

Cyber-Physical Modeling

LEAP Workshop

2021 November 4



Session 11 Cyber-Physical Modeling and Energy System Design

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Rethinking the
traditional
“feedforward” design
flow path for energy
systems

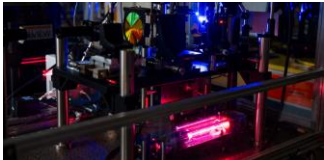
Solutions for Today | Options for Tomorrow



Technology Development in Power



Concept



Lab Testing



Numeric
Models



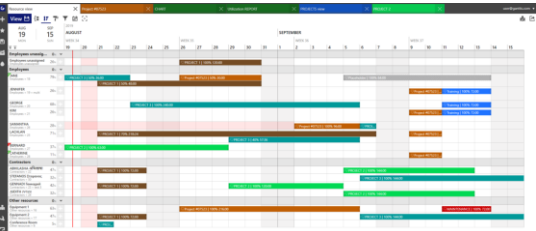
Opportunity
Identified



Pilot Plant



Feasibility Study



Project Development



Financial Closing



Detailed
Engineering



Start of
Construction



Power Plant

Most of the Risk Lies Here

Need for a Pilot Plant

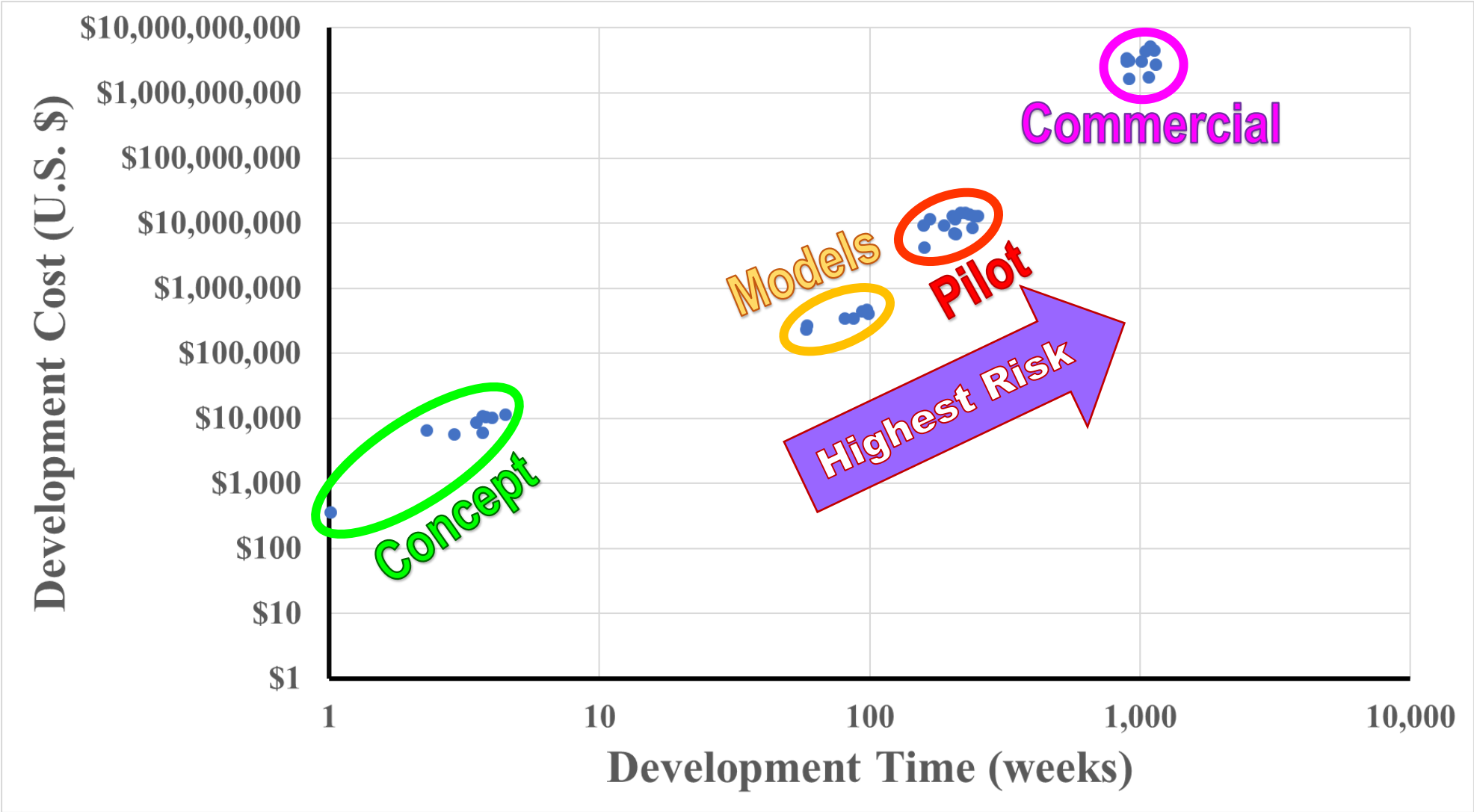


Feasibility Study

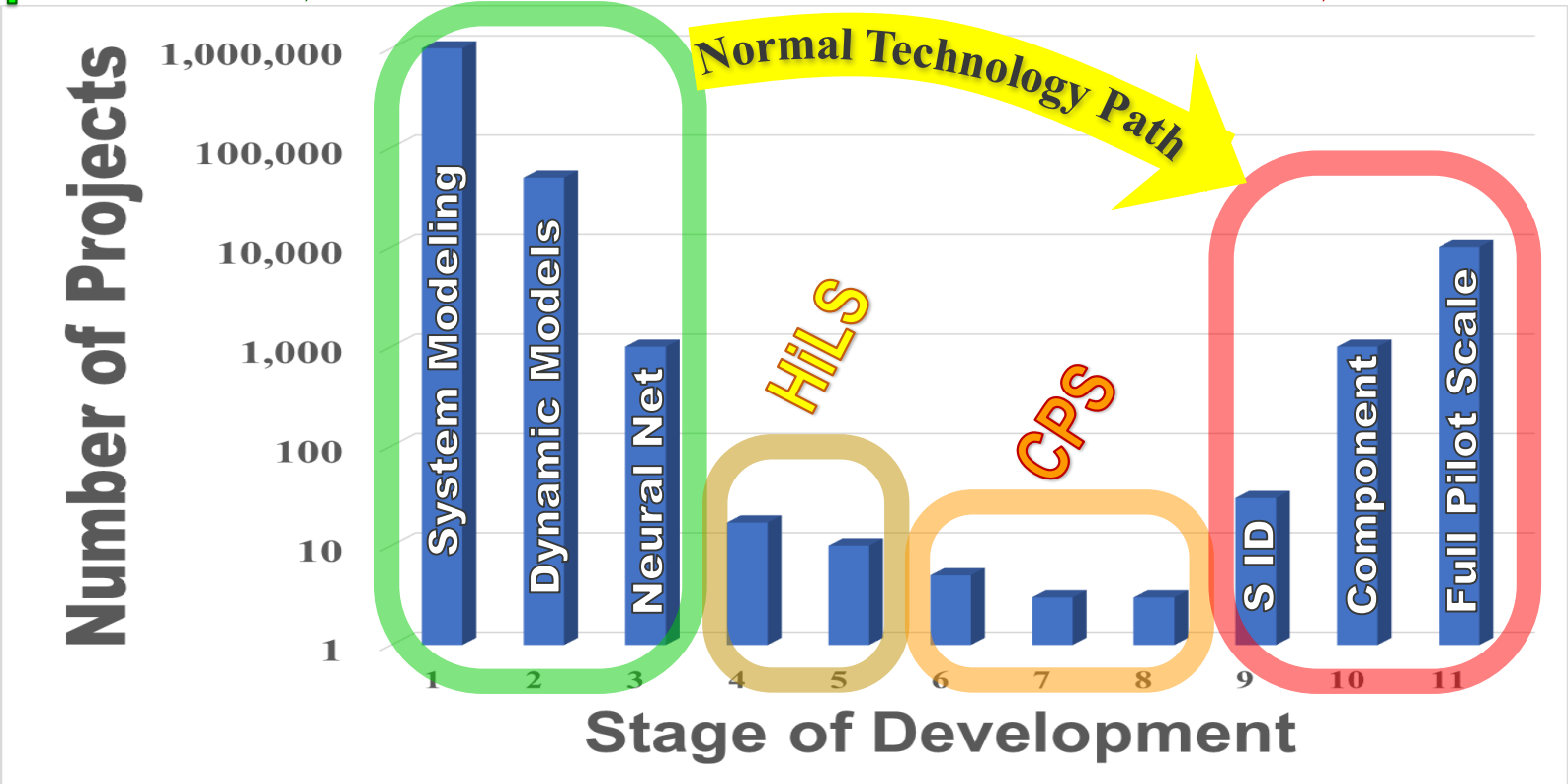
1. Conduct Initial Assessments
 - a. Engineering
 - b. Environmental
 - c. Economic
 - d. Legal
2. Technical Assessment
3. Conceptual Costs and Schedule
4. Summarize Results
5. Management Direction

1. Fuel Type/Availability
2. Technical Risk
3. Controls Development
4. Uprate Capability
5. Time to Construct
6. Emissions
7. Reliability, Availability, Maintainability
8. Footprint
9. Delivery Schedule
10. Delivery Logistics
11. Cycling Capability
12. Fuel Flexibility
13. Equipment Costs

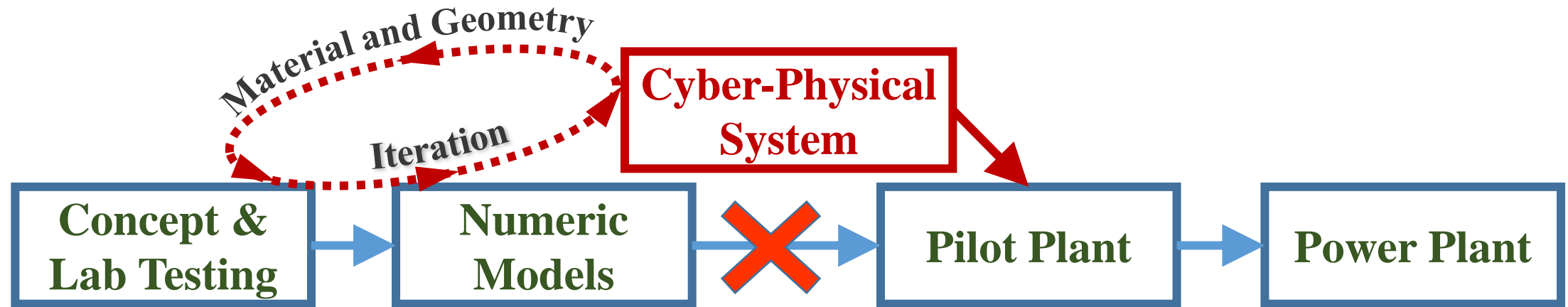
Technology Development Resources



Technology Development Valley of Death



Technology Development Pathways



Technology Development Capital Costs



Siemens Westinghouse pilot demonstration
220kW SOFC/GT Hybrid

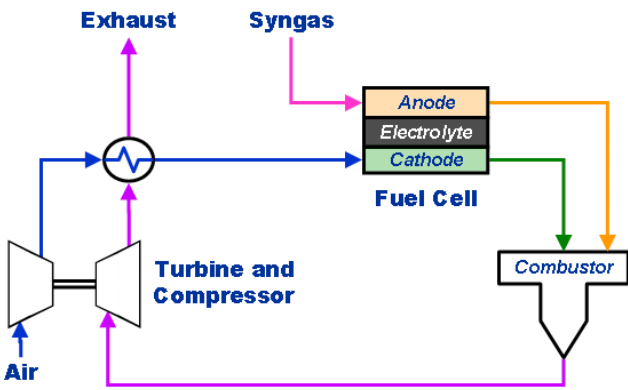
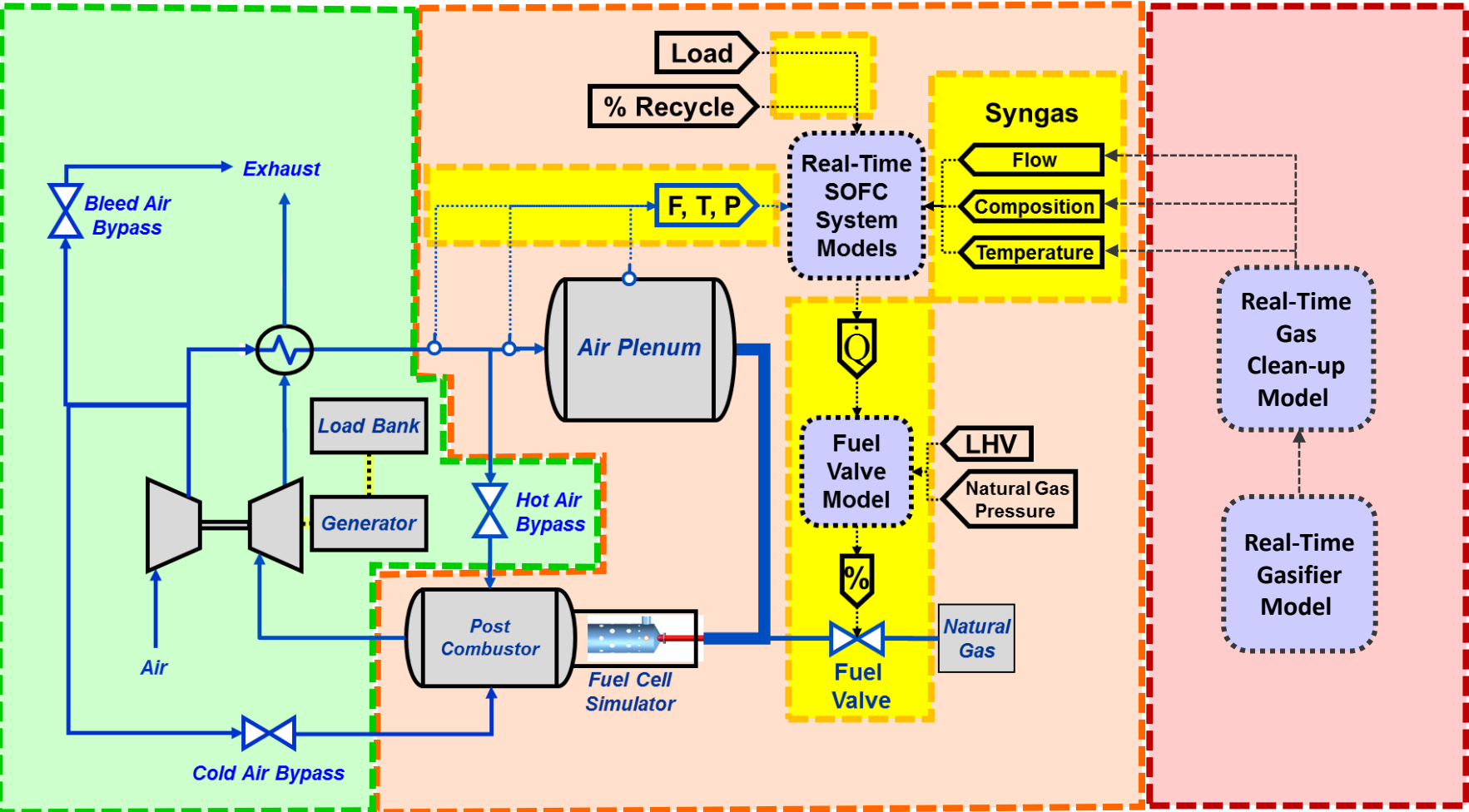
Cost: ~\$10 M



NETL cyber-physical system
400kW SOFC/GT Hybrid

Cost: ~\$1 M

Technology Development CPM Example



Interface and Middleware



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Thank You

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