ARRA Smart Grid Project Review and Analysis: Lessons for China

ARRA Background

China has growing interest and efforts in microgris and smart grid, but...

China's efforts	Problems
Well-developed transmission and some distribution technologies	Poorly developed electricity market, so cost-effective technologies are not deployed
Rapid development of large-scale central station renewables	Weak in distributed generation
Government requested microgrid demonstration projects	Many demos. are not successful or not really carried out • Lacking expertise from local government • Limited funding from central government

Increasing collaboration on smart grid between U.S. and China
e.g. US-China Climate Change Working Group, Smart Grid

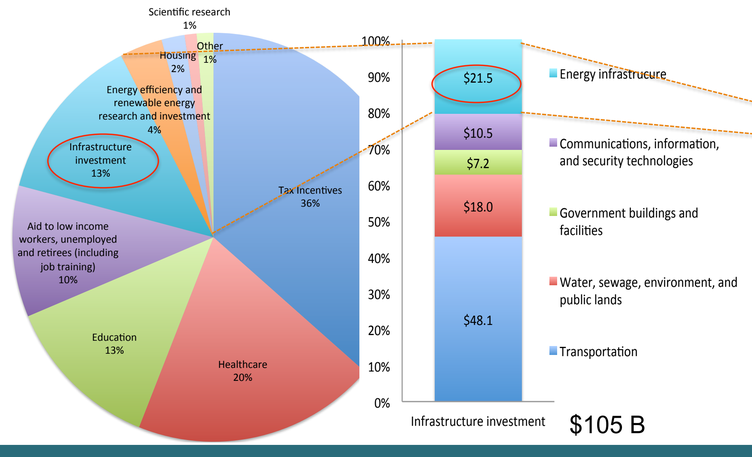
The American Recovery and Reinvestment Act (ARRA)

Signed early in Obama Administration, on 17 February 2009

To jumpstart the economy, save and create jobs, and build the foundation for long-term economic growth.

Overall government budget ~$800 billion

ARRA
American Recovery and Reinvestment Act of 2009



Smart Grid $4.5 billion

The $4.5 billion federal investment through ARRA was matched by smart grid award recipients through cost share with a total of $5.6 billion to reach a total investment of nearly $10 billion.

Funding Allocation of the ARRA Smart Grid Program

Government Funding Allocation

Type	Amount	# of Projects
Smart Grid Investment Grant (SGIG)	$3.48 Billion	99
Smart Grid Demonstration Program (SGDP)	$0.68 Billion	16 regional
		16 storage
Others	$0.32 Billion	

32 SGDP projects – demonstration of integrating advanced technologies

More innovative and comprehensive projects than SGIG

- ❖More reporting
- ❖Focus on advanced metering infrastructure (AMI); customer systems, i.e., in-home displays, direct load control devices, smart appliances, etc.; and dynamic pricing; but also distributed energy resources; transmission and distribution system technologies and energy storage

SGDP Recipients by Recipients Type

Recipients Type	# of Projects
Investor-owned Utilities	13
Municipal Utilities	4
Technology and Manufacturing Companies	11
Non-profit Organizations	3
Electric Coops	1

99 SGIG projects - deployment demonstrations and infrastructure improvements

- ❖Less innovative content
- ❖AMI, demand response, and transmission focused
- ❖Weaker reporting requirements
- ❖Only one legitimate microgrid project

Case Study of the Salem (Oregon) Microgrid

Battelle – Pacific Northwest Smart Grid Demonstration

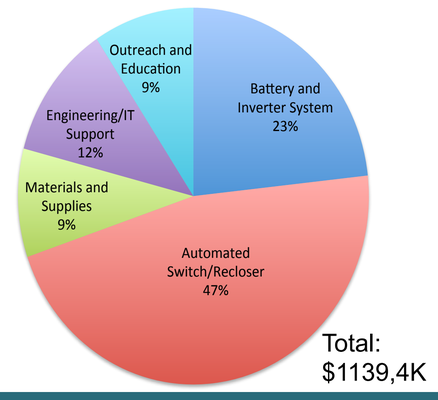
Sub-project: **Portland General Electric Site Tests**

Portland General Electric installed a microgrid ensuring about 500 commercial and retail customers maintain power during blackouts. The new 740 m^2 Smart Power Center houses the controls and batteries, and the PV array is nearby.

Portland General Electric tested microgrid technologies, batteries to transition to island operation. Installed at the Salem Smart Power Center are a grid-tied 5 MW × 1.25 MWh lithium-ion bank of electric vehicle batteries controlled by CAN-BUS, and it was one of two operated by an investor-owned utility.

Footprint of the Salem Smart Power Project, including its potential microgrid resources and switches

Annualized Cost of the Distribution Switching and Microgrid System and its Components



Total: $1139,4K

Findings and Recommendations for China

ARRA Successful Factors

1. **Strong legislation and financial support**
   Federal government support came in response to severe recession, i.e. stimulus needed
2. **Basis already existed, (technology & legislation)**
   Technology was ready: clear definition of smart grid existed in legislation, sought *shovel-ready* projects
3. **Competitive electricity, ancillary services, and demand response mechanisms in place**
   A market environment allows companies to recover costs and capture benefits from smart grid technologies, such as volt-VAR control, PV, etc.
4. **Motivation of matching fund sources**
   Main sources of matching funds were utilities and technology vendors, although some local government.

5. **Scientific reporting and dissemination**
   Interim and final technical reports all posted at https://www.smartgrid.gov
   Performance data based on metrics developed by the U.S. Dept. of Energy
   Federal government website shows ARRA smart grid projects materials, all freely available to the public
   A cost-benefit framework provided by the Electric Power Research Institute and DOE, though few projects have used it

Recommendations for China

1. **China needs a real electricity market**
   To link generation, transmission, and distribution, and involve consumers
   Market mechanisms and price signals essential
2. **China needs to learn from US on transparency**
   Performance reporting needs to be public
   Data generally difficult to obtain in China
3. **China can do better than US**
   Stronger monitoring and reporting requirements and implementation possible
   More comprehensive cost-benefits analysis possible
   Phased funding possible

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