

Micro Grids:

Fundamentals, Thoughts, Moving beyond Economics(?)

May 06, 2014

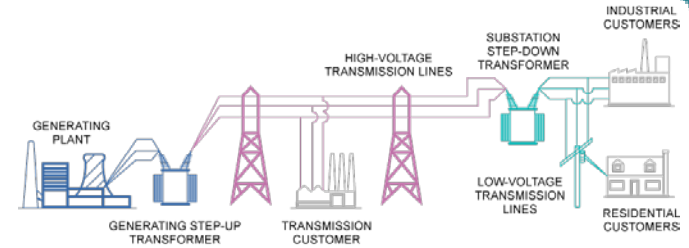
by

David Goodman, Ph.D., CEA

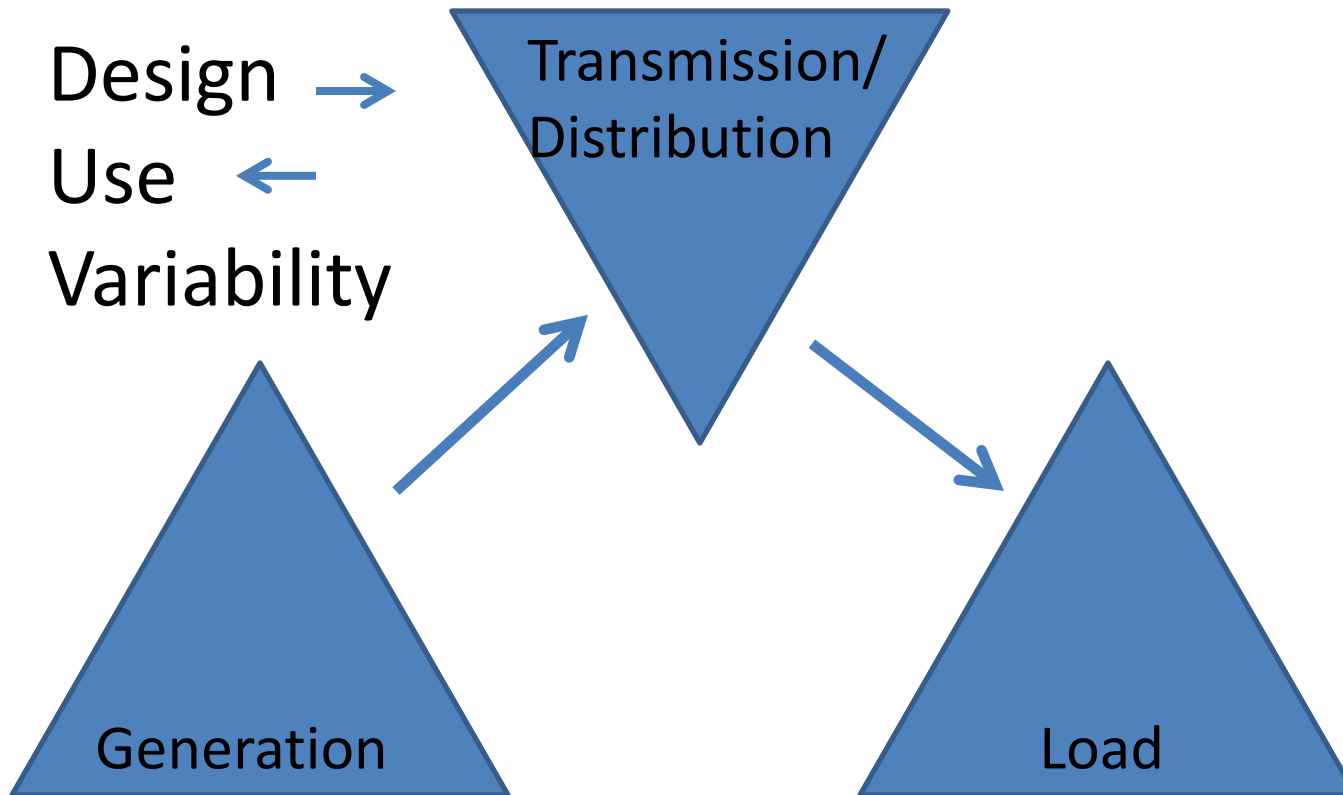
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Fundamentals

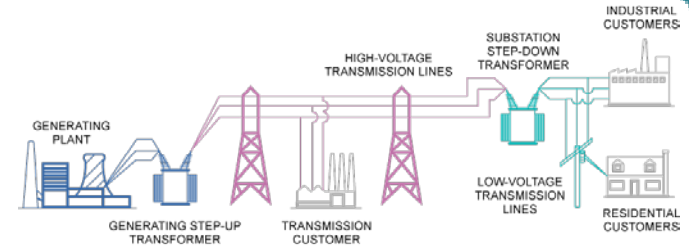


- Design →
- Use ←
- Variability

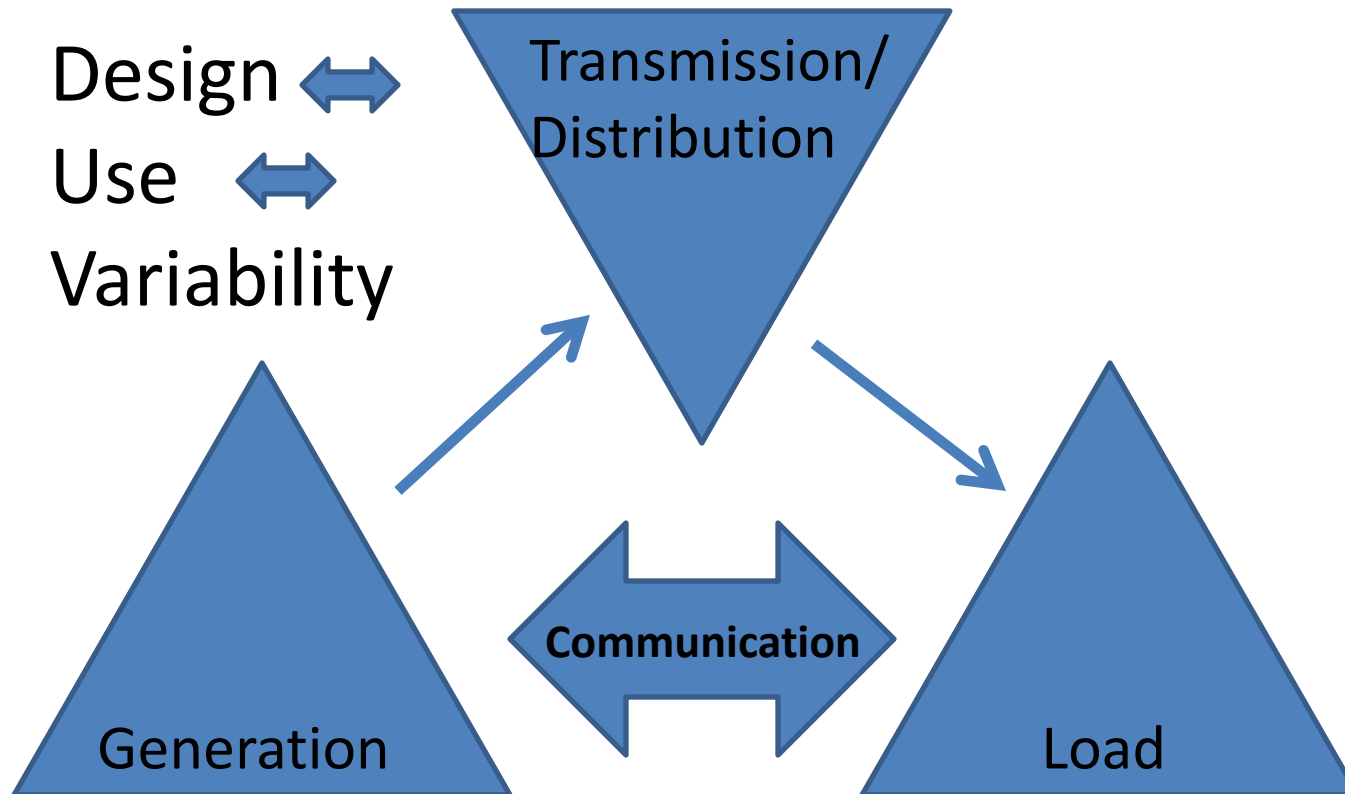


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Fundamentals

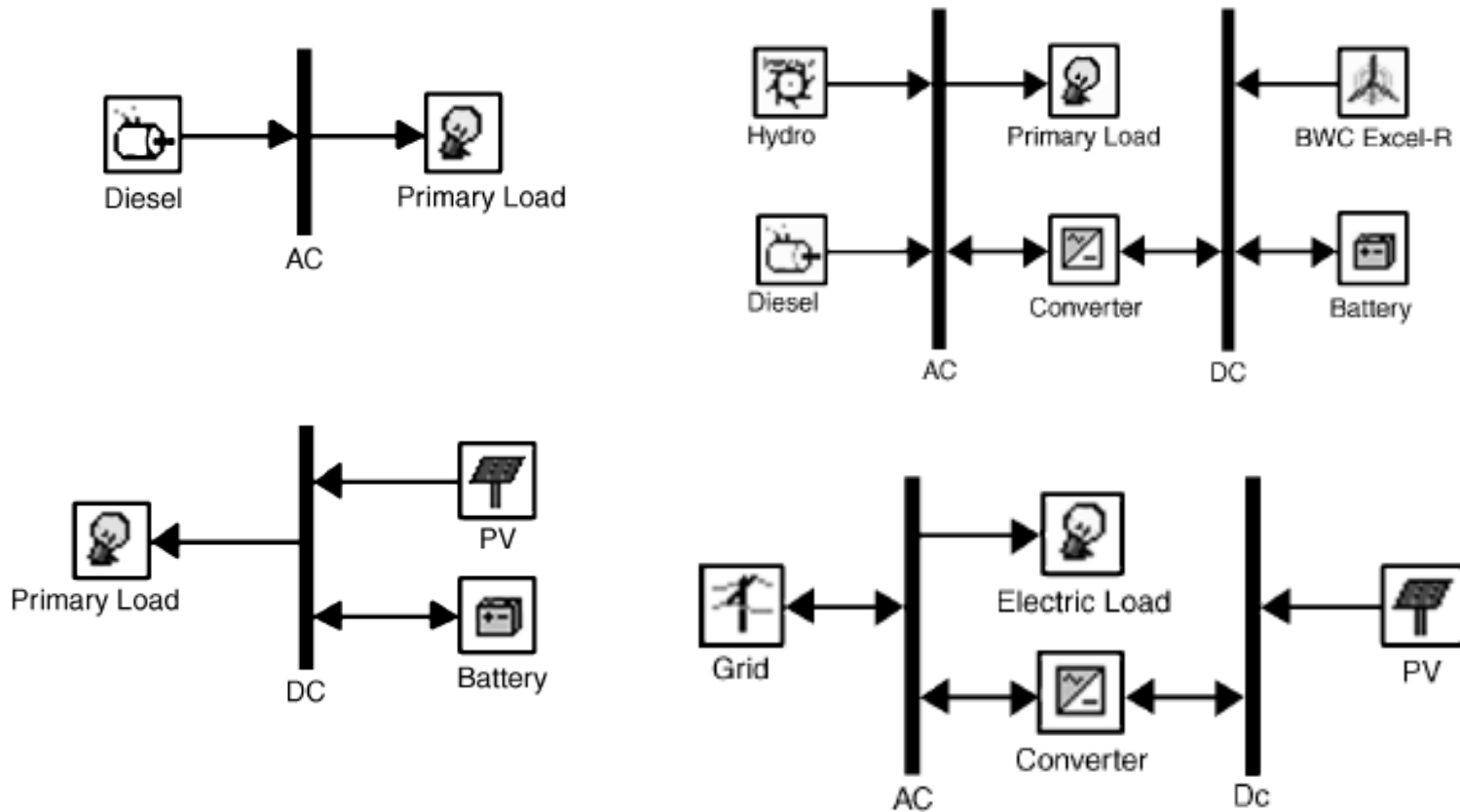


- Design ↔
- Use ↔
- Variability



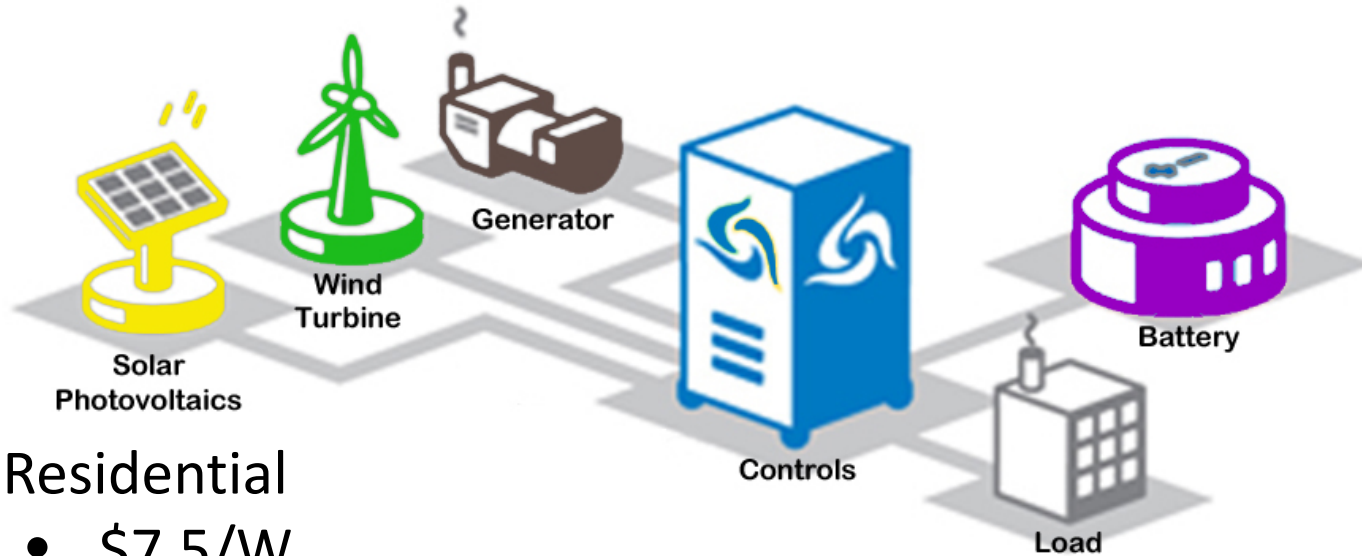
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System Examples



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System Examples



- Residential
 - \$7.5/W
- Commercial
 - \$5.5/W
- Utility
 - \$3/W
- Compare
 - Retail \$1 ~ 5-6¢
 - Wholesale Cayuga ~ 1.5 ¢

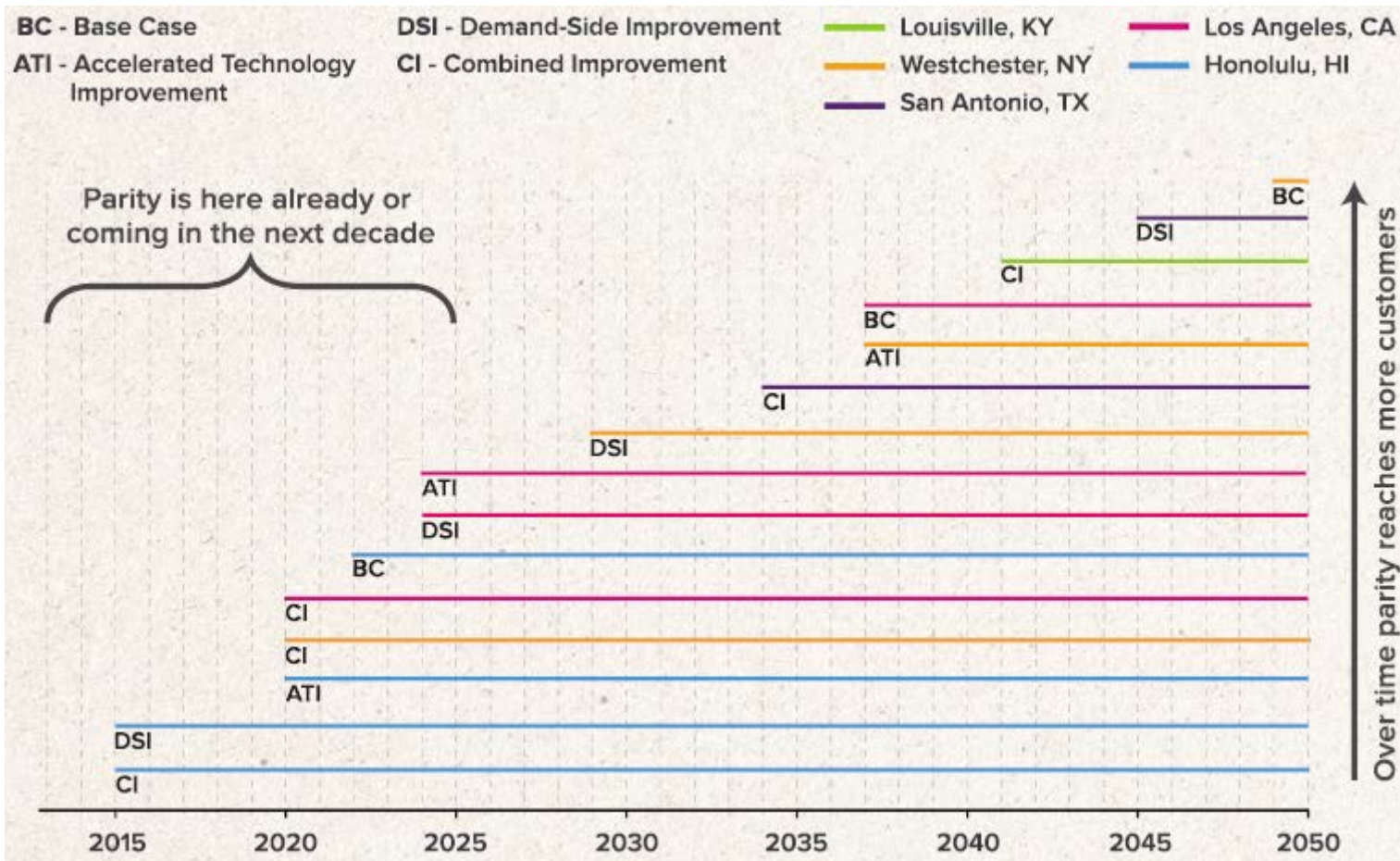
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Cost Justification (RMI-Homer)

	 WESTCHESTER, NY	 LOUISVILLE, KY	 SAN ANTONIO, TX	 LOS ANGELES, CA	 HONOLULU, HI
INSOLATION (kWh/m ² /day)	4.5 kWh	4.5 kWh	6 kWh	6 kWh	5.5 kWh
2012 AVG RETAIL PRICE (\$/kWh)	\$0.15–\$0.20	\$0.06–\$0.08	\$0.05–\$0.09	\$0.09–\$0.17	\$0.34–\$0.41
Installed PV (MW)	122.02 MW	2.92 MW	131.16 MW	2074.53 MW	27.33 MW
MARKET STRUCTURE	Deregulated	Regulated	Deregulated	Deregulated	Regulated

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Cost Justification (RMI-Homer)



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Cost Justification (is that it?)

- Rationale
 - Car
 - Phone
- Benefits
 - Stability
 - PF (Canada: Whitby Hydro)
 - Reliability
 - New Service/Profits
 - ESCO or Utility



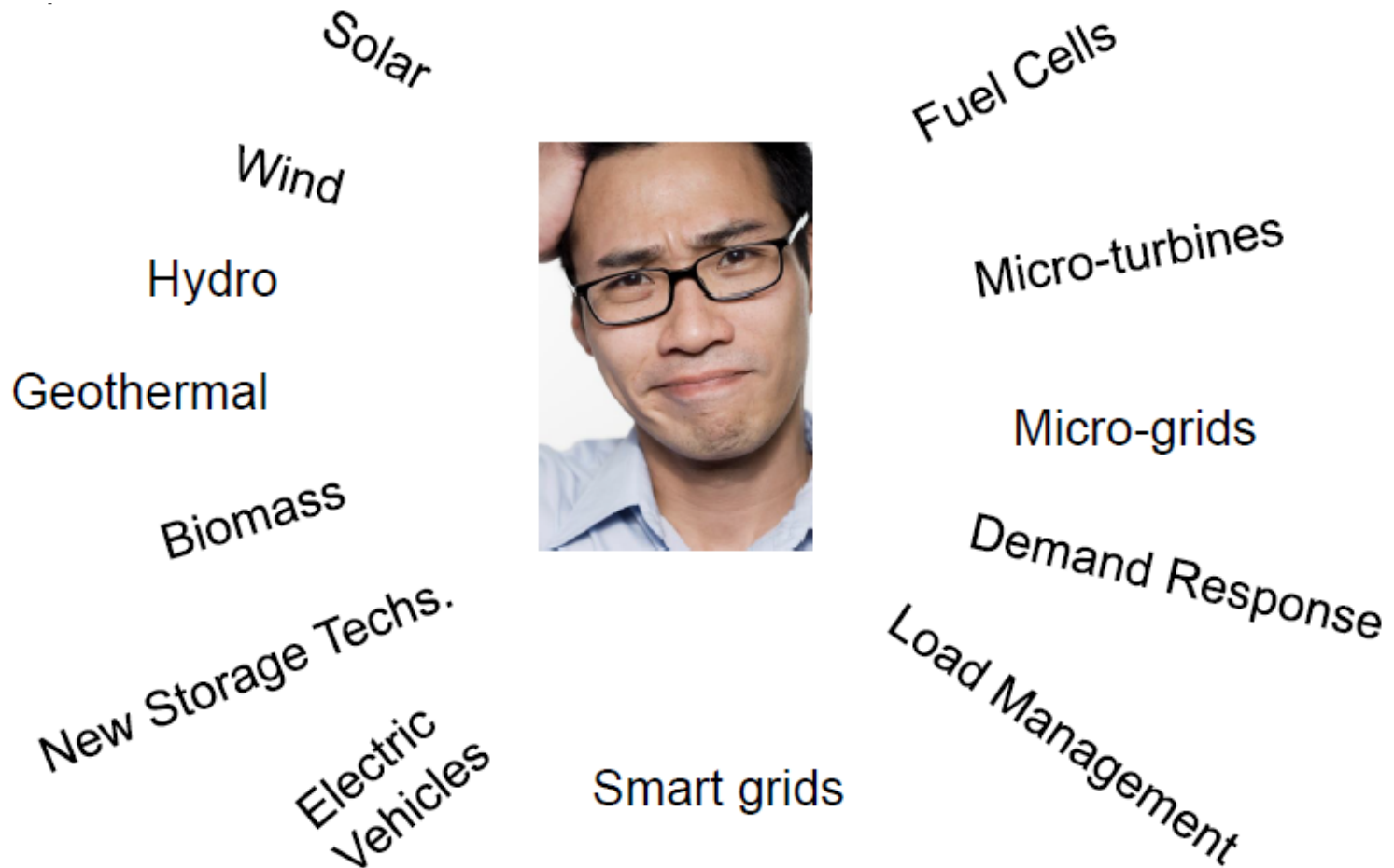
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Reliability (customer service)

Major Blackouts			
Date	Cause	People	Duration
October 2012	Hurricane Sandy	8.2 Million (17 states)	~ 14 days
June 2012	Derecho Storm	4.2 Million (11 states)	~ 10 days
October 2011	Snow Storm	3 Million (~10 states)	~ 10 days
September 2011	Heat & Error	2.7 Million (2 states)	~ 12 hours
August 2003	Trees & Error	55 Million (8 states)	~ 4 days

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New Service/Profits



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Utility/ESCO

- Utility
 - Must deal with Downsides
 - New service = New \$\$\$
 - Service = Data = Reduced Variability
 - Capital Intensive – Rates Guaranteed
- ESCO
 - New service = New \$\$\$
 - Capital Intensive – Subsidies highly variable

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My Thoughts

- What do you think?

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