Hype Cycle for Intelligent Grid Technologies

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Environmental Issues are Getting on the Main Stage

- In 2006, 29% of the anthropogenic CO2 emissions came from the power sector.
- With BAU, it will go to 38% by 2030.
- Options:
  - Supply side: Renewables, Nuclear, CCS, Natural Gas
  - Demand side: energy efficiency, DER
- CO2 emissions is now a business issue:
  - Legislation to limit emissions likely
  - Cap and Trade, Carbon Disclosure Project, Liability

CEO and Board: What is the risk? Are we doing enough?
Consumers: What can I do? How is my utility company helping?

Regulatory Sentiment and Consumer Attitude

Environmental concerns are forcing governments to address energy sustainability by:

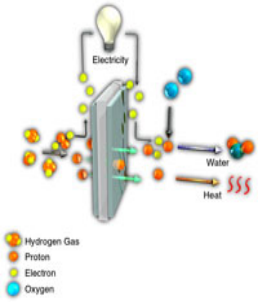
- Promoting/mandating (RPS) investment in "renewables"
- Encouraging utilities to offer and consumers to participate in energy efficiency programs

The **EU** announced plan 20% renewable 20% CO2 emission reduction 20% consumption reduction by 2020.

President Obama energy/environment vision:
25% renewable by 2025
80% CO2 emission cut by 2050

"Environmentally enlightened" consumers are getting into the driver's seat by:

- Participating in energy-efficiency programs
- Deploying renewable distributed energy resources



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Energy Technology Consumerization: Power to The People

Old Model: Reactive

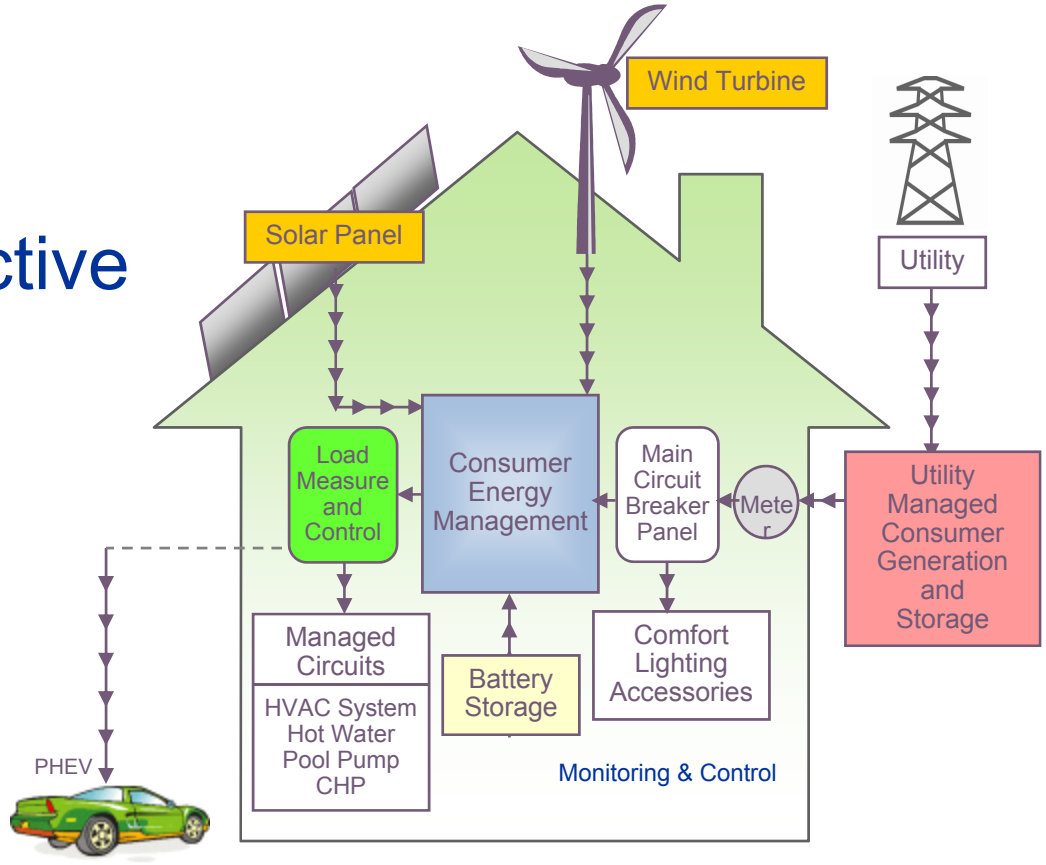
- Demand-Side Management

Current Model: Corrective

- Demand Response

Future Model: Active

- Consumer Energy Management



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Intelligent Grid Provisions of US Title XIII of the Energy Independence and Security Act of 2007

a reliable and secure electricity infrastructure that can meet future demand growth and to achieve each of the following, which together characterize a Smart Grid:

1. Increased use of digital information and controls technology to improve reliability, security, and efficiency of the electric grid.
2. Dynamic optimization of grid operations and resources, with full cyber-security.
3. Deployment and integration of distributed resources and generation, including renewable resources.
4. Development and incorporation of demand response, demand-side resources, and energy-efficiency resources.
5. Deployment of “smart" technologies (real-time, automated, interactive technologies that optimize the physical operation of appliances and consumer devices) for metering, communications concerning grid operations and status, and distribution automation.
6. Integration of “smart” appliances and consumer devices.
7. Deployment and integration of advanced electricity storage and peak-shaving technologies, including plug-in electric and hybrid electric vehicles, and thermal-storage air conditioning.
8. Provision to consumers of timely information and control options.
9. Development of standards for communication and interoperability of appliances and equipment connected to the electric grid, including the infrastructure serving the grid.
10. Identification and lowering of unreasonable or unnecessary barriers to adoption of smart grid technologies, practices, and services.

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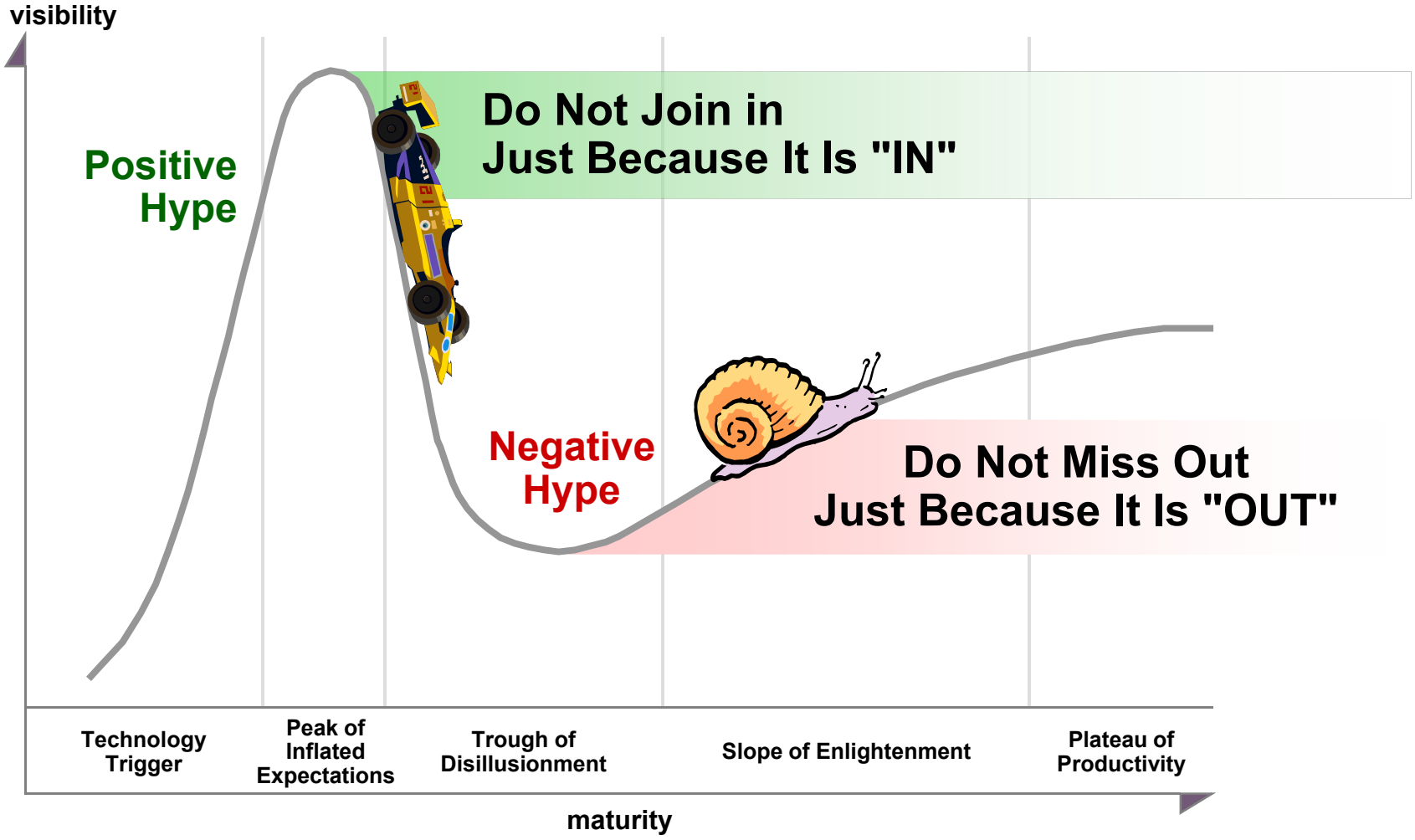
Main Interpretation of the Hype Cycle



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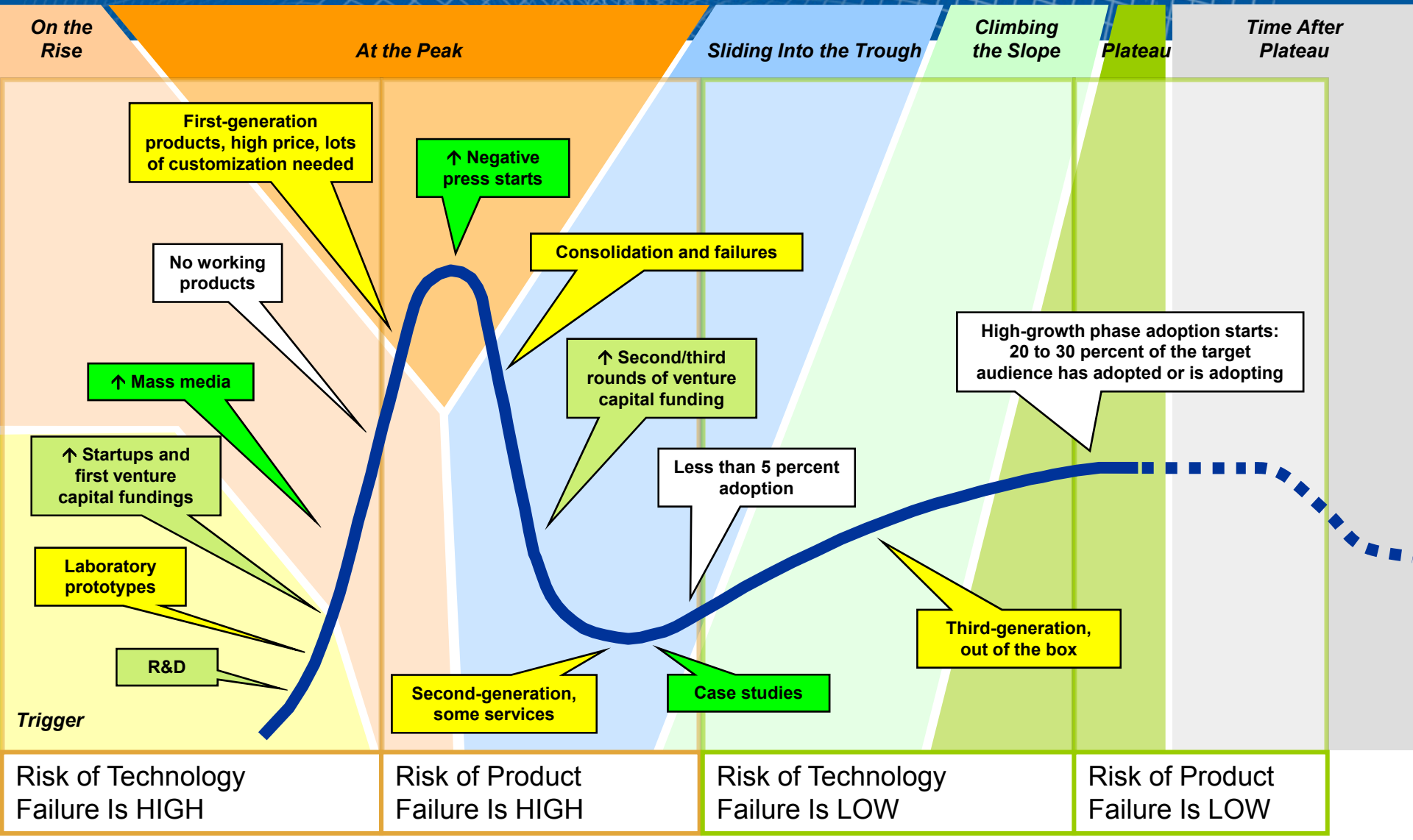
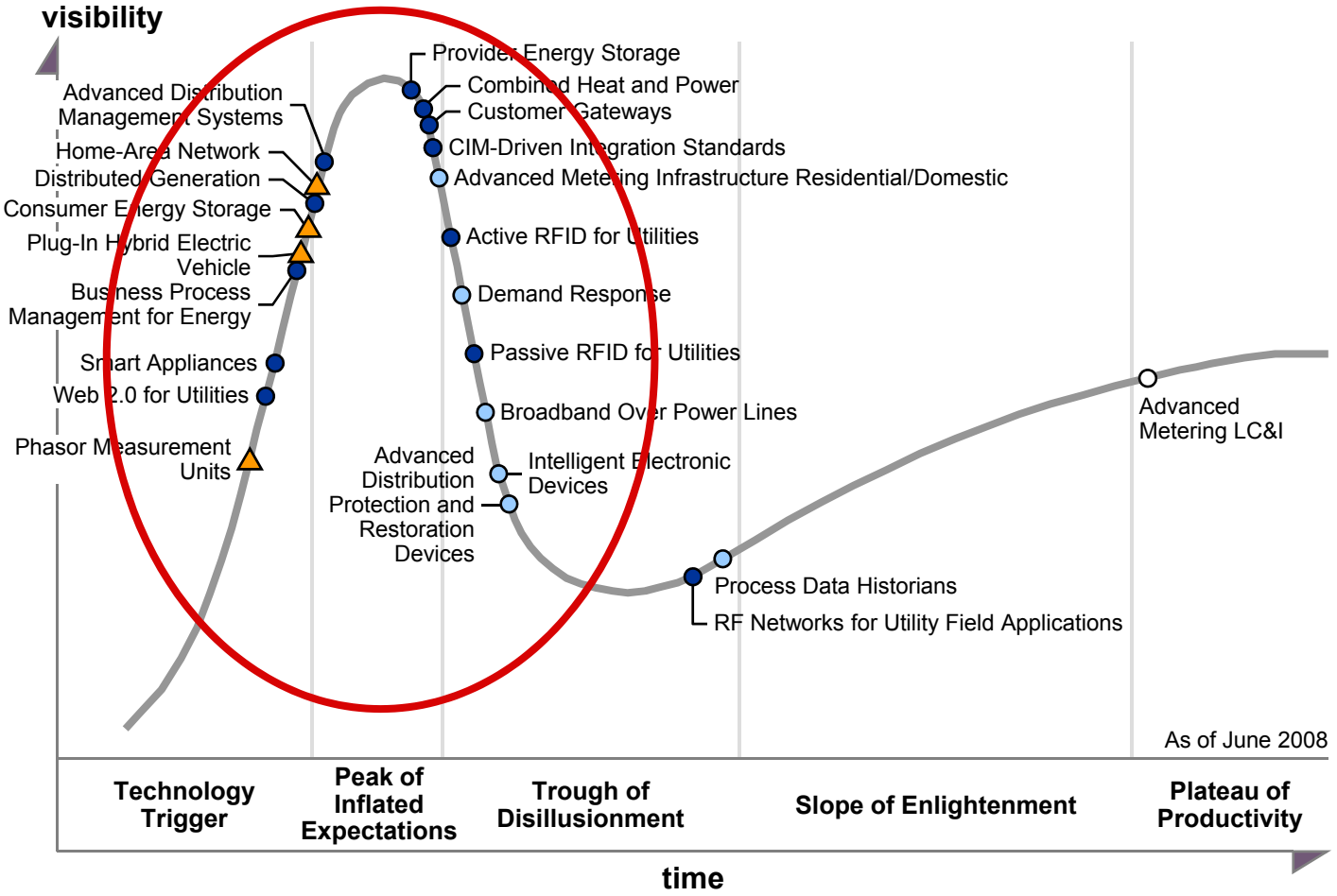
Some Hype Cycle Forensics



Intelligent Grid Technology Hype Cycle



Years to mainstream adoption:

○ less than 2 years ◔ 2 to 5 years ● 5 to 10 years △ more than 10 years ⊗ obsolete before plateau

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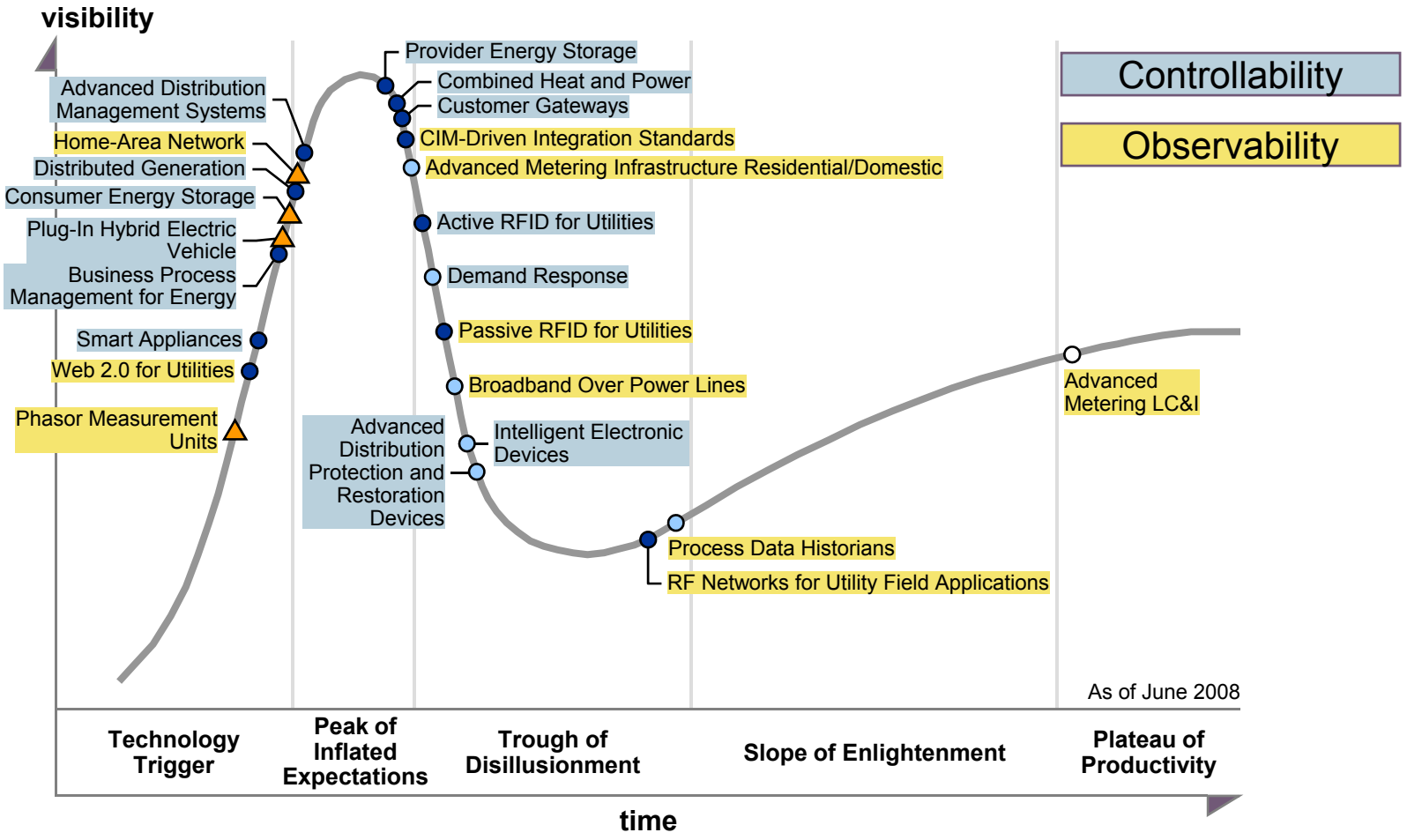
Intelligent Grid Technology Hype Cycle



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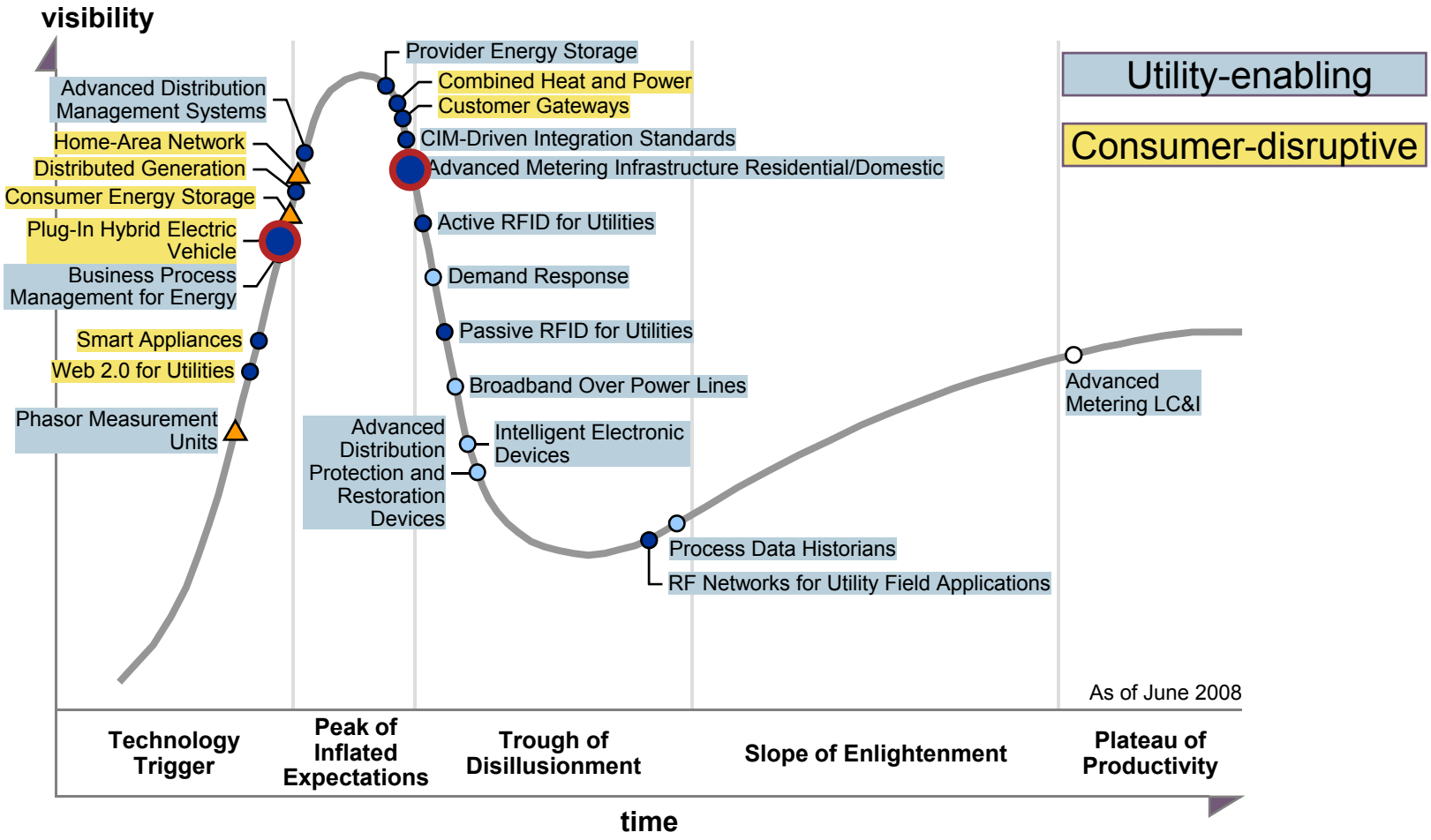
Intelligent Grid Technology Hype Cycle



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Priority Matrix: What's Coming; When and How Hard Will It Hit?

benefit	years to mainstream adoption			
	less than 2 years	2 to 5 years	5 to 10 years	more than 10 years
transformational		Advanced Metering Infrastructure Residential/Domestic Demand Response	Distributed Generation	
high	Advanced Metering LC&I		Business Process Management for Energy Combined Heat and Power Customer Gateways Web 2.0 for Utilities	Consumer Energy Storage Phasor Measurement Units Plug-In Hybrid Electric Vehicle
moderate		Advanced Distribution Protection and Restoration Devices Broadband Over Power Lines Intelligent Electronic Devices Process Data Historians	Active RFID for Utilities Advanced Distribution Management Systems CIM-Driven Integration Standards Passive RFID for Utilities Provider Energy Storage RF Networks for Utility Field Applications Smart Appliances	Home-Area Network
low				

As of June 2008

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Recommendations

- Advocate a joint ownership of an intelligent grid initiative across the enterprise, but aware that it may impede decision making.
- Approach IG initiative as an enterprise architecture exercise to obtain a coherent "common requirements vision," with key architectural principles, an intelligent grid master plan and, eventually, an implementation road map.
- Be aware that conflict between open innovation and intellectual property (IP) protection is exacerbated in vendor-sponsored intelligent grid collaborative initiatives.
- Use AMI deployment as a proxy for a more strategic intelligent grid initiative and can identify numerous issues, including governance, security, collaborative engagement models and IP ownership.
- Establish clear intelligent grid project governance, starting from top-level executive sponsorship, and involve stakeholders from different business units that can benefit or be affected by it.
- Evaluate the impact of the intelligent grid on security.
- Institute a technology watch function, and monitor the maturity and adoption of technologies that enable the intelligent grid.