34th Annual INCOSE international symposium

hybrid event

Dublin, Ireland
July 2 - 6, 2024

Presentation no. 313

Easing SE implementation in daily life

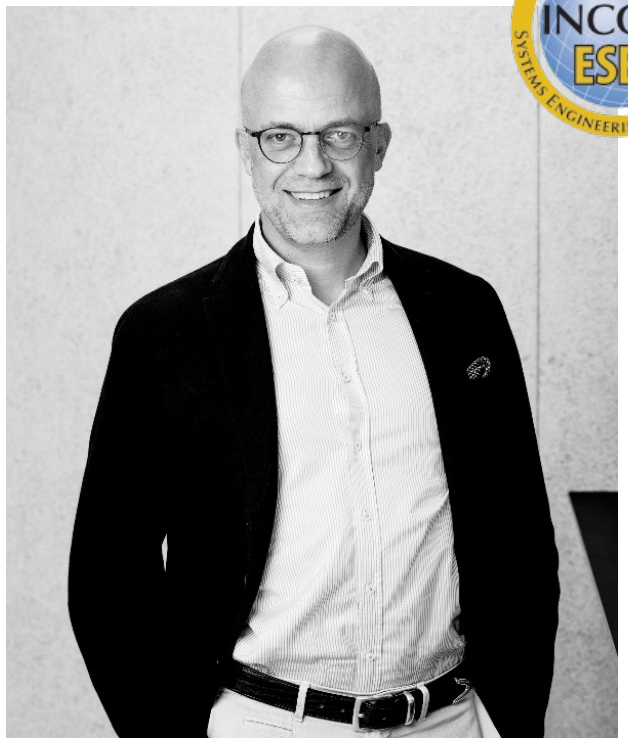
SYSTEMS ENGINEERING A/S

A selection from our portfolio

MOLIO aarhusvand Ørsted READI Vestas Chevron Energy Norway Tetra Pak Aalborg Forsyning Hafslund

SYSTEMS ENGINEERING A/S

Systems engineers certified by INCOSE



Henrik Balslev
Managing partner

Expert Systems
Engineering Specialist

HV **electrical engineer** B.Sc. 1988

Project director large scale projects = 40 MEUR

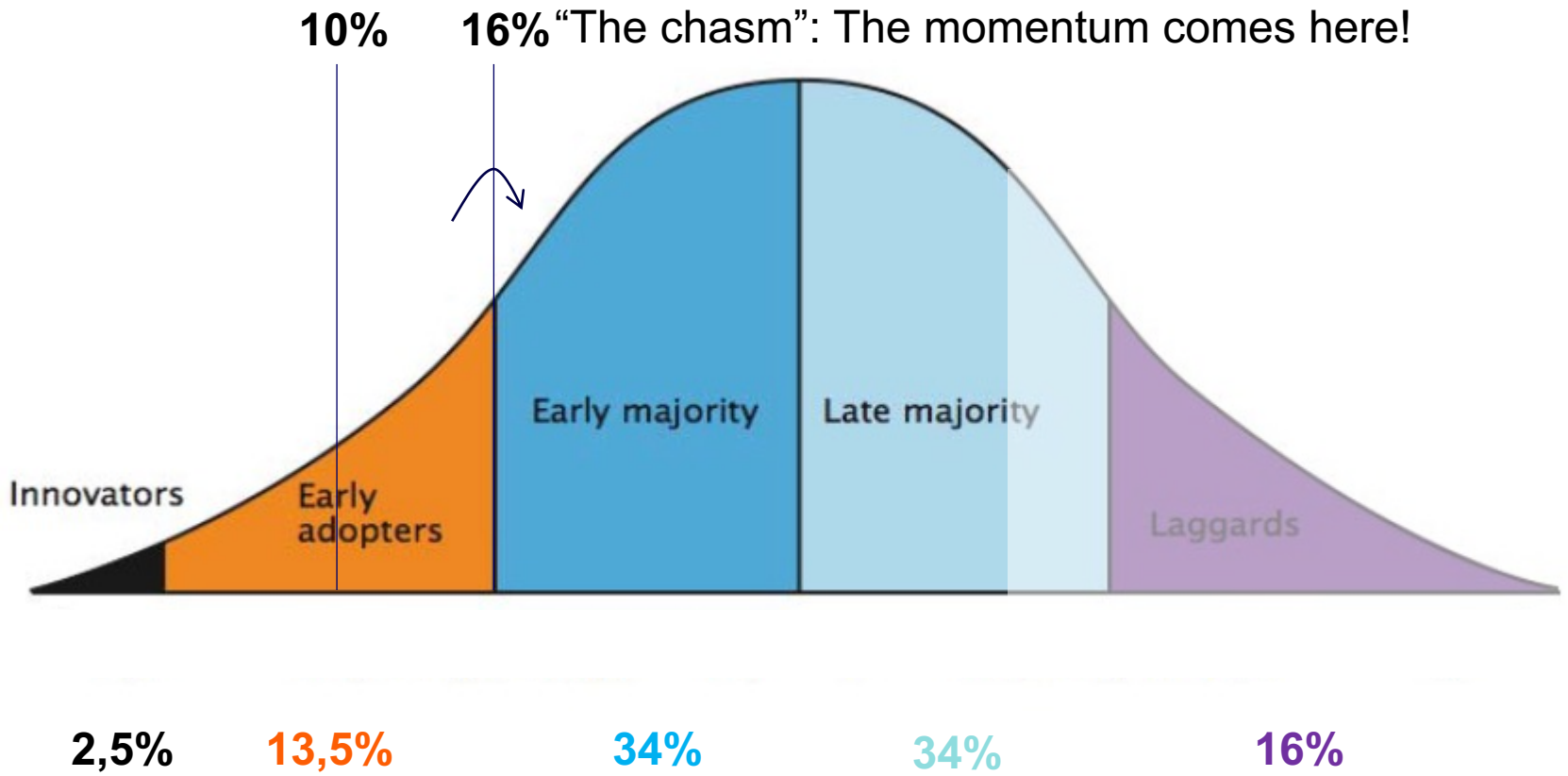
Practical SE implementation.

THE PROBLEM

“What exactly are organizations new to SE supposed to do next Monday 8am with SE and how?”

LAW OF DIFFUSION OF INNOVATION

Our preferred model to create a change. The key is momentum!



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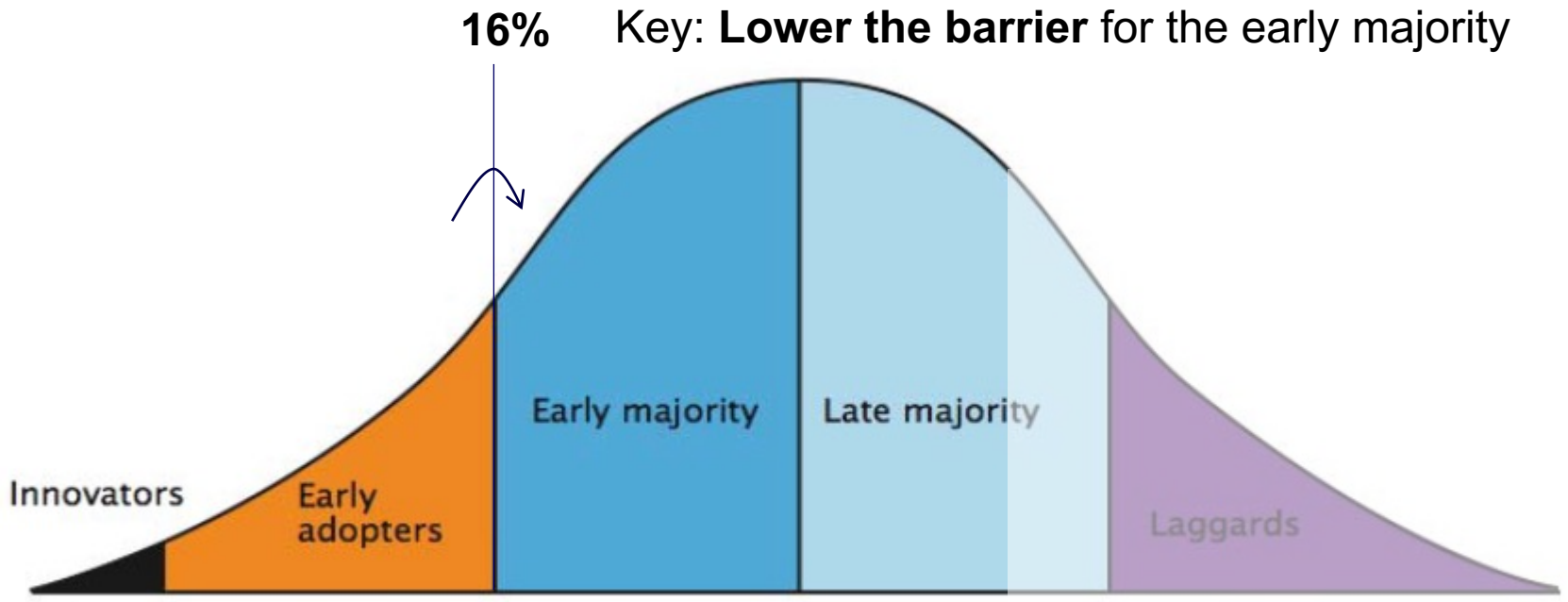


SYSTEMS ENGINEERING

Three steps to systems engineering

3. Systems Engineering A/S have made SE practical **in daily life** by the Systems Engineering Concept® (**SEC**). Low barrier entry point. Module approach to SE. Manuals, checklists, practical training in pilot projects, tool support etc.

2. The INCOSE **community** network, certification and handbook. Knowledge sharing, industry specific workgroups etc.

1. Basic **rules and principles** defined in ISO/IEC/IEEE 15288 *System life cycle processes.*

CONCEPT

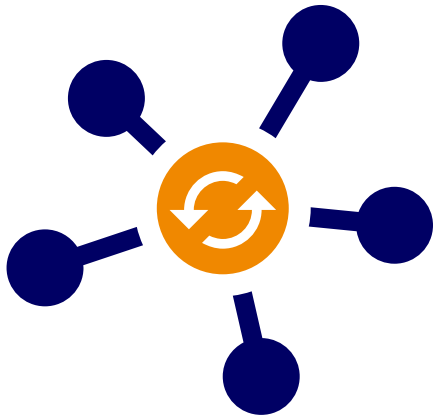
collection of ideas and knowhow behind the design of a given entity

Fast implementation

Person **independent**

Scalable and **repeatable**

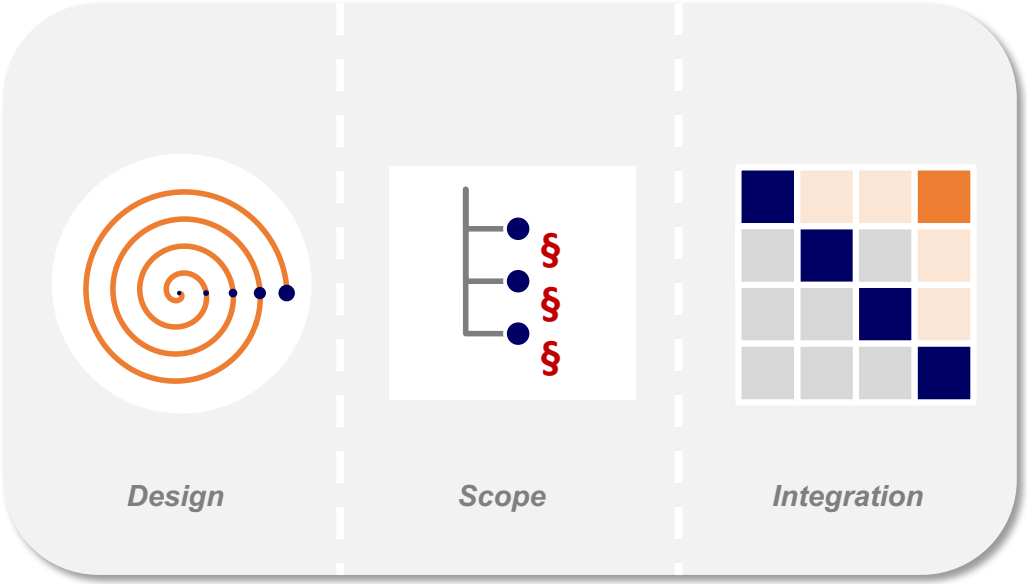
madklubben



Systems Engineering Concept®

by Systems Engineering A/S

Systems Engineering Concept®



M1

System Structuring Module

M2

System Development Module

M3

System Reference Model Module

M1

System Structuring Module

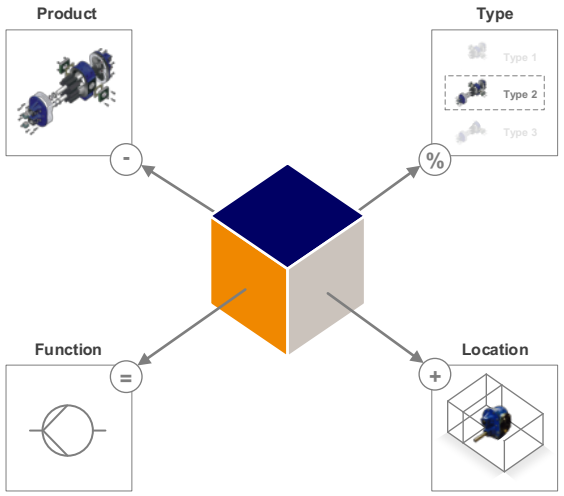
This is our starting point
in <u>any</u> project in <u>any</u> domain!

Creating a common understanding of the systems,
using a common language,
in the form of a **reference model**.

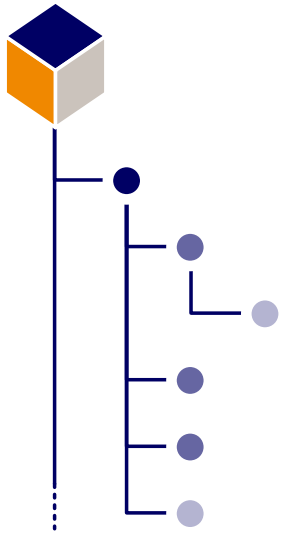
M1: ISO/IEC 81346 REFERENCE MODEL

*The ISO/IEC 81346 Reference Designation System ("**RDS**")*

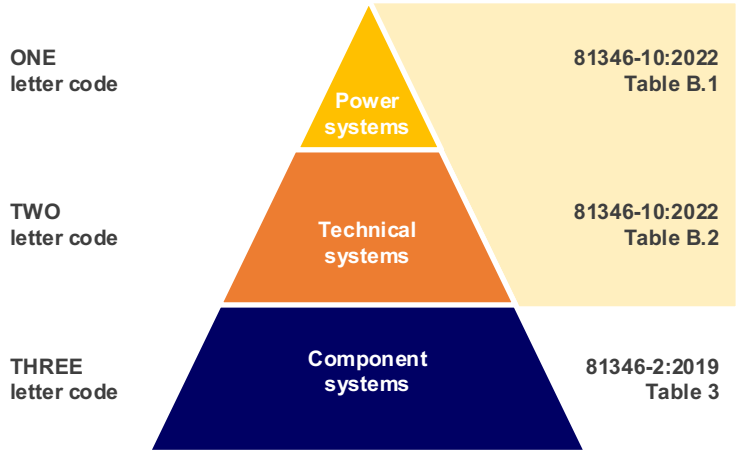
1. Aspects
Different viewpoints



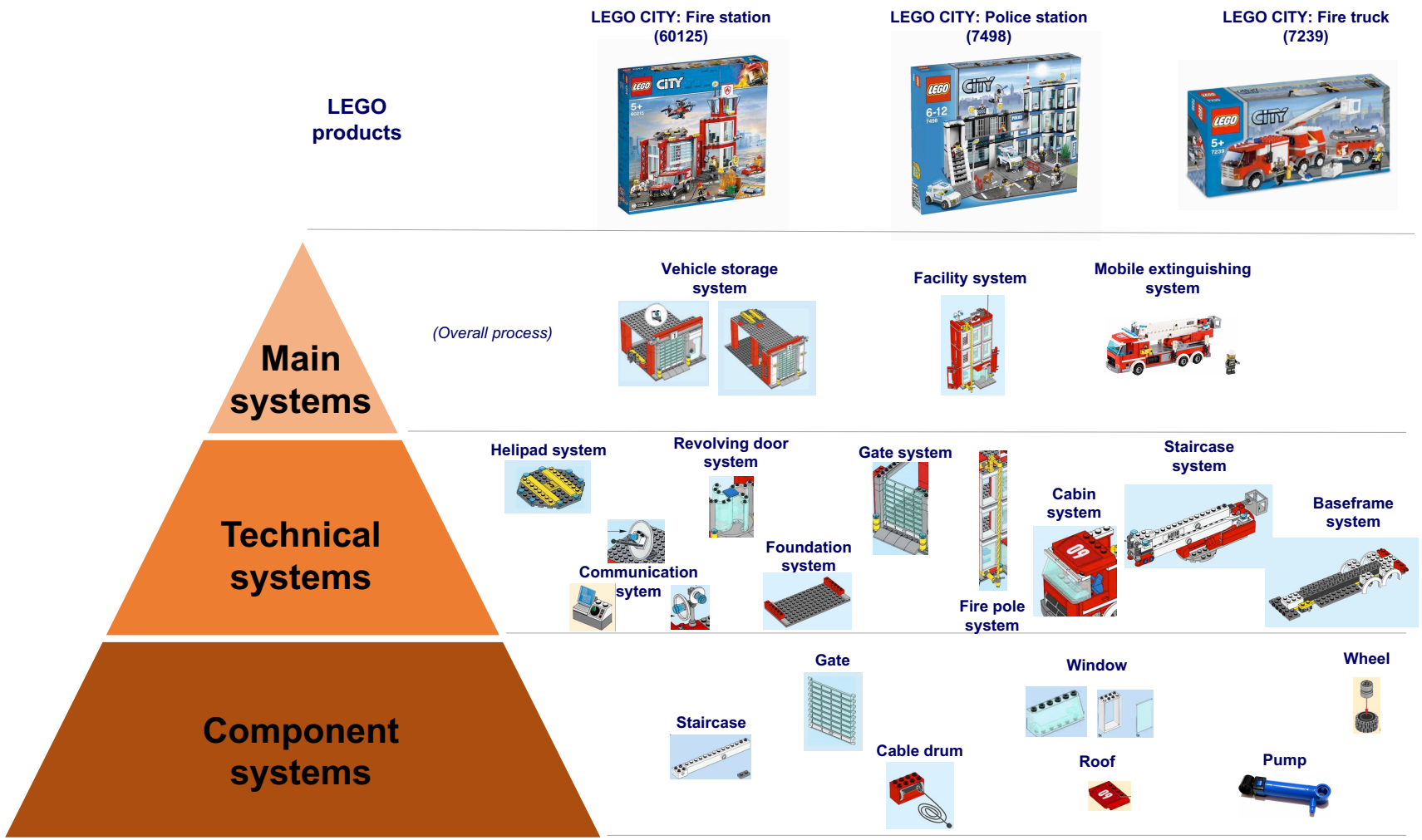
2. Structure
Detailing the model



3. Library
System elements bricks



M1: ISO/IEC 81346 REFERENCE SYSTEM



Total RDS 81346 system elements: 730

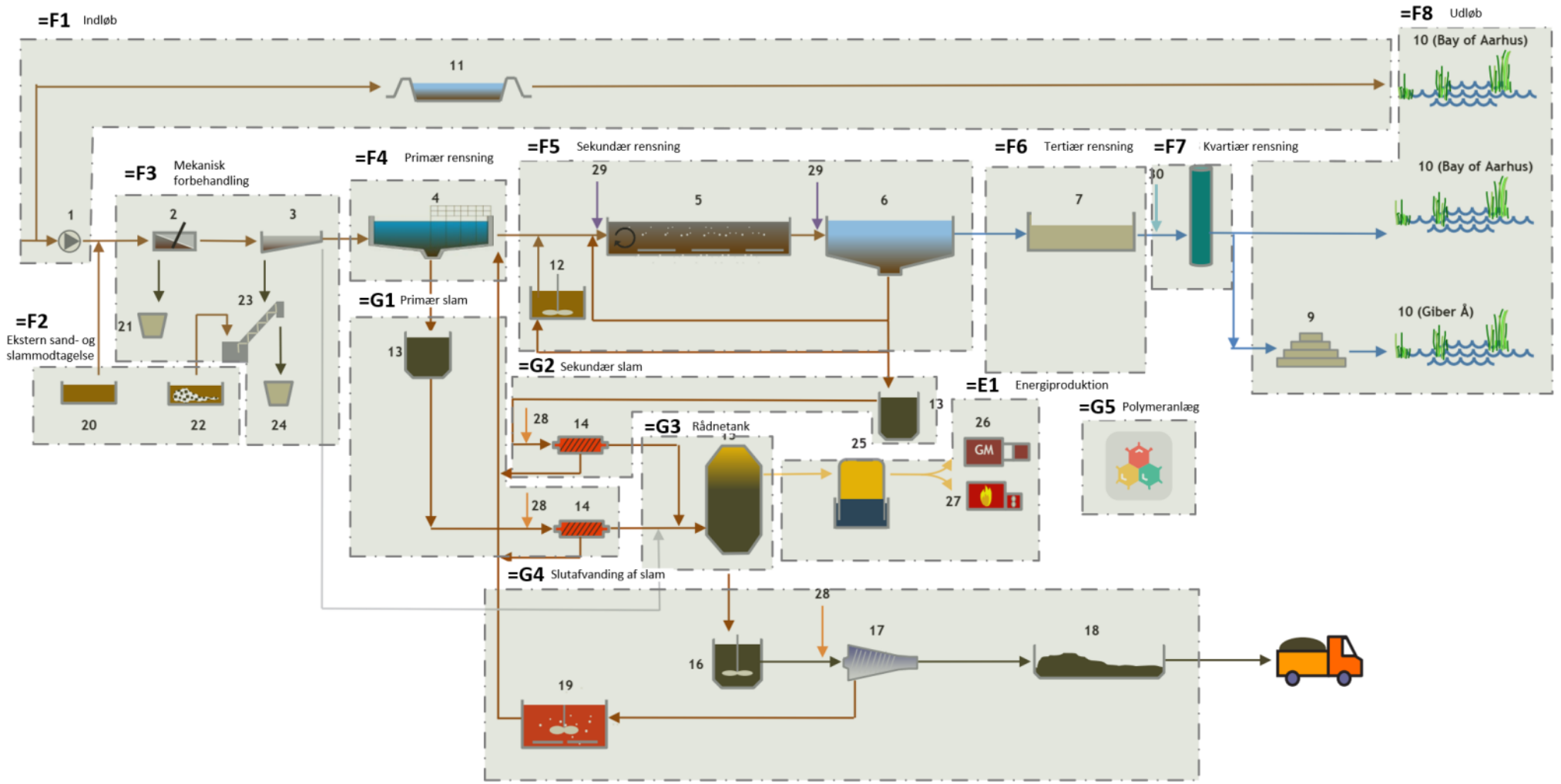
THE RDS 81346 SYSTEM LIBRARIES

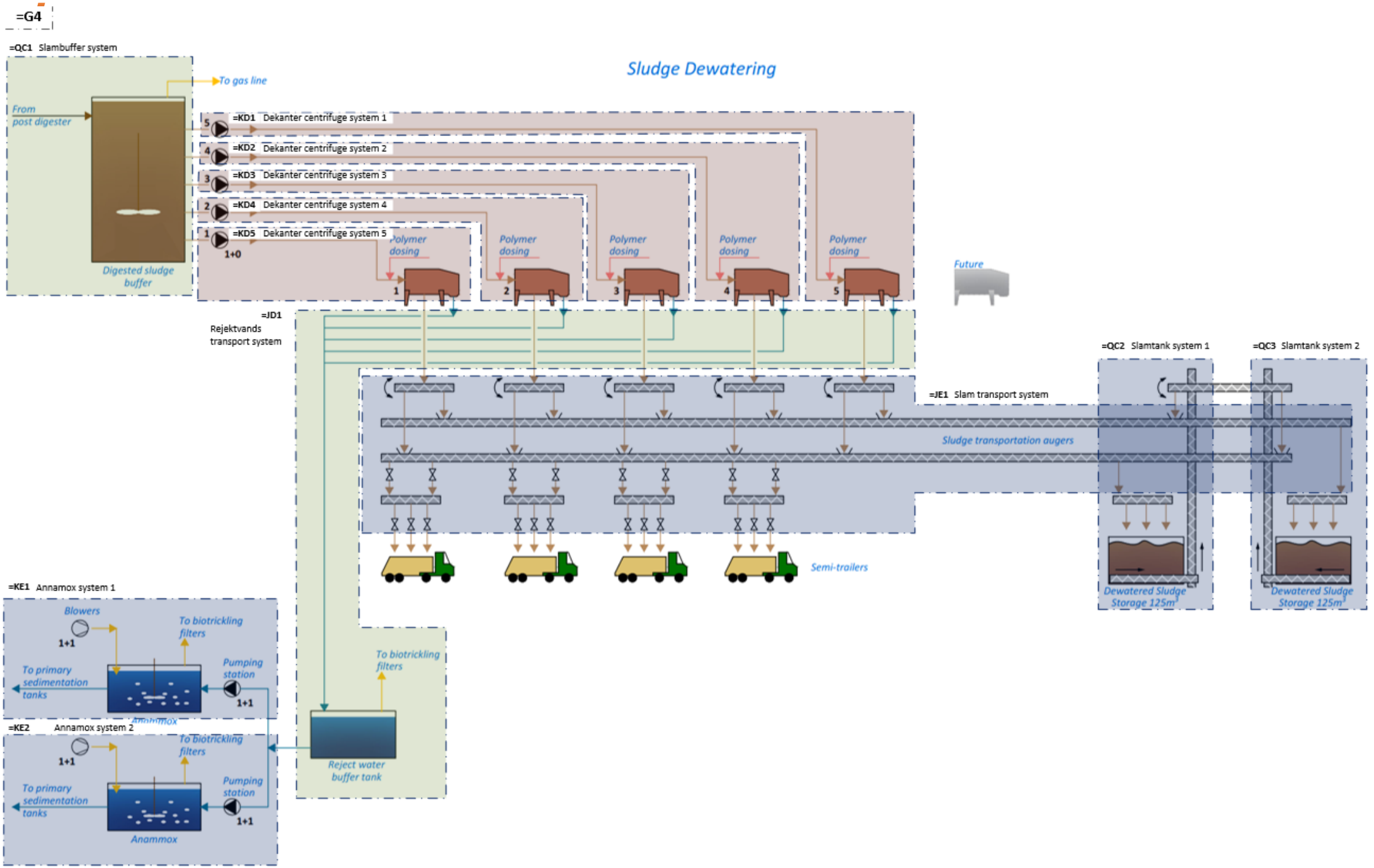
Different tables for different industries – fast development since 2018

General classification	Power systems	Construction works	Manufacturing	Aircrafts	Processes
Part **2**	*Part* **10**	*Part* **12**	*Part* **14**	*Part* **20**	*Part* **50**

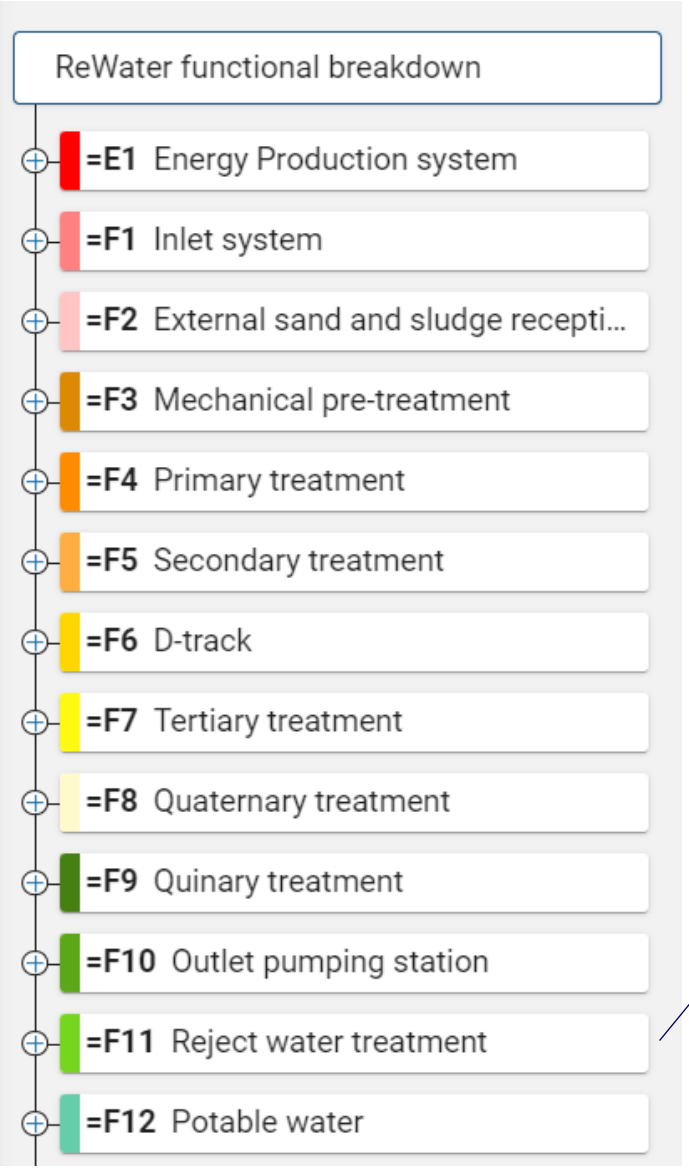
AARHUS REWATER SYSTEMS

AARHUS REWATER SYSTEMS

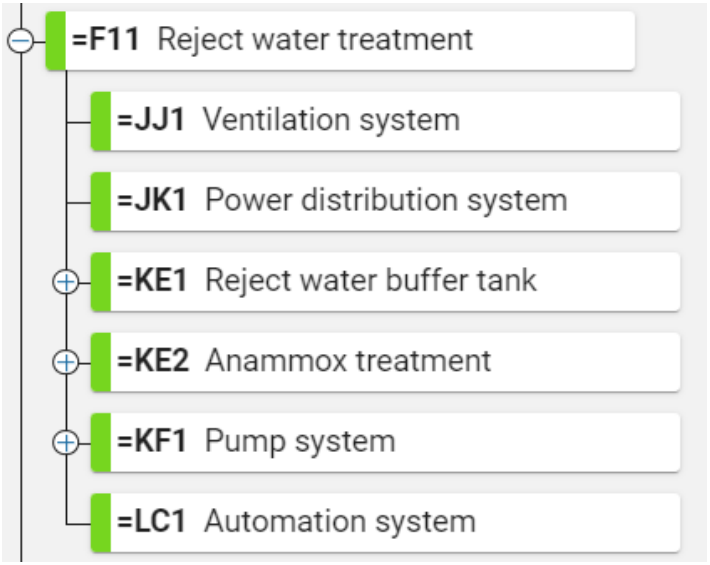



=G4
=QC1 Slambuffer system
Sludge Dewatering
To gas line
From post digester
Digested sludge buffer
=KD1 Dekanter centrifuge system 1
=KD2 Dekanter centrifuge system 2
=KD3 Dekanter centrifuge system 3
=KD4 Dekanter centrifuge system 4
=KD5 Dekanter centrifuge system 5
1+0
Polymer dosing
Future
=JD1
Rejektvands transport system
=QC2 Slamtank system 1
=QC3 Slamtank system 2
=JE1 Slam transport system
Sludge transportation augers
Semi-trailers
Dewatered Sludge Storage 125m³
=KE1 Annamox system 1
Blowers
1+1
To biotrickling filters
To primary sedimentation tanks
Pumping station
Anammox
=KE2 Annamox system 2
Reject water buffer tank

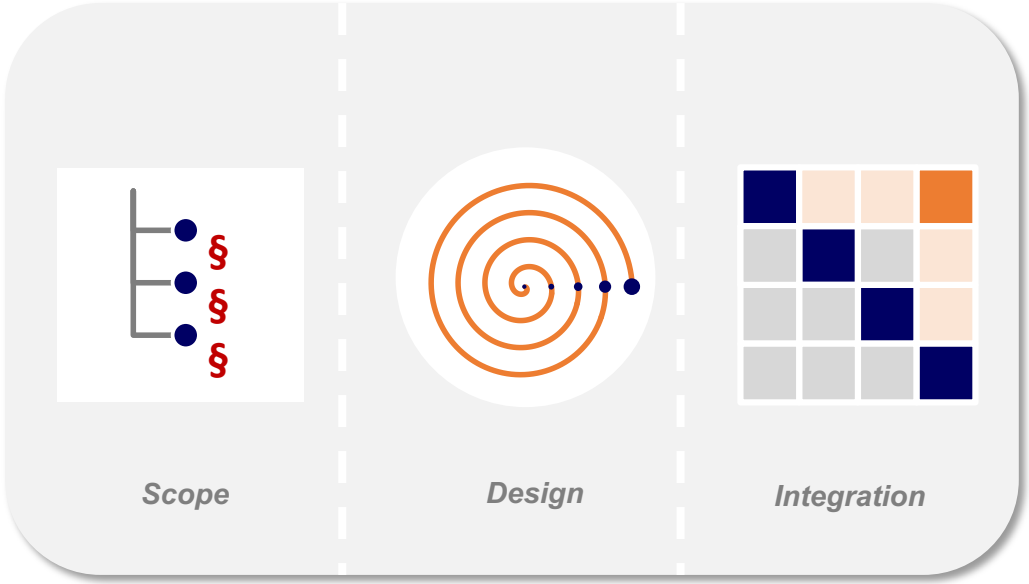
RDS 81346 REFERENCEMODEL



System Owner



Systems Engineering Concept®



M1

System Structuring Module

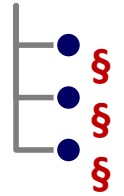
M2

System Development Module

M3

System Reference Model Module

It's all about creating a common languages

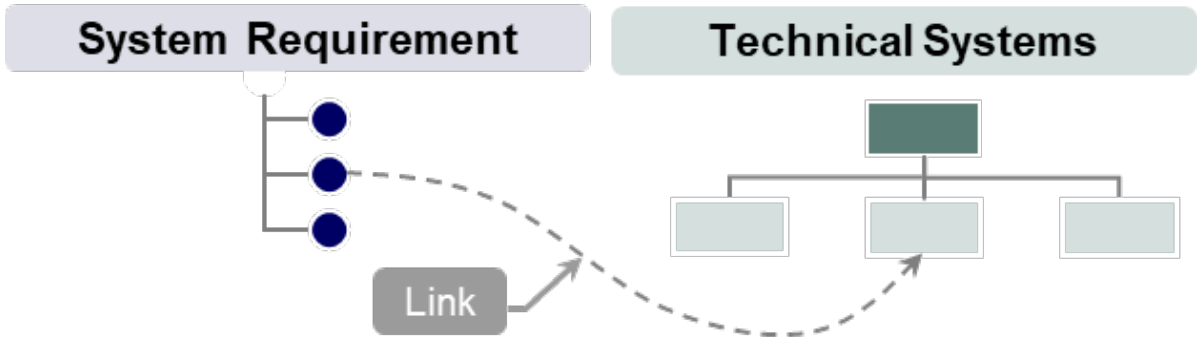


Scope
M2a

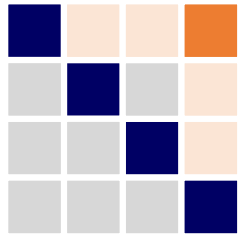
SYSTEM SCOPE

REQUIREMENT TRACEABILITY

Linking requirements to system elements



Linking an element of the System Requirement with an element of the Technical System – both consist of a hierarchal structure documents the dependency between the two elements and is the basis of **requirement traceability**.



Integration
M2c

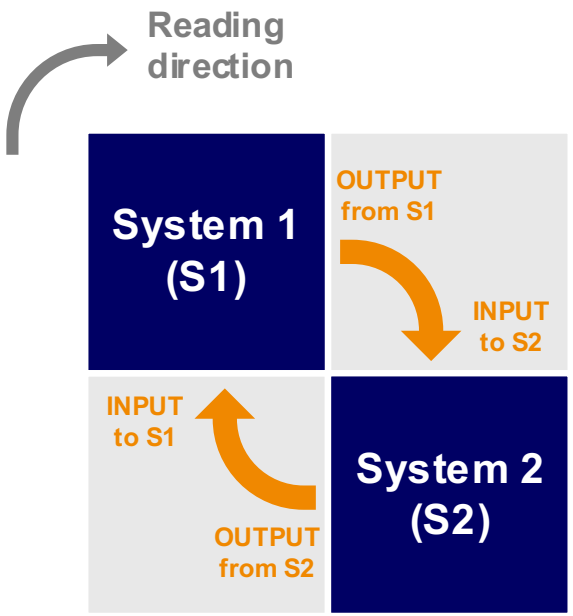
SYSTEM INTEGRATION

Systems and their interactions

INTEGRATION MANAGEMENT

Systematic interface control by RDS 81346 in the N2 diagram

M2c



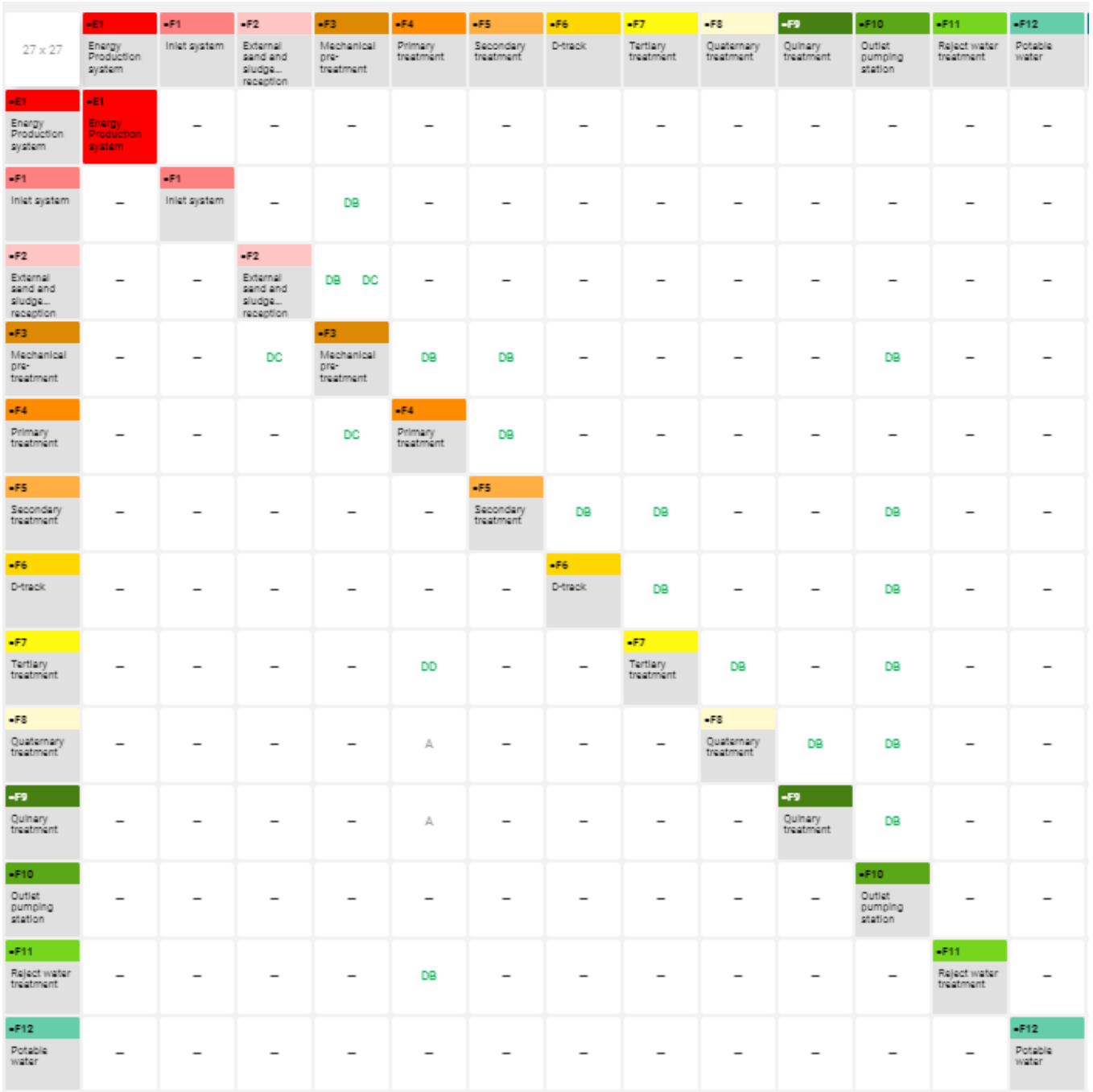
A1	DB	-	BB	-
-	A2	AA	-	CA CC
?	?	B1	?	?
-	BB	-	B2	-
CB	-	-	-	B3

Examples of Interface classifications:
AA – Data transfer
BB – Command signal
CA – Electrical energy transfer
CB – Heating transfer
CC – Cooling transfer
DB – Liquid transfer

RDS 81346

->

N2 diagram



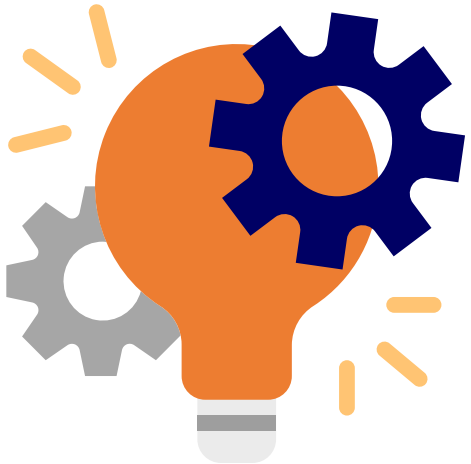
27 x 27	-E1 Energy Production system	-F1 Inlet system	-F2 External sand and sludge... reception	-F3 Mechanical pre-treatment	-F4 Primary treatment	-F5 Secondary treatment	-F6 D-track	-F7 Tertiary treatment	-F8 Quaternary treatment	-F9 Quinary treatment	-F10 Outlet pumping station	-F11 Reject water treatment	-F12 Potable water
-E1 Energy Production system	-E1 Energy Production system	–	–	–	–	–	–	–	–	–	–	–	–
-F1 Inlet system	–	-F1 Inlet system	–	DB	–	–	–	–	–	–	–	–	–
-F2 External sand and sludge... reception	–	–	-F2 External sand and sludge... reception	DB DC	–	–	–	–	–	–	–	–	–
-F3 Mechanical pre-treatment	–	–	DC	-F3 Mechanical pre-treatment	DB	DB	–	–	–	–	DB	–	–
-F4 Primary treatment	–	–	–	DC	-F4 Primary treatment	DB	–	–	–	–	–	–	–
-F5 Secondary treatment	–	–	–	–	–	-F5 Secondary treatment	DB	DB	–	–	DB	–	–
-F6 D-track	–	–	–	–	–	–	-F6 D-track	DB	–	–	DB	–	–
-F7 Tertiary treatment	–	–	–	–	DD	–	–	-F7 Tertiary treatment	DB	–	DB	–	–
-F8 Quaternary treatment	–	–	–	–	A	–	–	–	-F8 Quaternary treatment	DB	DB	–	–
-F9 Quinary treatment	–	–	–	–	A	–	–	–	–	-F9 Quinary treatment	DB	–	–
-F10 Outlet pumping station	–	–	–	–	–	–	–	–	–	–	-F10 Outlet pumping station	–	–
-F11 Reject water treatment	–	–	–	–	DB	–	–	–	–	–	–	-F11 Reject water treatment	–
-F12 Potable water	–	–	–	–	–	–	–	–	–	–	–	–	-F12 Potable water

27
Main systems

216
Technical Systems

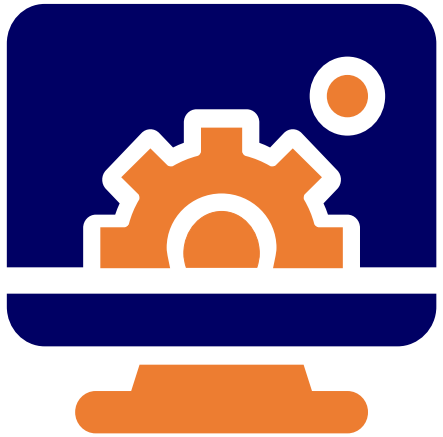
> 1.200
interfaces

Systems Engineering Concept®



SEC / *methods*

SEC / *services*



SEC / *software*

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Session 10.4.2: Scaled modelling.
Presentation #303.
Thomas Barré / AIRBUS
Friday 05. 09:45-10:25
Wicklow Hall 2B