis aute irure dolor in reprerit in voluptate velit esse cillum dolore eu fugiat nulla pariatur.
- Excepteur sint occaecat cupid nonproident, sunt in culpa qui officia deserunt mollit anim id est laborum.

Title and content slide (2 column)

- First column text is set in black, single spaced, Artifakt ElementOfc 36pt font.
- Or second column displays a photo, graphic, chart, or video
- Always be sure to include an image credit when applicable. The DAM is the source for this information.

Pier 9

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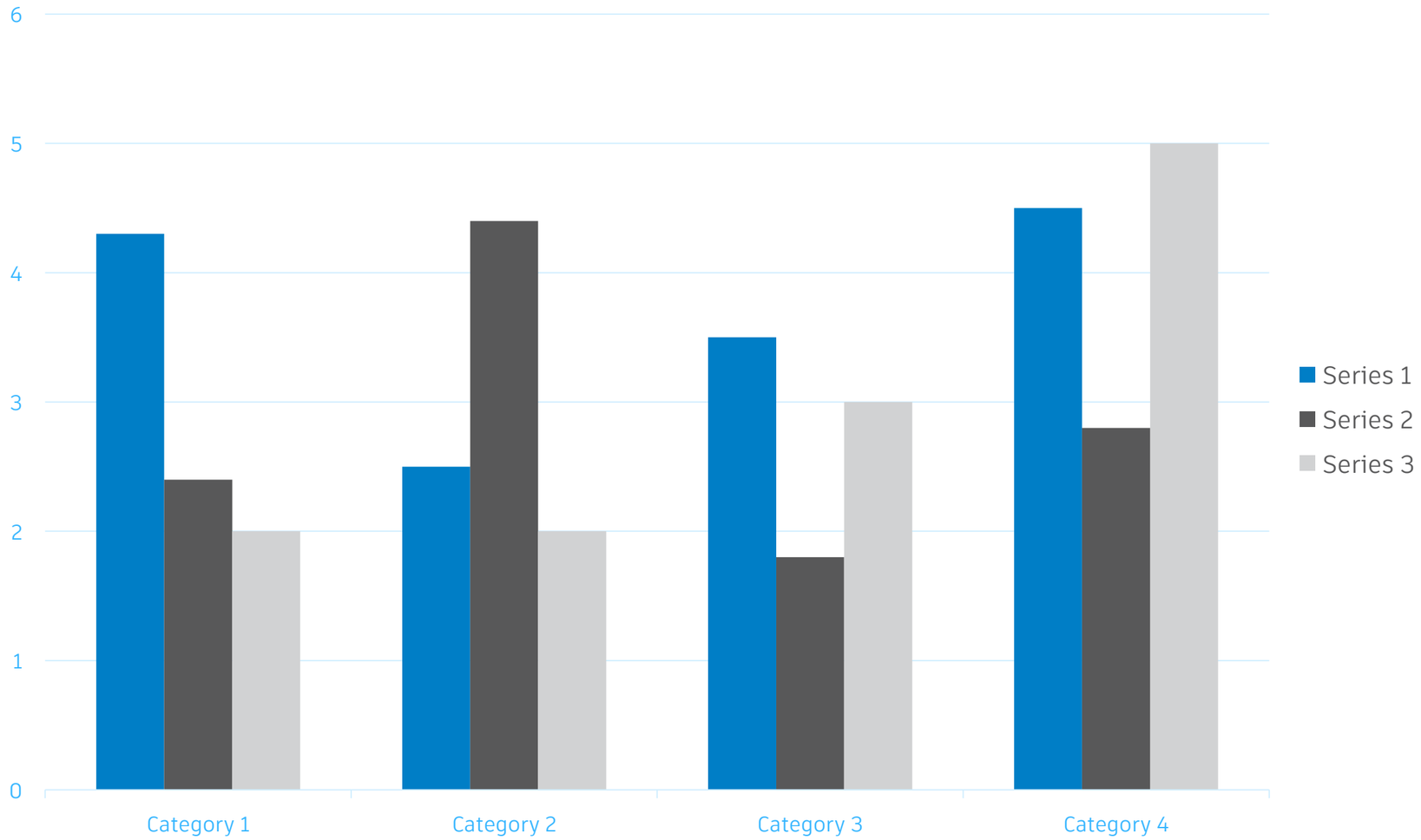
Bar charts



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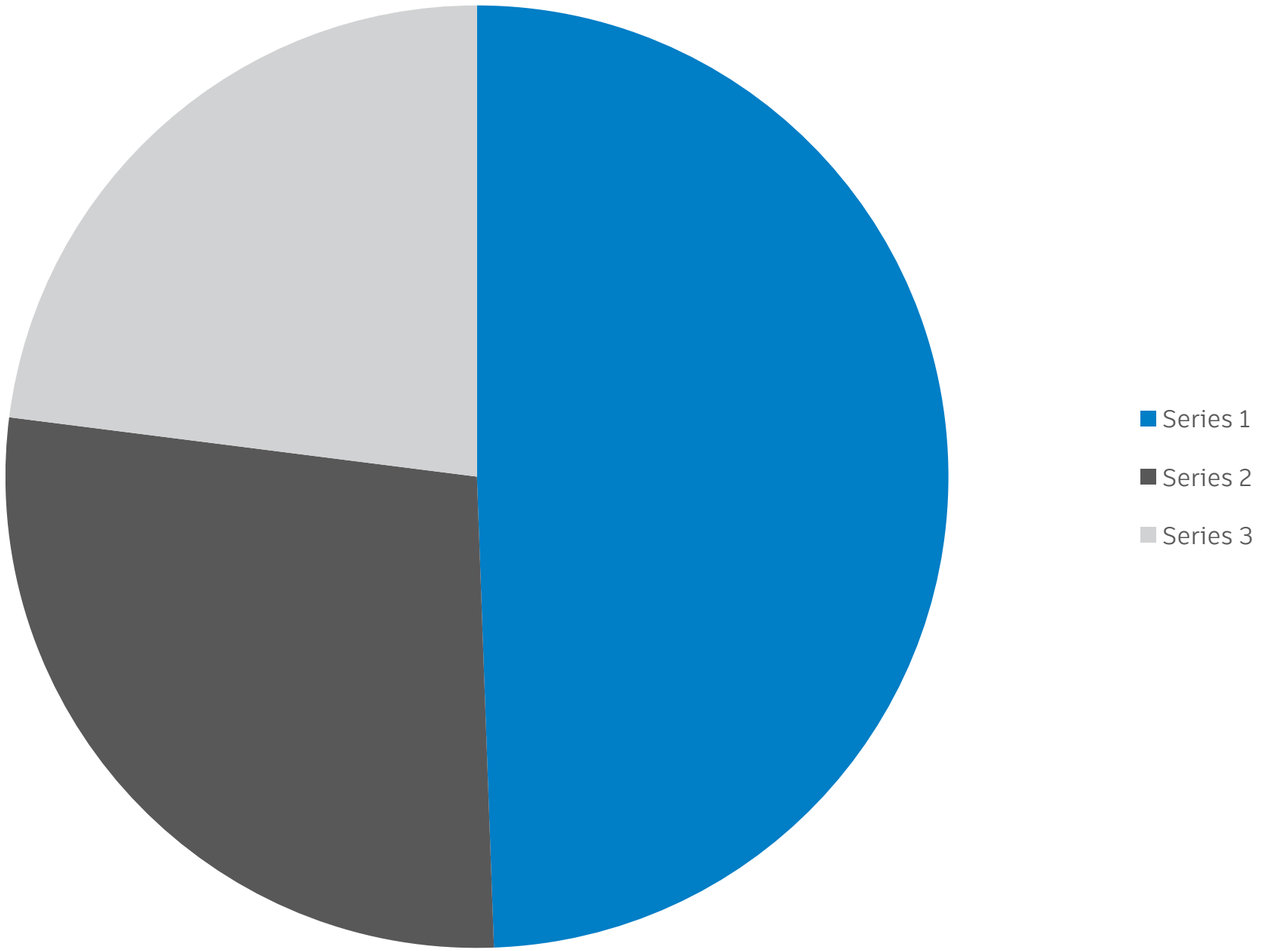
Not liking the chart? Change it up in the Chart Design Type tab, click Reset if modules do not look correct.

Pie charts



Charts and graphs are now a functioning part of the Autodesk University template.
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AU colors and slide layout

- The following colors unite and enrich the AU 2017 experience.

blue

R 0 G 126 B 198

black

R 0 G 0 B 0

white

R 255 G 255 B 255

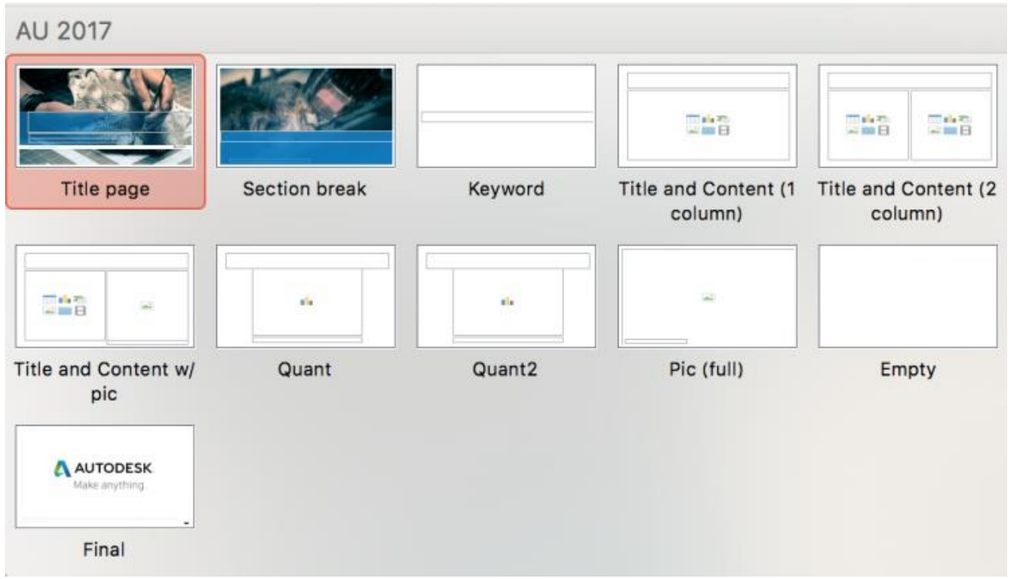
dark gray

R 88 G 88 B 90

light gray

R 209 G 210 B 212

- Access the slide layouts for this template on the Home tab under Slides/Layout.



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- DAM

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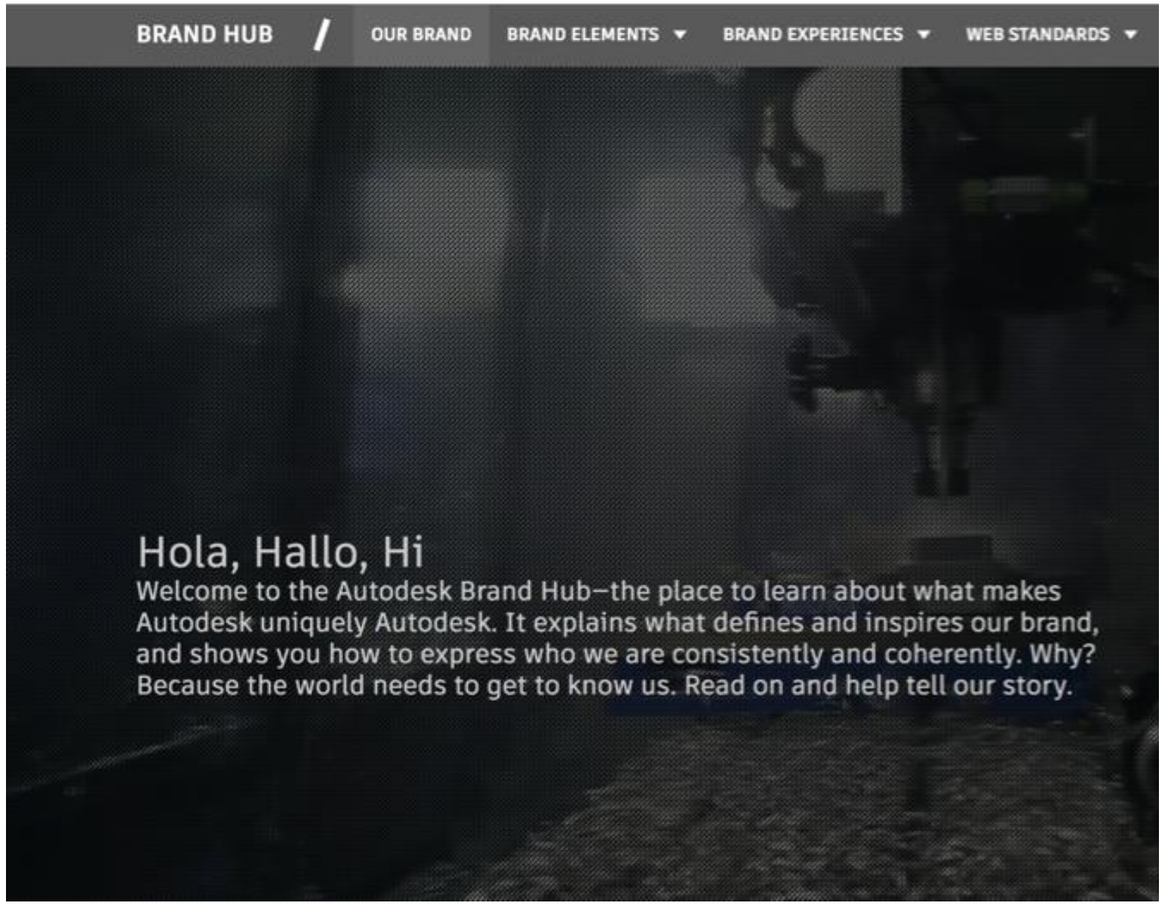
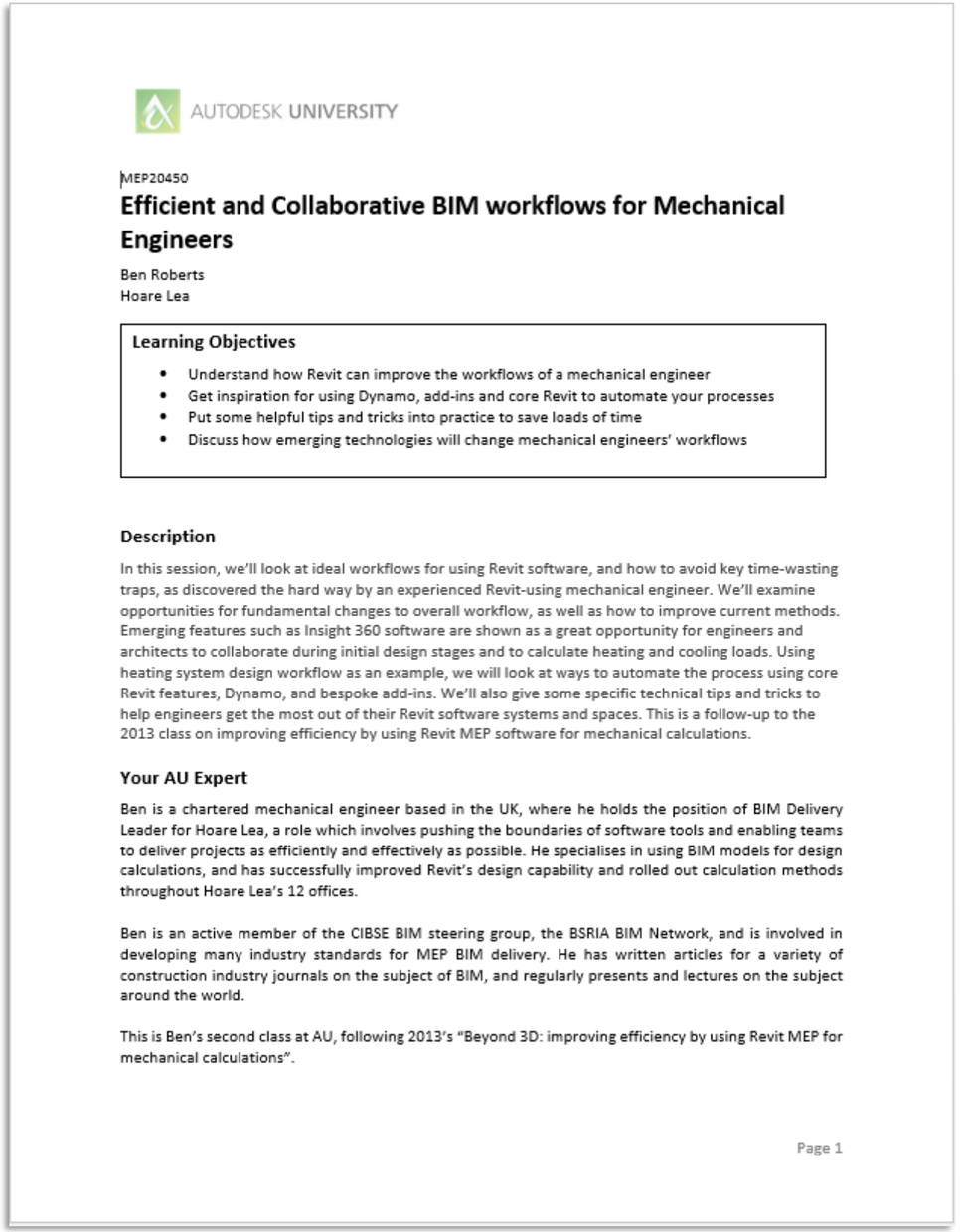


Class Handout

- Full walk-throughs
- Screenshots of everything
- Available now at AU online



AUTODESK UNIVERSITY

MEP20450

Efficient and Collaborative BIM workflows for Mechanical Engineers

Ben Roberts
Hoare Lea

Learning Objectives

- Understand how Revit can improve the workflows of a mechanical engineer
- Get inspiration for using Dynamo, add-ins and core Revit to automate your processes
- Put some helpful tips and tricks into practice to save loads of time
- Discuss how emerging technologies will change mechanical engineers' workflows

Description

In this session, we'll look at ideal workflows for using Revit software, and how to avoid key time-wasting traps, as discovered the hard way by an experienced Revit-using mechanical engineer. We'll examine opportunities for fundamental changes to overall workflow, as well as how to improve current methods. Emerging features such as Insight 360 software are shown as a great opportunity for engineers and architects to collaborate during initial design stages and to calculate heating and cooling loads. Using heating system design workflow as an example, we will look at ways to automate the process using core Revit features, Dynamo, and bespoke add-ins. We'll also give some specific technical tips and tricks to help engineers get the most out of their Revit software systems and spaces. This is a follow-up to the 2013 class on improving efficiency by using Revit MEP software for mechanical calculations.

Your AU Expert

Ben is a chartered mechanical engineer based in the UK, where he holds the position of BIM Delivery Leader for Hoare Lea, a role which involves pushing the boundaries of software tools and enabling teams to deliver projects as efficiently and effectively as possible. He specialises in using BIM models for design calculations, and has successfully improved Revit's design capability and rolled out calculation methods throughout Hoare Lea's 12 offices.

Ben is an active member of the CIBSE BIM steering group, the BSRIA BIM Network, and is involved in developing many industry standards for MEP BIM delivery. He has written articles for a variety of construction industry journals on the subject of BIM, and regularly presents and lectures on the subject around the world.

This is Ben's second class at AU, following 2013's "Beyond 3D: improving efficiency by using Revit MEP for mechanical calculations".

Me (Ben Roberts)

- 2007 – 2009: Mechanical Engineer
- 2009 – 2012: Senior mechanical engineer & BIM Champion
- 2012 – 2017: BIM Delivery Leader