혁신형SMR기술개발사업단
Innovative SMR Development Agency

The Development of Innovative SMR and Digital Twin Framework

i-SMR Development Agency
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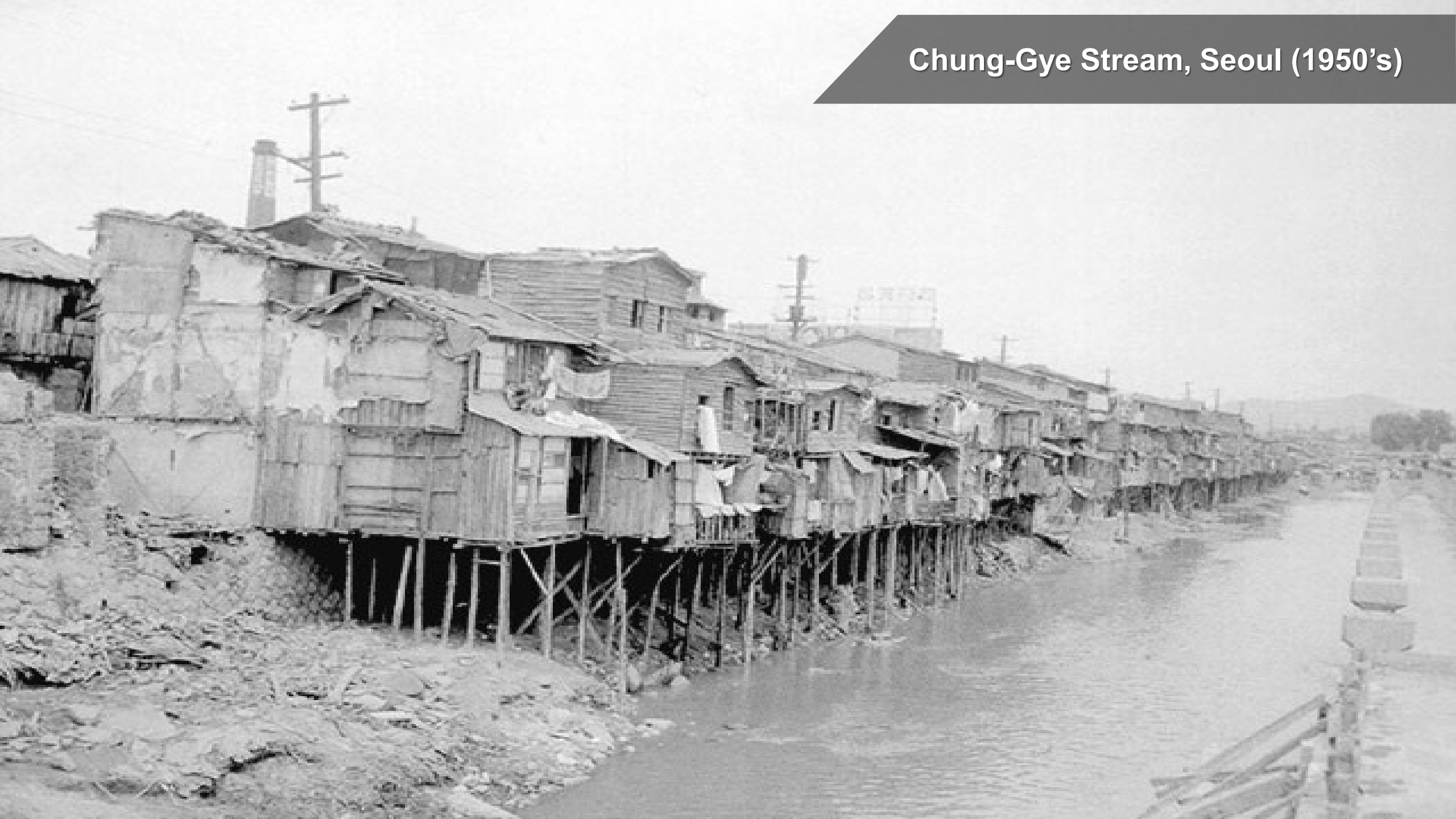

Chung-Gye Stream, Seoul (1950's)

Chung-Gye Stream, Seoul (Now)

Chung-Gye Stream, Seoul (Now)

President Park Chung Hee, Overseeing the main control room of Kori-1,
Korea’s first commercial nuclear plant (1978)

… and 60 years across

Saeul Nuclear Power Plant 3,4 (Ulsan)

Nuclear Energy Development in Korea (1950s)

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Technology Localization Completion Rate

10% → 30% → 75% → 95%

* PHWR based on CANDU6 ** OPR+ Reactor

1950~1970s	1980s	1990s	2000s	2010s	2020s
Foreign Technology Dependence	Technology Accumulation	Technology Localization	Technology Advancement		Technology for Export

Turnkey Approach

- Kori #1, 2
- Wolsong #1*

Non-Turnkey Approach

- Kori #3, 4
- Hanbit #1, 2
- Hanul #1, 2
- Wolsong #2, 3, 4*

Development of OPR 1000

- **Hanbit #3, 4**, 5, 6
- Hanul #3, 4, 5, 6

Development of APR 1400

- Shin-Kori #1, 2**
- Shin-Wolsong #1, 2**
- Saeul #1, 2
- Shin-Hanul #1, 2
- Export to UAE

Development of APR+

- Nu-Tech 2012
  - Reactor Coolant Pump(RCP)
  - Man-Machine Interface System(MMIS)
  - Safety and Performance Analysis Code for NPP(SPACE)

Nuclear for the World

- EU-APR1400
- EU-APR1000
- i-SMR

Foreign Contractors	Foreign-Korean Joint Design & Manufacturing	Korean Contractors	Korean Contractors
	•Foreign : Prime Contractors •Korean : Sub-contractors	•Korean : Prime Contractors •Foreign : Sub-contractors	

Innovative Small Modular Reactor(i-SMR) Development Status

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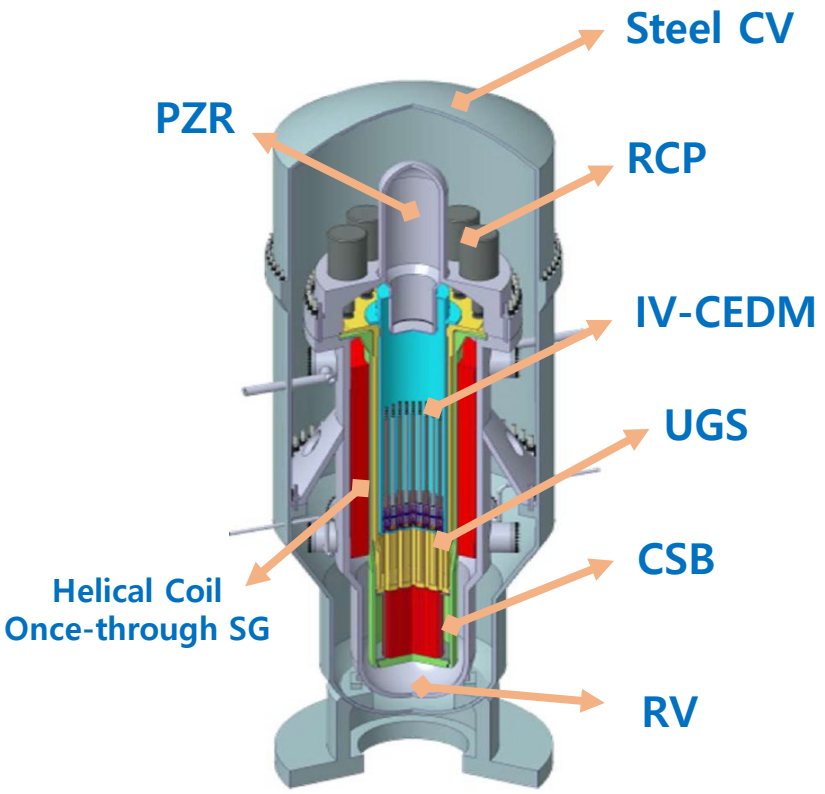
General

- **PWR**
- **170MWe POWER**
- 80 years design life

Economics

- Overnight cost : $3,500 /kWe
- LCOE : LCOE $65 /MWh
- **Modular design and Factory manufacturing**
- Construction time ≤ 42 month (4 modules)



Schematic diagram of RV and CV

Safety

- **CDF : 1.0 × 10-9 /M·Y**
- **Fully Passive Safety System**
- EPZ : Within site boundary

Flexibility

- **Boron Free Operation**
- Multipurpose Utilization
- Load Following Operation

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The Challenge Is End-to-End Connectivity and Traceability

Can every engineering decision be traced across the lifecycle?

A Digital Twin starts with structured, traceable engineering information — not with a 3D model.

i-SMR Digital Twin Framework

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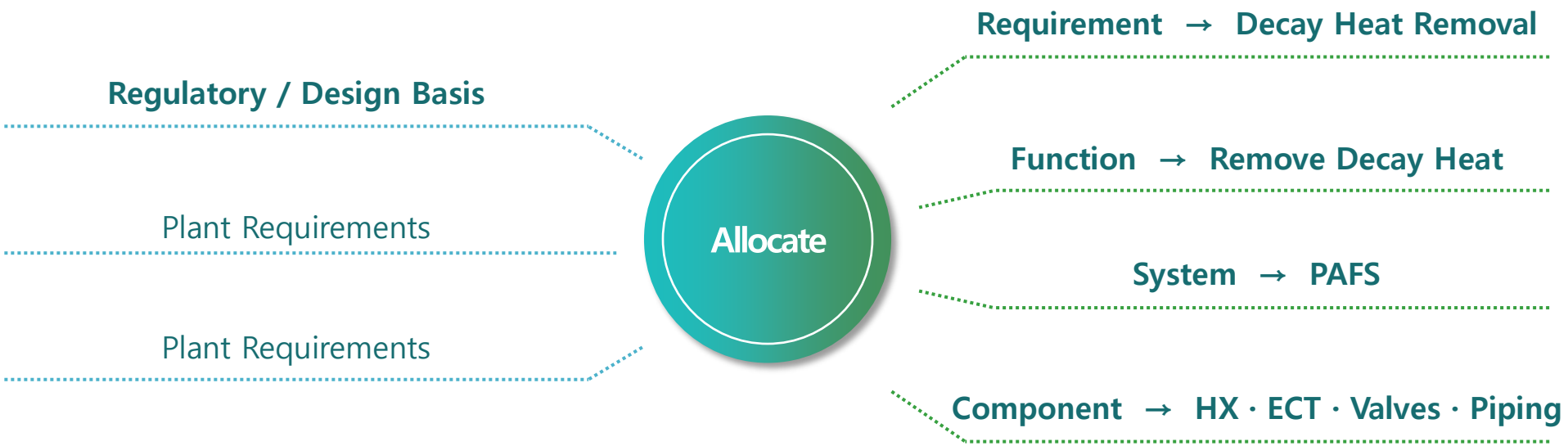
Build the Foundation First — Then Evolve Toward Digital Twins

We are not starting with the Digital Twin.
We are building the engineering foundation that makes the Digital Twin possible.

Requirements & System Architecture



Requirements define WHAT. Architecture defines HOW and WHERE.

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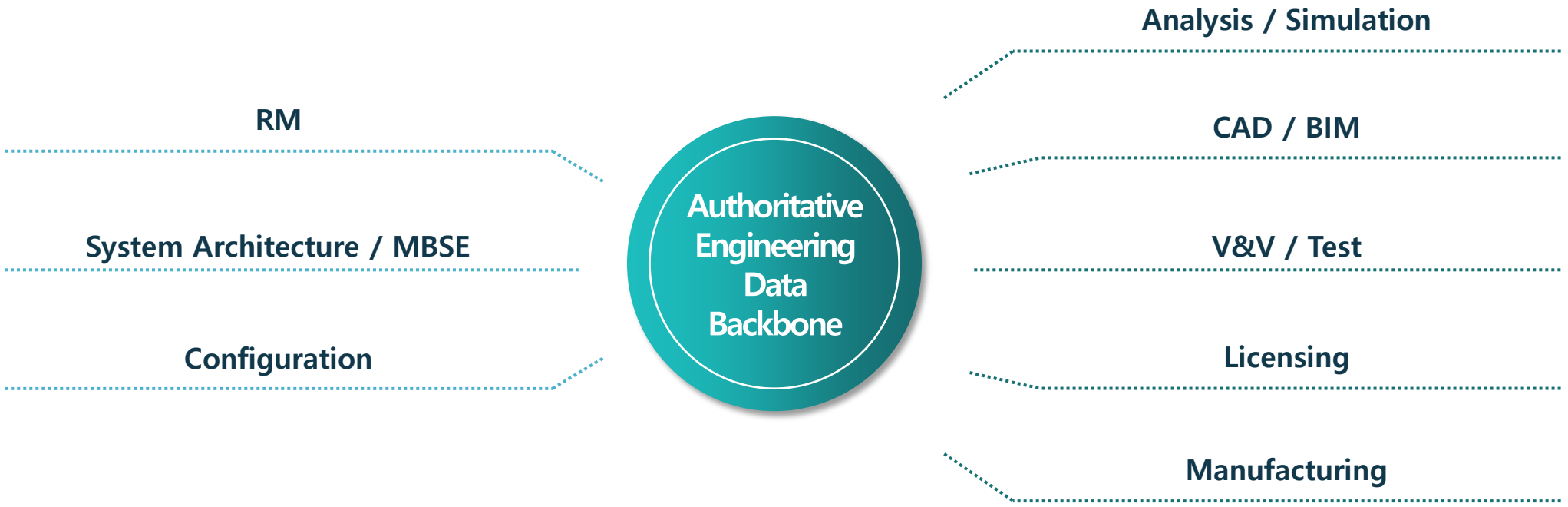
Connect the Engineering Backbone Across Disciplines



Bidirectional Traceability • Controlled Configuration

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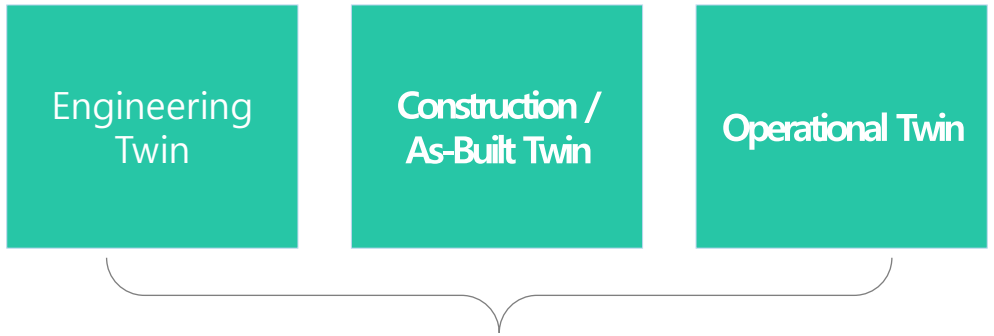

Key Use Case

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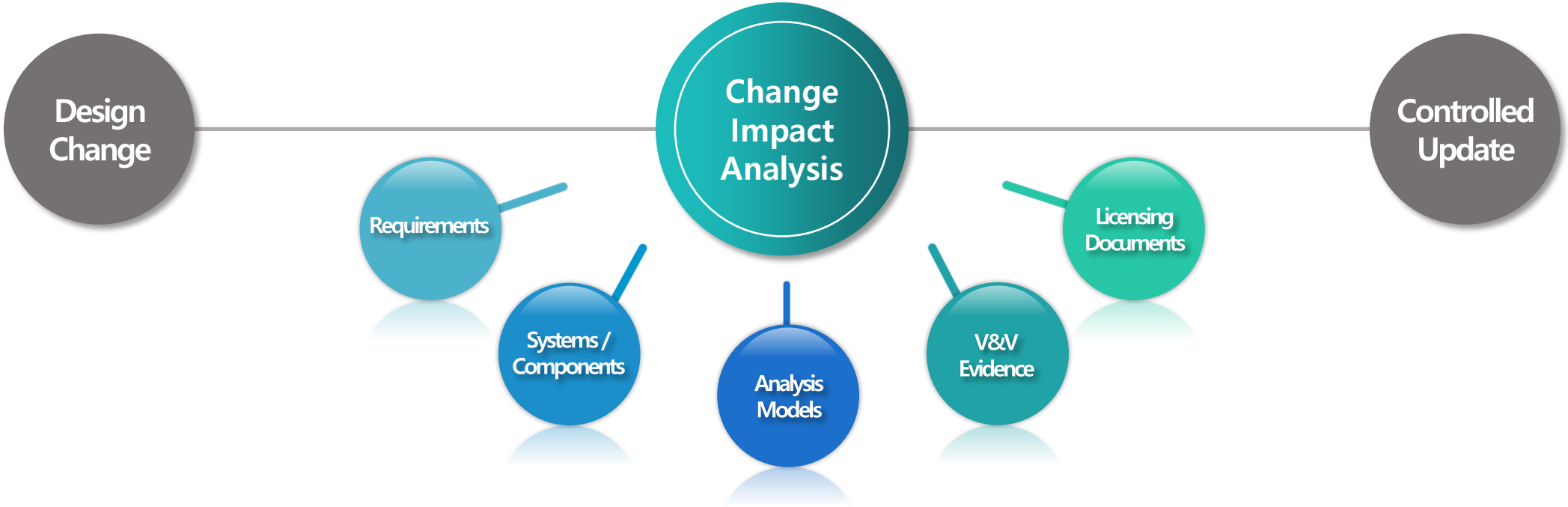
Engineering & Licensing Digital Twin



Faster impact assessment • Stronger licensing traceability • Better configuration control

Implementation Roadmap

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From SDA to FOAK and Operation

1. Foundation

RM · Architecture · MBSE

2. Digital Thread

Engineering integration & traceability

3. FOAK Twin

Engineering · Manufacturing
Construction · As-Built

4. Operational Twin

Plant data · Prediction
Maintenance · Optimization

SDA → Detailed Design → FOAK → Construction / As-Built → Operation

Near-term priority: establish the engineering foundation that enables future operational digital twins.

Key Takeaways

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From a Trusted Engineering Baseline to Lifecycle Digital Twins

01	Requirements Management	Defines the trusted baseline
02	System Architecture	Defines the engineering structure
03	Digital Thread	Connects the lifecycle

Together, they enable the i-SMR Digital Twin.

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Thank You