Shaping Tomorrow: Exploring the Advancements and Persistent Effects of Industrial Equipment Modeling

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Agenda

What is a problem?

What is process in engineering?

Mathematical modeling of processes

Complex example: rotary equipment

Software approach

Why is it important?

Problem in a nutshell

Industrial companies want to

- Plan better

- Understand their technologies

- To be digital

Industrial companies missing software tools!

Evgenii Lykov, 15/02/2024, https://www.conf42.com/ce2024

Process

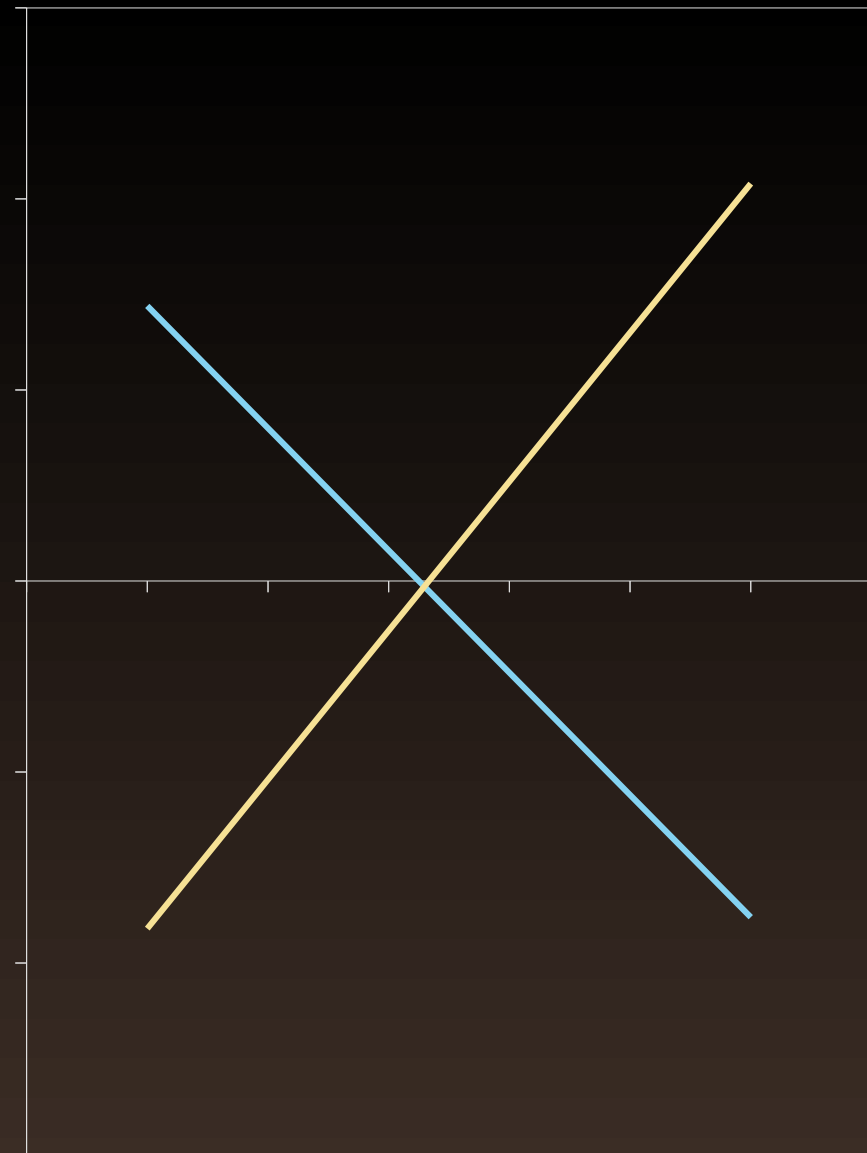Series of interrelated tasks which transform inputs into a given output

- Conveyor

- Brewery

- Chemical

- Oil and gas refinery

We model best

Physical parameters

- Temperature

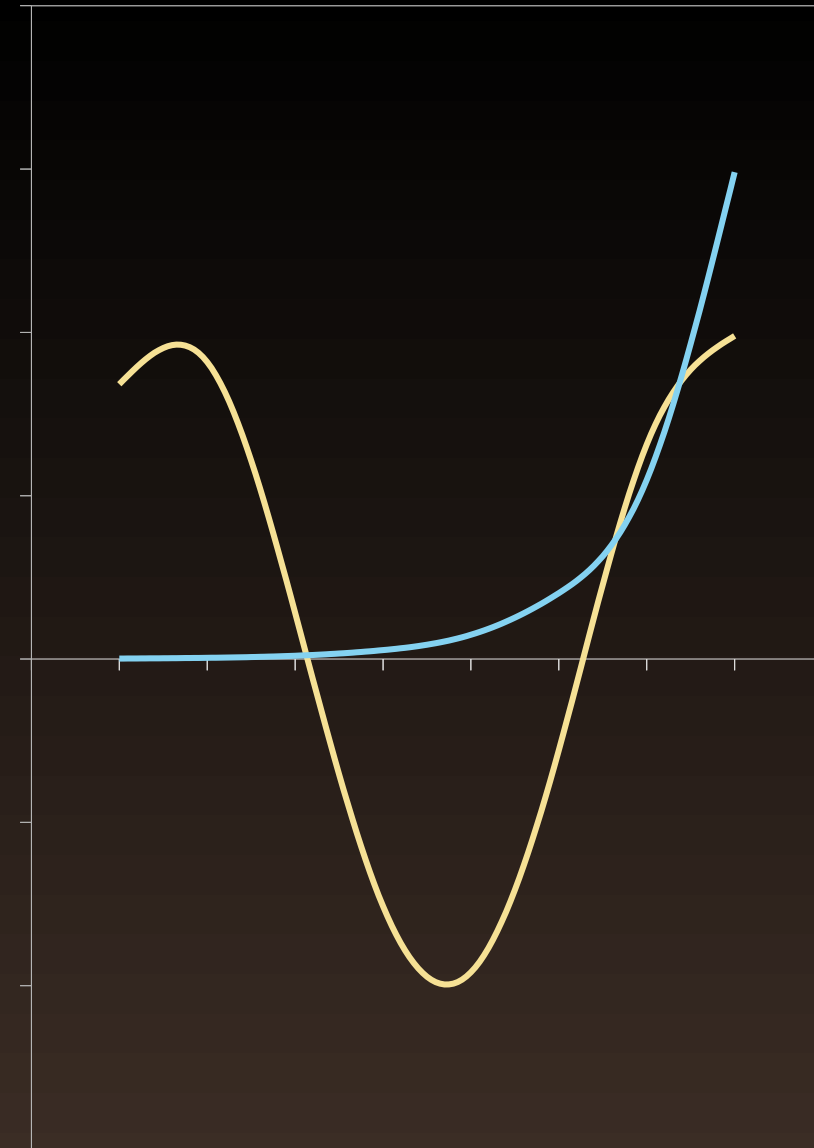- Pressure

- Flow rate

- Energy

We model good

Combination of some physical parameters

Thermodynamics

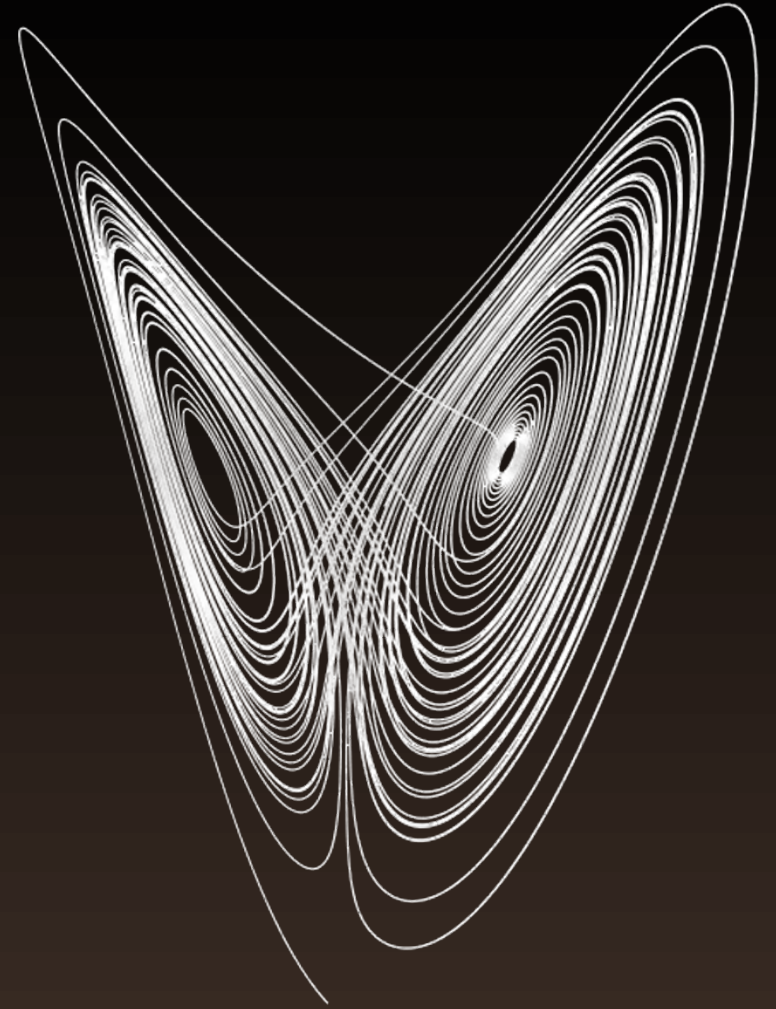Chemical reactions

Hydrodynamics

We model not so well

Combination of many physical parameters

Industrial rotary equipment

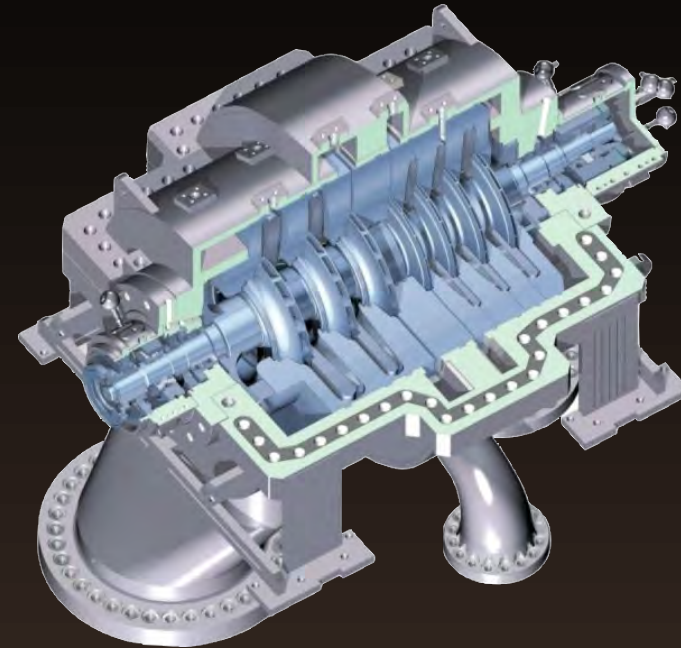- Compressors – gas

- Pumps – liquids

Rotary equipment: gas compressor

Range of processes require increase
of the pressure of various gases

- Air conditioning process

- Chemical reactors

- Natural gas transportation
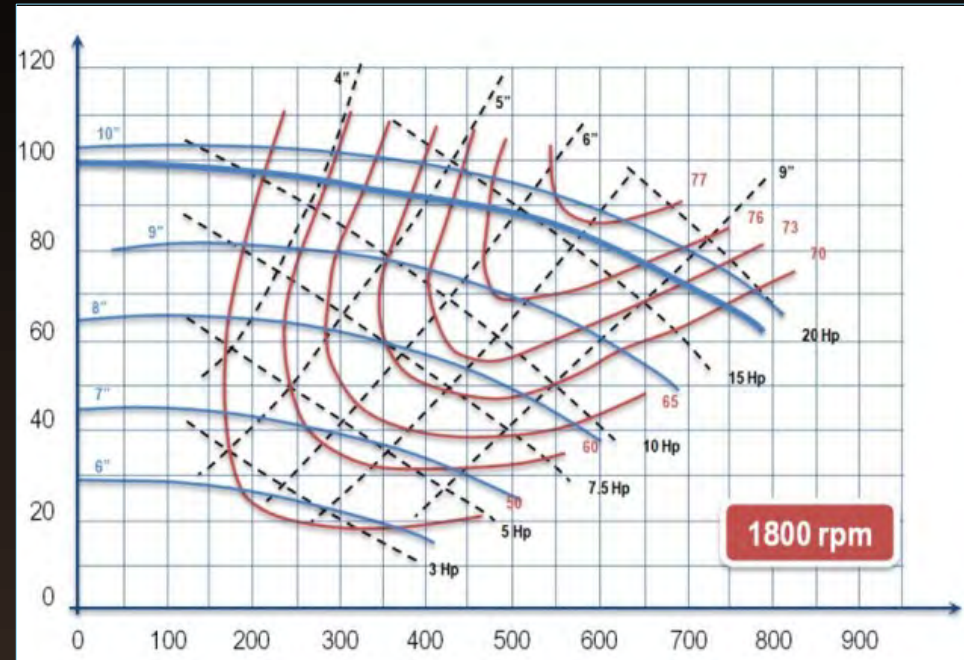
Size range from watts to megawatts

What is the problem?

Too many variables

- Pressure

- Flow rate

- Rotation speed

- Power

Too many hardware designs

Parallel operation optimisation
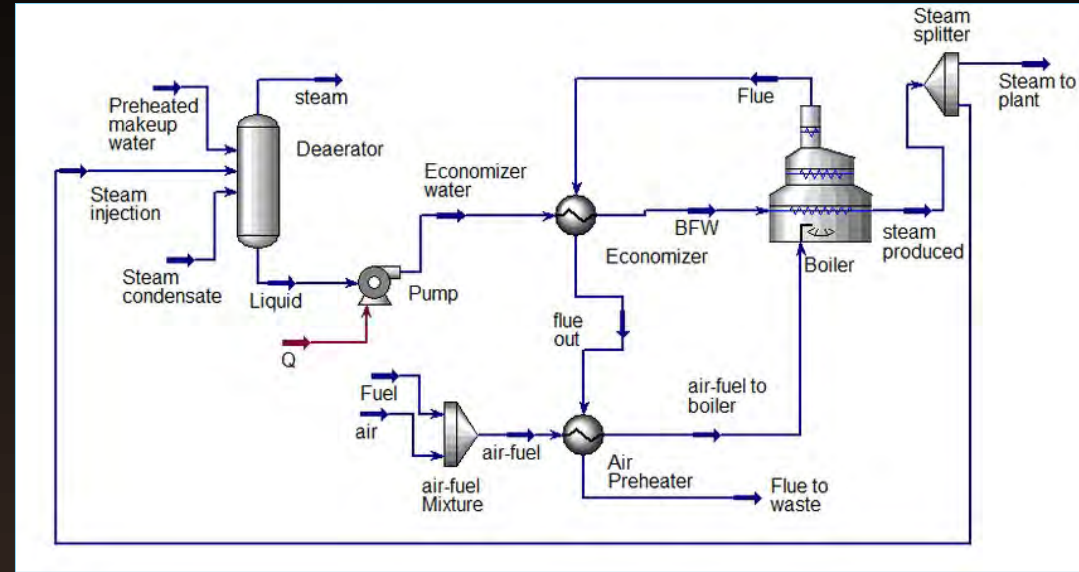
Existing model software

Quite powerful tools exist
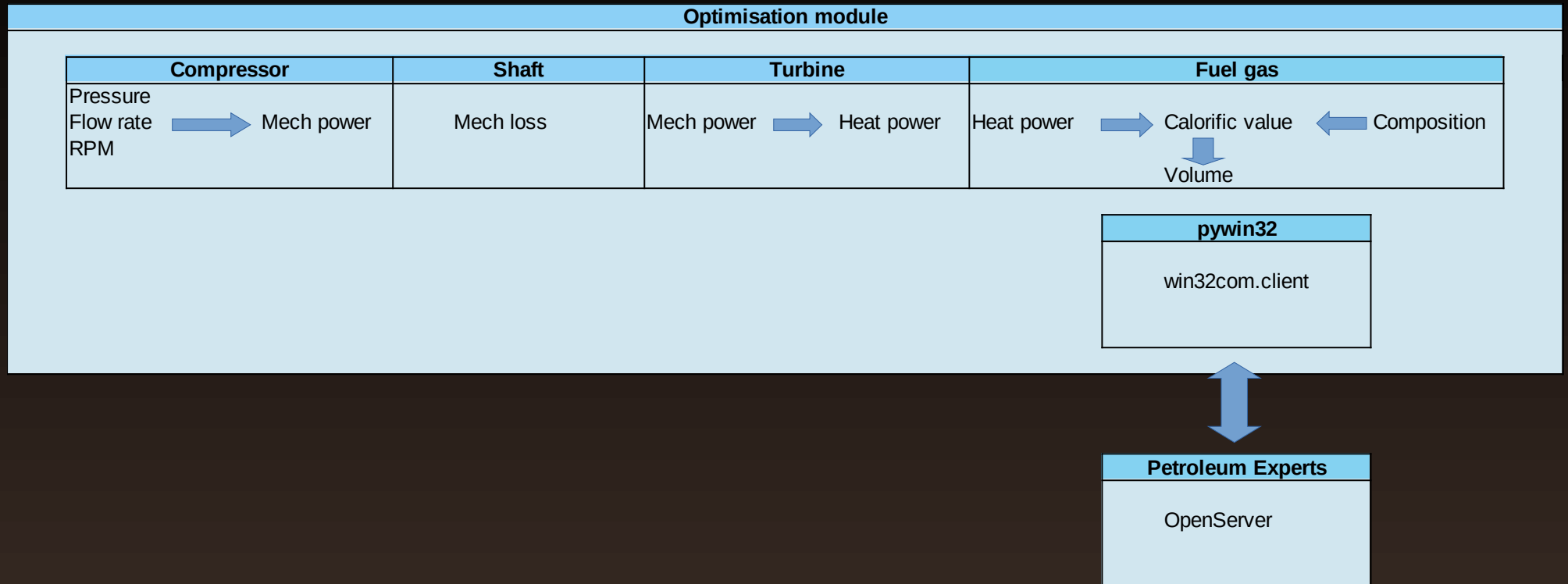
- Aspen

- ProSim

- SimTech

Few open-source projects

Lack of flexibility

Simplification

Workarounds

Optimisation module			
Compressor	**Shaft**	**Turbine**	**Fuel gas**
Pressure Flow rate RPM → Mech power	Mech loss	Mech power → Heat power	Heat power → Calorific value ← Composition ↓ Volume

pywin32

win32com.client

Petroleum Experts

OpenServer

Why is it important?
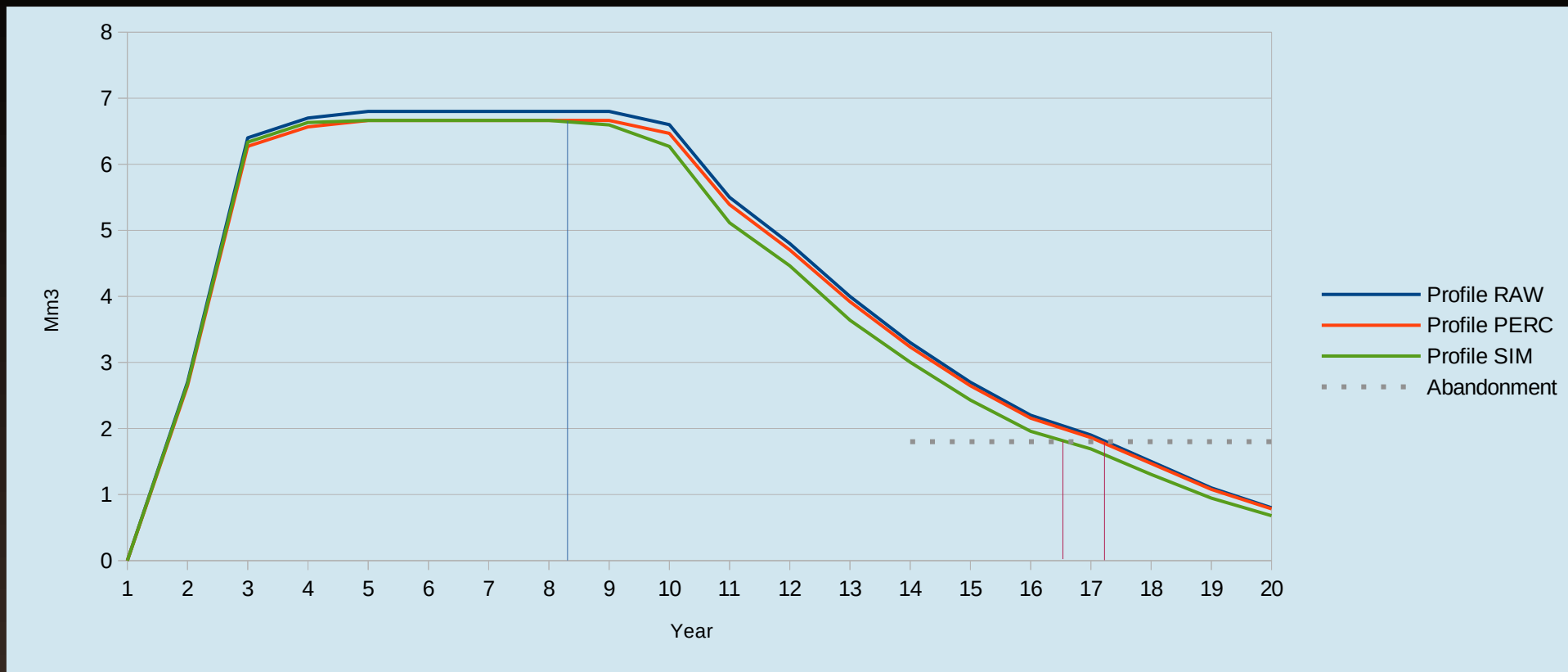
Lack of long-term planning

Variation of process size

Significant change of process over time

⬇

Money loss

Economics

Economics

Bad approach

- Take average values
  - Loose more in future

Good approach

- Invest in own modeling software development
  - Be safe

Delta in millions dollars

Conclusions

A gap in complex industrial equipment modeling

More software development required

Need more interconnection possibilities

Lack of strategic planning

Thank you!