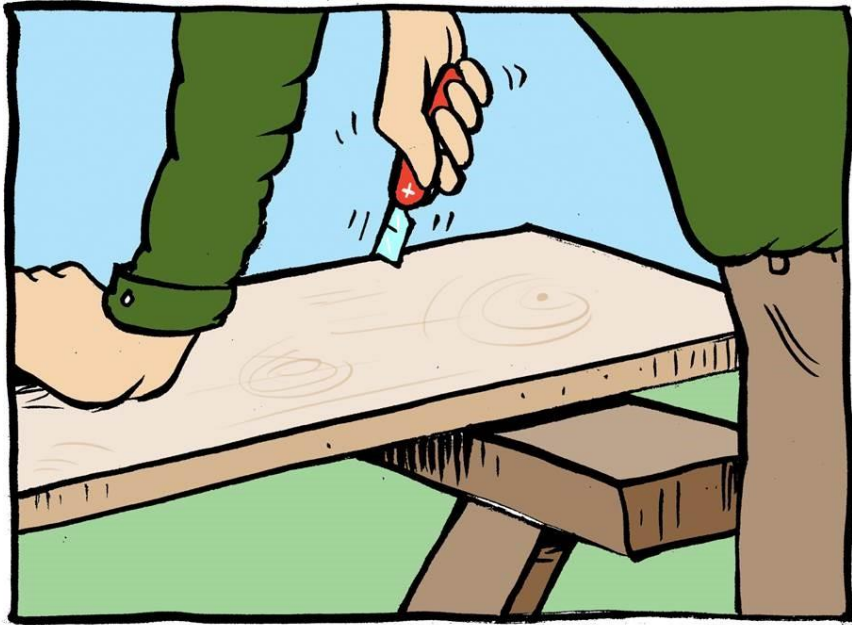
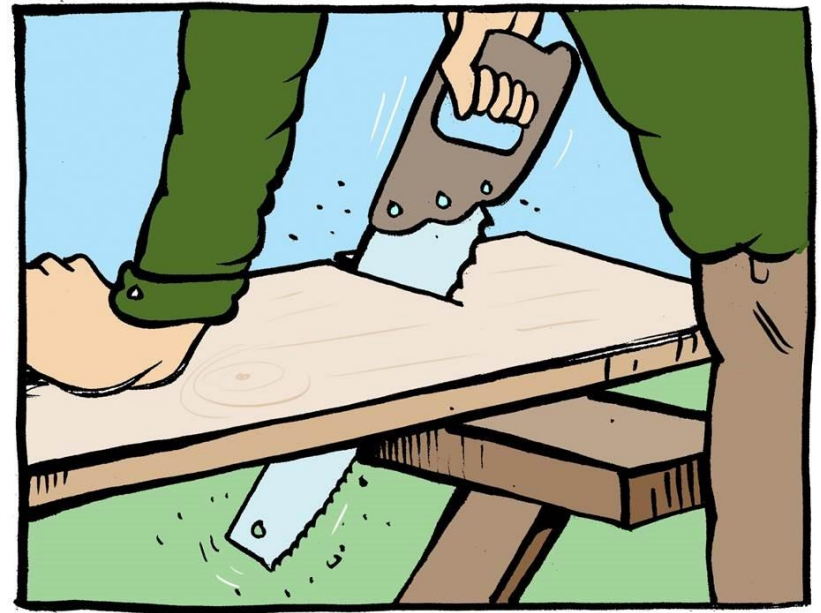




VS.



Do we really want
a toolbox full of
Swiss army
knives???





RAPTM

Energy solutions
for a changing world

Smart Gas Investment: How Many Swiss Army Knives do We Need?

Dr. Carl Linvill, Principal
Regulatory Assistance Project

RAP Webinar
July 9, 2015

The Regulatory Assistance Project

50 State Street, Suite 3
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Our Experts



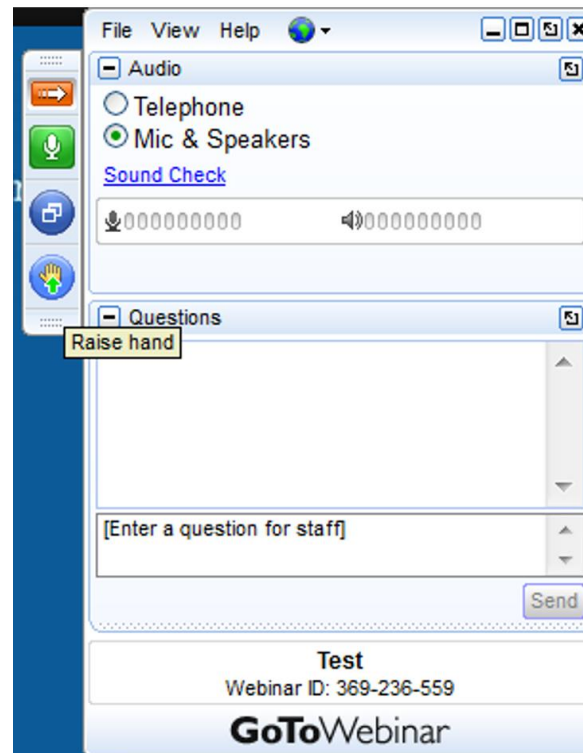
Speaker:
Carl Linvill, Principal



Moderator: Richard Sedano,
Principal and US Programs Director

Housekeeping

Please send questions through the Questions pane.



Overview

- Inexpensive gas could be a blessing or a curse
- Three low-carbon pathways often posited
- I don't own a tool box full of Swiss army knives, how about you?
- Stranded investment risk
- An algorithm for limiting stranded costs

Some people are really excited about gas

More than \$500 Billion investment in gas generation and midstream infrastructure needed by 2035

- EIA (2014) and INGAA (2014)

Inexpensive gas is a blessing, but may be a curse

- Current low gas prices are an economic boost
- Over-commitment to long-term gas investment can become a stranded investment curse

Consider three common low-carbon pathways

- Large-scale RE, much greater grid extension and integration
- Customer resources become very cost effective
- Nuclear and fossil with CCS

Under the first two pathways, large-scale gas investment will become stranded

- Marginal analysis based on incremental change from current conditions may indicate gas investment
- Transformational change of the path 1 or 2 variety will render those investments stranded well before end of life

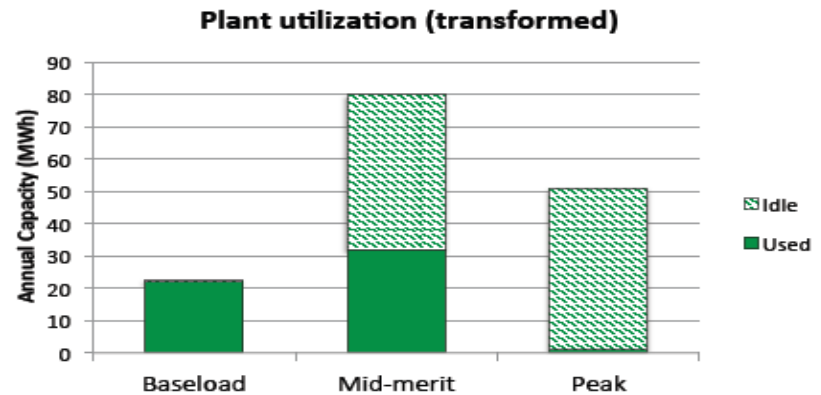
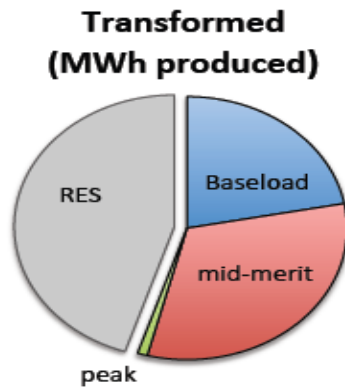
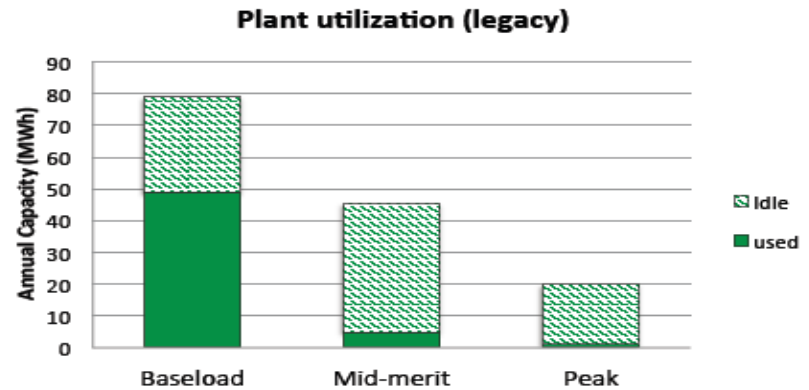
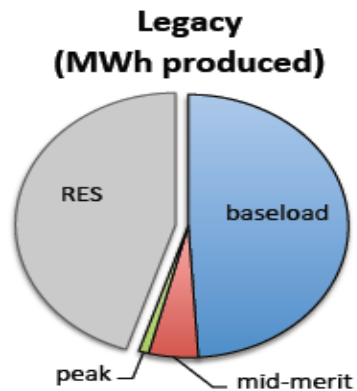
Do you want to
bank on
incremental
change or
pathway 3?



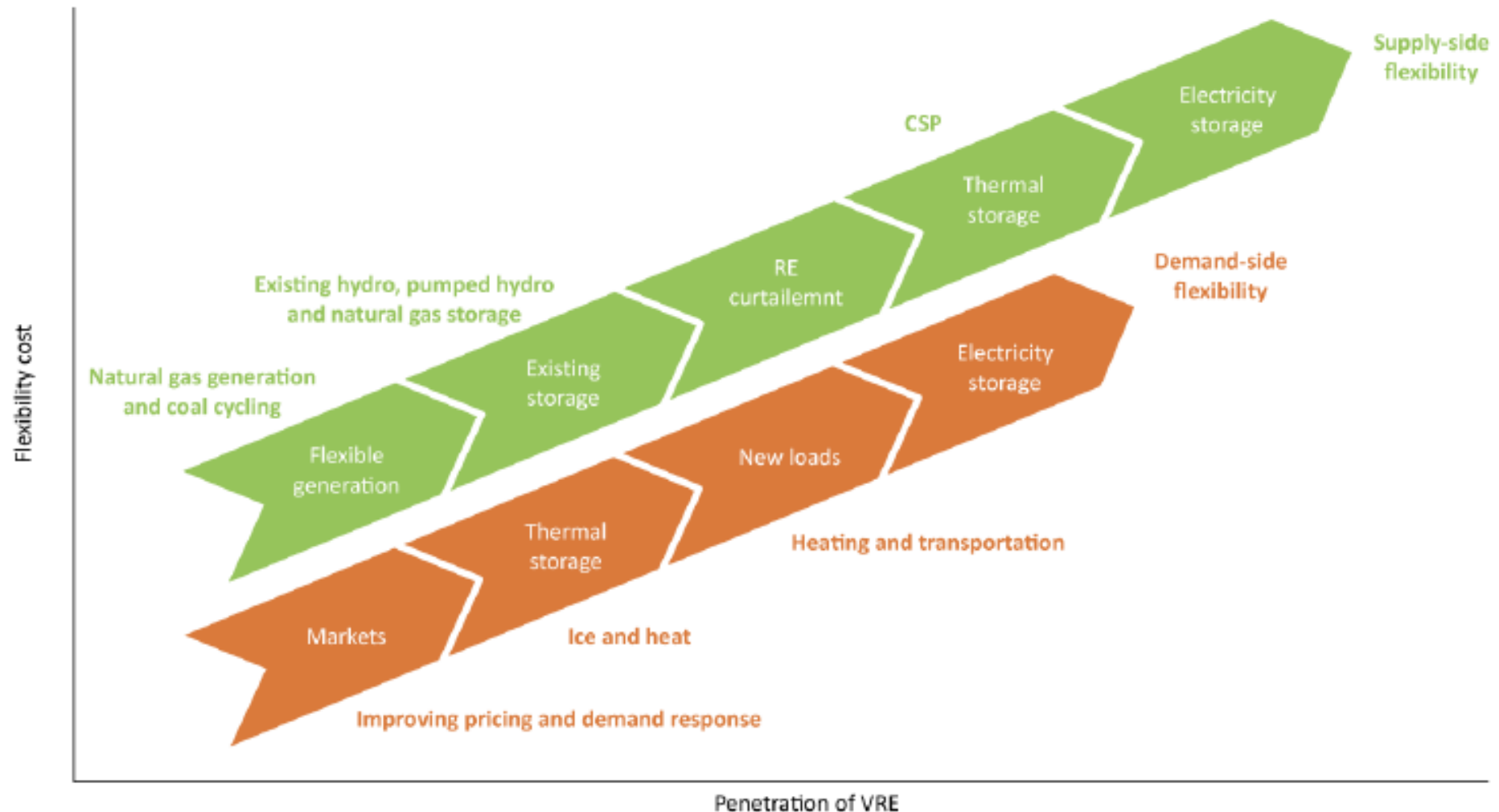
So how much gas do we need?

- For baseload
- For flexibility

Less baseload

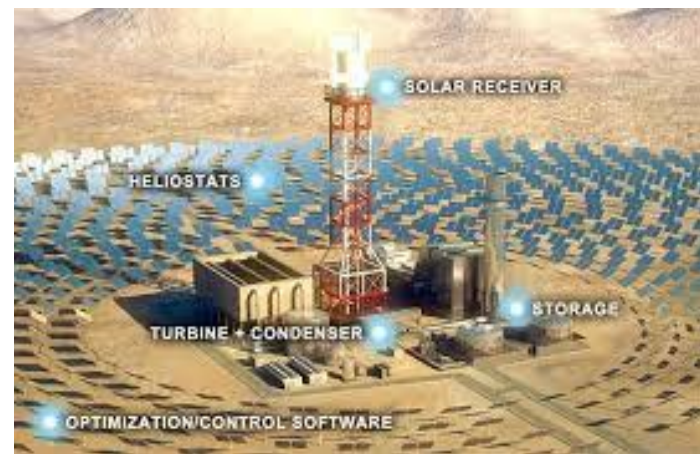
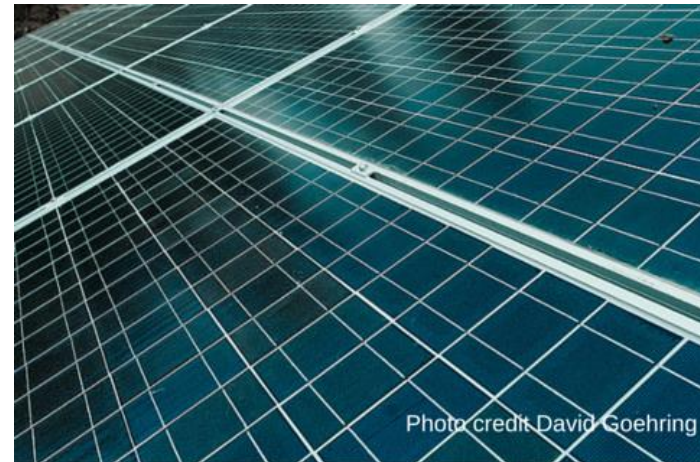


Flexibility comes from many places

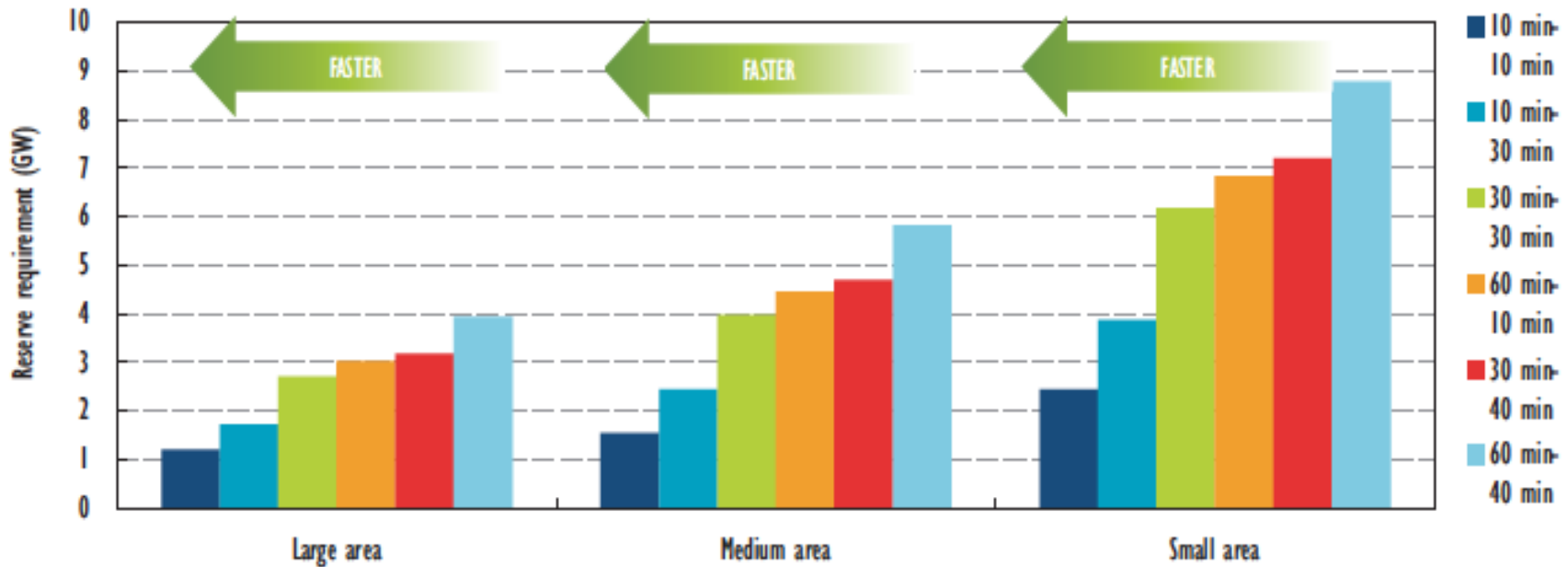


Source: IEA Energy Technology Perspectives 2014

RE: more than just kWh



Larger balancing areas, “faster” markets

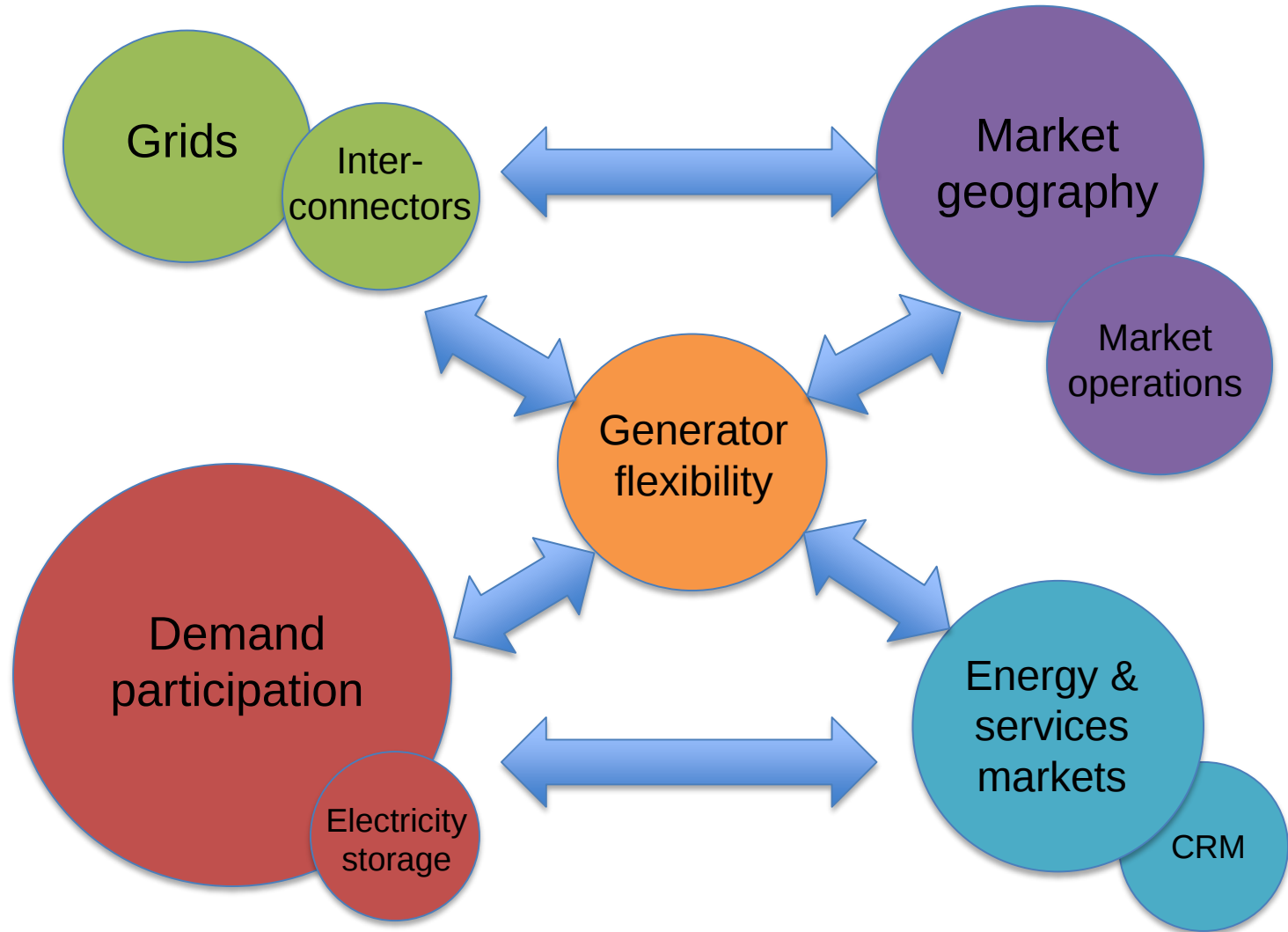


Source: National Renewable Energy Laboratory (U.S.), 2013

Balance control authority over larger geographic footprints:

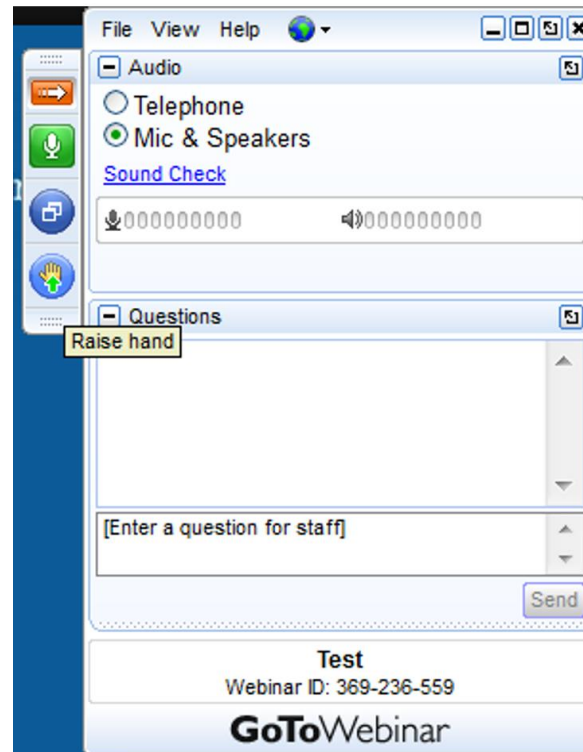
- Reduces variability of demand
- Reduces the impact of individual generator events
- Increases real-time access to balancing resources
- Among other benefits, reduced reserves requirements

So it is really unclear how much gas we will need



Questions

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through the
Questions pane.



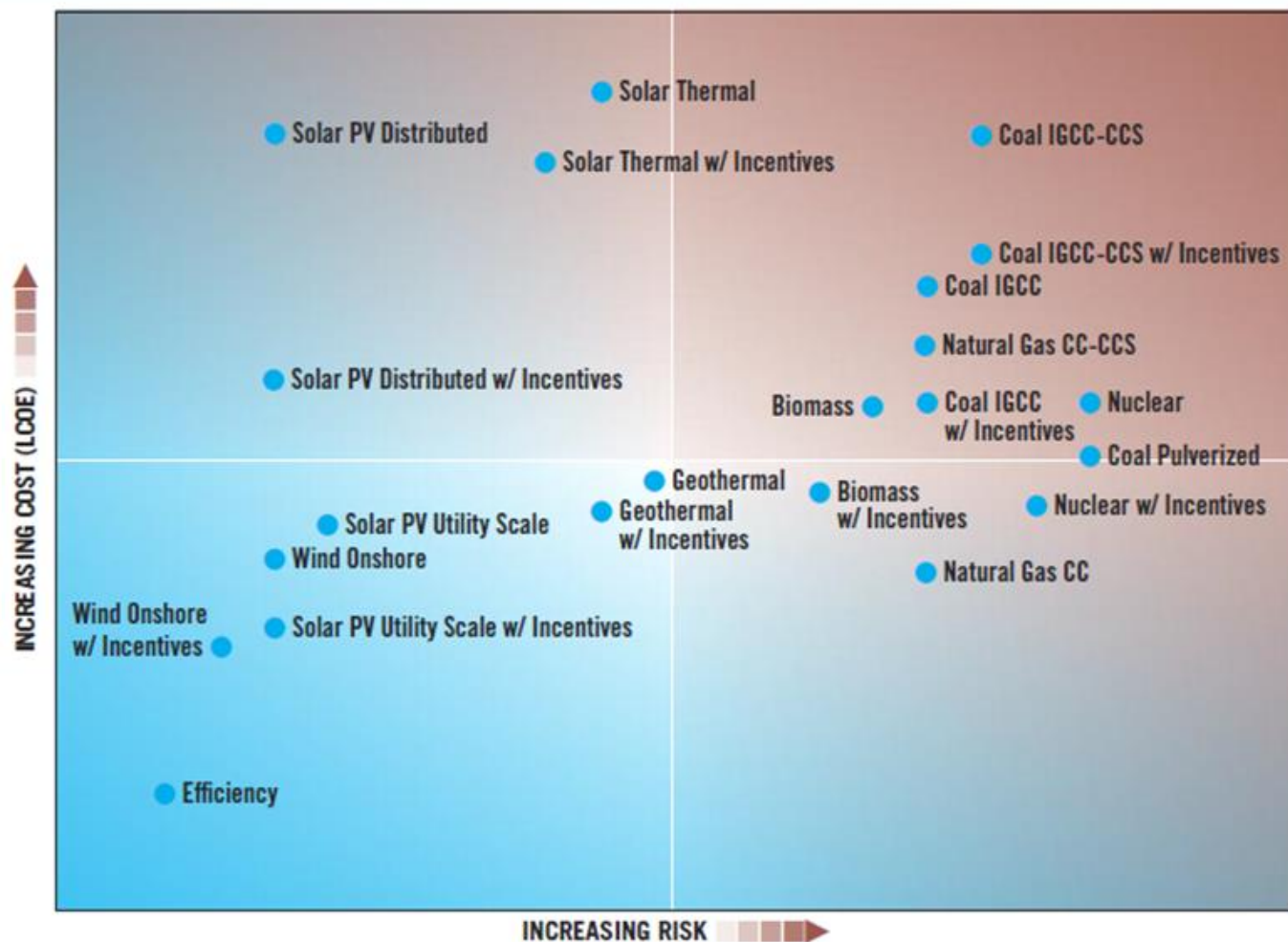
Proposition: Some say, gas is perfect for a time of uncertainty because it's flexible

- I don't own a tool box of Swiss army knives, do you?
- We need to engage in the harder work of being selective on the capabilities that we need gas to fulfill.

Risk-Aware Resource Selection

- Explicit consideration of risk factors is necessary in evaluating portfolios, this is best done as a stakeholder process.
- Here is a sample **qualitative** assessment by Binz, Sedano, Furey, and Mullen (2014):

2014 UPDATE RANKING: RELATIVE COST VS. RELATIVE RISK OF NEW GENERATION RESOURCES

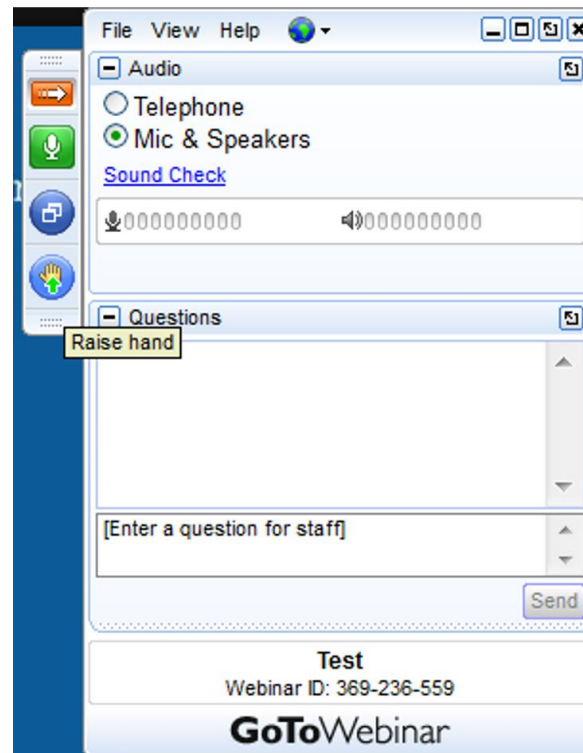


Risk-aware policies support smart gas investment and mitigates stranded cost

1. ICT investment will lay the foundation for DER engagement
2. Invest in system operation and cooperation improvements
3. Make system needs transparent through markets, procurement, and planning
4. Promote resource inclusivity
5. Procure and dispatch cleaner energy resources first
6. Effective permitting of beneficial resources

Questions

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through the
Questions pane.



How much gas do we need?

1. Build an ICT infrastructure foundation
2. Make system needs transparent
3. Promote resource inclusivity
4. Procure and dispatch clean first
5. Facilitate permitting of infrastructure that improves operation and cooperation
6. Then ask the question, how much gas?

Resources

- What Lies Beyond Capacity Markets? (Hogan, Gottstein, (RAP))
<http://raponline.org/document/download/id/6041>
<http://raponline.org/document/download/id/4854>
- More than Smart: A Framework to Make the Distribution Grid more Open, Efficient and Resilient (Resnick Institute, DeMartini)
<http://morethansmart.org/wp-content/uploads/2015/06/More-Than-Smart-Report-by-GTLG-and-Caltech-08.11.14.pdf>
- Demand Response as a Power System Resource (Hurley, et al. (Synapse for RAP))
www.raponline.org/document/download/id/6597
- CAISO DR/EE Roadmap: Maximizing Preferred Resources (CAISO)
<http://www.caiso.com/Documents/DR-EERoadmap.pdf>

More Resources

- Teaching the Duck to Fly (Lazar (RAP))
<http://www.raonline.org/document/download/id/6977>
- Integrating Renewables at Least Cost in the West
<http://www.raonline.org/document/download/id/5041>
- Aligning Power Markets to Deliver Value (Hogan (RAP) for APP)
<http://www.raonline.org/document/download/id/6932>
- Power Market Operations and System Reliability in the Transition to a Low Carbon Economy (RAP)
<http://www.raonline.org/document/download/id/7600>

About RAP

The Regulatory Assistance Project (RAP) is a global, non-profit team of experts that focuses on the long-term economic and environmental sustainability of the power and natural gas sectors. RAP has deep expertise in regulatory and market policies that:

- Promote economic efficiency
- Protect the environment
- Ensure system reliability
- Allocate system benefits fairly among all consumers

Learn more about RAP at www.raponline.org

Carl Linvill
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Global
US
China
EU

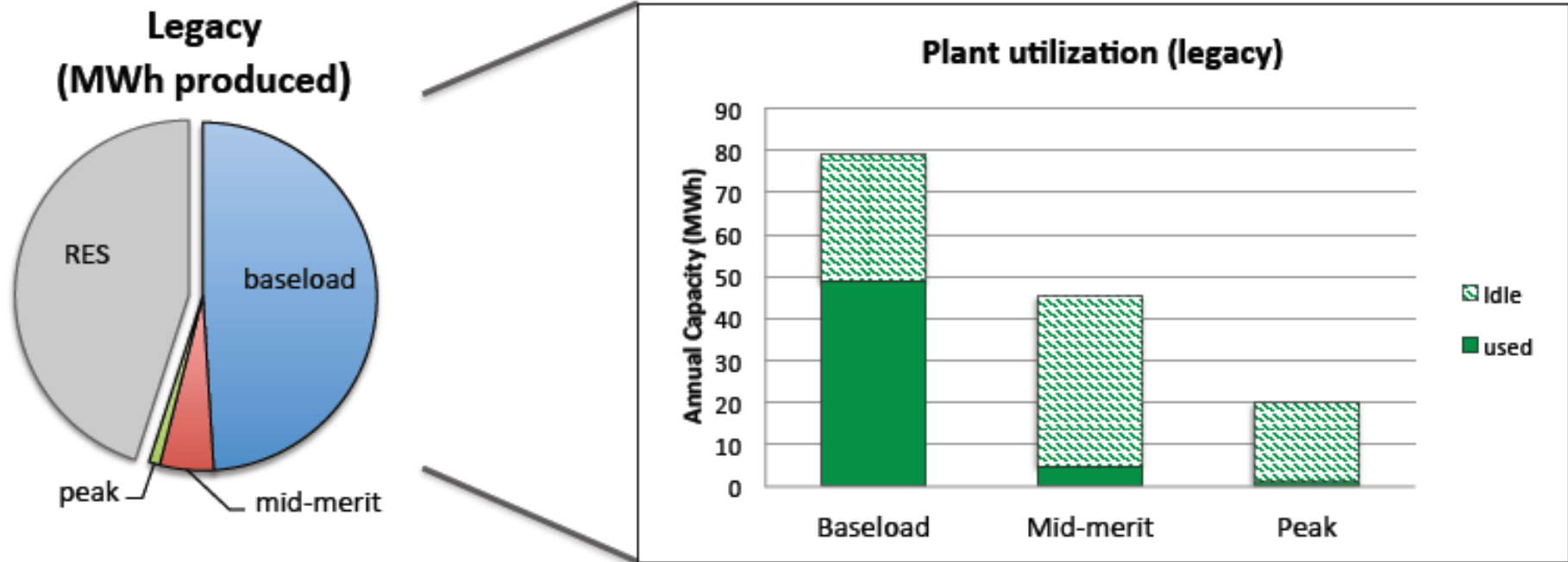
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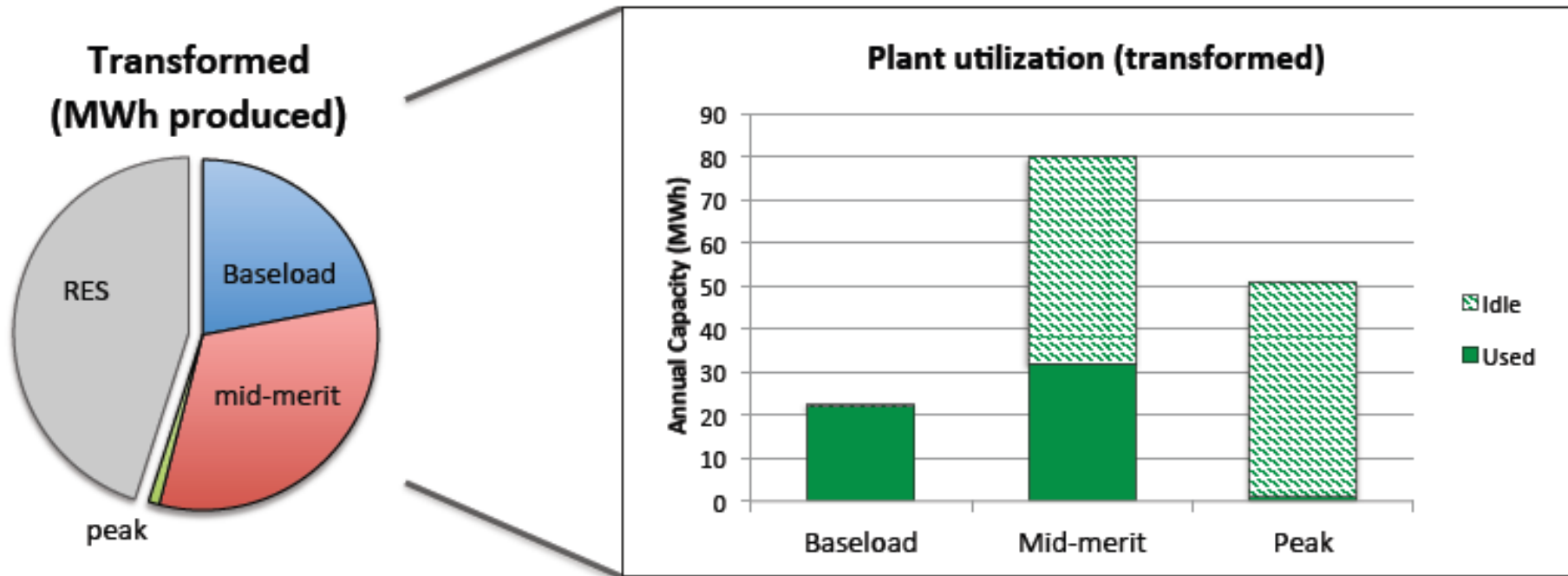
“How much?” depends on “what kind?”



Reliable, but costly & unstable, with investment based on:

- Single-product capacity mechanisms
- Inflated targets for generation adequacy
- No significant role for demand-side participation
- Flawed energy market implementation

“How much?” depends on “what kind?”



Reliable, low-cost & stable, with investment based on:

- Improved functioning of energy & balancing markets
- Transparent/objective/independent/regional RA assessment
- If desired, a simple multi-product CRM as a safety net
- Full demand-side participation in all markets