MEP SMART: EARLY HVAC DESIGN USING DYNAMO

Alejandro Mata
MSc. Design Engineer | HVAC & Hydraulics
alma@moe.dk, https://dk.linkedin.com/in/alejandro-mata-5b639343
Learn how to increase early HVAC design performance with Autodesk Revit by creating a dynamic and smart MEP model in early design phases and utilizing it across all different project phases for design calculation.
Key learning objectives

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

- Learn how to convert 2D lines to HVAC BIM objects.
- Learn how to perform early HVAC calculation by using “Dummy” equipment families combined with Dynamo.
- Learn how to use new HVAC custom nodes for Dynamo (when model is not finished).
- Learn more about integrated HVAC design.
A little about MOE – A leading Danish consulting engineer company
Why early energy analysis and integrated design is so important?
Holistic design
Proactive decision support during early design

https://buildingdesign.moe.dk/
From HVAC design perspective
Challenges of creating a dynamic smart HVAC model from project kick off

- Using BIM from day 1 as HVAC design tool
- Not integration between design data and BIM model

- HVAC Design Data
- Integration of
- HVAC BIM Model
Source of challenges in early HVAC design

- Design and creativity constraints of Autodesk Revit in comparison with hand sketching.

- HVAC model can’t be used for calculations until model is finished.
No limits for our lovely and smart Dynamo 😊
Are you ready for some Dynamo action?
SCRIPT 1. FROM HAND SKETCH TO BIM
Script 1. Workflow

Traditional

Hand sketch → CAD → Revit

BIMtopia

RVT placeholder → RVT families

AU2016

Hand sketch → RVT families
Script 1. Workflow software and format detailing

- Adobe Illustrator (Ai)
- AutoCAD DWG
- Autodesk Revit (RVT)
- Dynamo
Script 1. Dynamo Script Structure

1. Origin and end points from lines and policurves from CAD link

2. Selection of pipe type

3. Selection of piping system

4. Creation of pipes within Revit

5. Assignment of diameter
Script 1. Dynamo Script - Description

- Imput 1 - Origin and end points from lines and policurves from CAD link
Script 1. Dynamo Script - Description

- Input 2 – Selection of pipe type
Script 1. Dynamo Script - Description

- Imput 1 – Selection of pipe system and reference level
Script 1. Dynamo Script - Description

- Pipes generation into Revit (dynamoBIM.org) and assignment of pipe diameter
Script 3. Valoration

✓ Enables the user to convert sketch drawings automatically into Autodesk Revit

✗ It doesn’t generate pipes fittings in connection nodes. But with a little bit of coding can be achieved.
SCRIPT 2. “DUMMY” connection nodes to MEP Spaces design information regarding Heating Design
Script 2. Workflow

Conventional

Placement of radiators + modelling of radiators pipes to main supply pipe
Piping design
Design coordination
Delivery

AU2016

Radiators + Dummies
Design Coordination
Modelling of pipes
Design Coordination
Delivery
Script 2. Aim

- Enables HVAC engineer to perform heating piping design calculation earlier in the design process without modelling radiator pipes or floor heating.

- Dynamically integrated with heat loss MEP Spaces design information.
Script 2. Dummy introduction
Script 2. Dummy insertion showcase
Script 2. Dynamo Script Structure

1. Bounding Box from MEP spaces, dummy families and radiators

2. Sorting out radiators and dummy families by spaces

3. Assign radiator data to dummy
Script 2. Dynamo Script - Description

- 1. Retrieves bounding box from MEP spaces, dummy families and radiators
2.1. Sort out dummy families by MEP spaces
Script 2. Dynamo Script - Description

- 2.2. Sort out radiators by MEP spaces
Assignment of radiators design data to dummy families
Script 2. Dynamo Script - Valoration

- Enables the user to get design radiator data into the dummy family without modelling pipe radiator

- Automation of dimensioning of pipes as long as the heat capacity of the radiators is estimated

- Insertion of dummy families and radiator dimensioning need to be also automated
SCRIPT 3. HVAC calculations with BIM model unfinished
Script 3. Workflow

Conventional

Finished HVAC model → Optimization of HVAC design → Design coordination → Delivery

AU2016

HVAC modelling + Optimization → Design Coordination → HVAC modelling + Optimization → Design Coordination → Delivery
Script 3. Aim

- Enables HVAC engineer to perform design calculations such as pressure drop and velocity earlier in the design process.

- Connects open connections of duct and pipes virtually via Revit API -> ConnectTo Method
Script 3. Aim
Script 3. Dynamo Script Structure

1. Selection of ducts

2. Access to connections

3. Retrieves open connectors

2. Hook up connectors virtually
Script 3. Dynamo Script - Description

- Selection of ducts and access to connectors
Script 3. Dynamo Script - Description

- Retrieves open connectors
Script 3. Dynamo Script - Description

- Hook up open connectors virtually
Script 3. Example showcase
Alma Package Nodes
Script 3. Valoration

- Enables the user to connect open connections virtually without having a completed HVAC model
- Total pressure drop and velocity of the HVAC system can be roughly estimated in early phases
- In order to disconnect connectors “virtually” hooked up must be removed.
Project case – Rødovre Centrum, Denmark

- Decrease of total pressure drop of ventilation system in 55% by utilizing HVAC model in early phases.
Outline - Early HVAC design workflow

- Conventional BIM
- Integrated BIM
Questions

- Thanks a lot for your time
Your class feedback is critical. Fill out a class survey now.

Use the AU mobile app or fill out a class survey online.

Give feedback after each session.

AU speakers will get feedback in real-time.

Your feedback results in better classes and a better AU experience.