Panel discussion: System Efficiency and Emissions TradeOffs

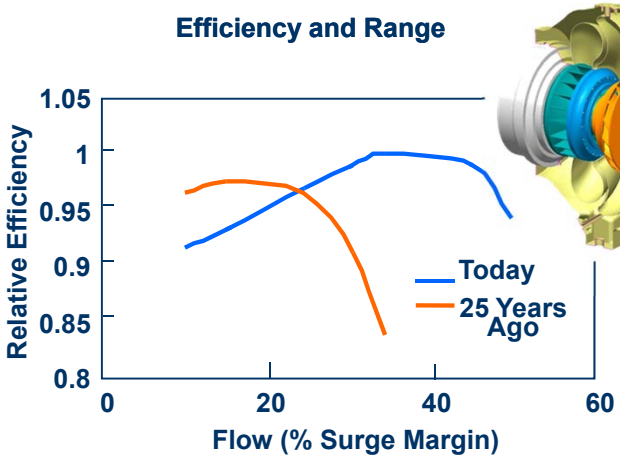
Rainer Kurz
Solar Turbines Incorporated
San Diego, CA

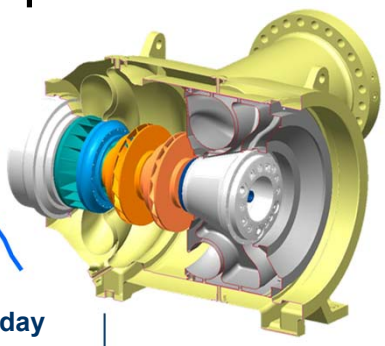
Presented at the 2018 Gas Turbines for Energy Network (GTEN) Fall Workshop in Ottawa – October 2018. The GTEN Committee shall not be responsible for statements or opinions advanced in technical papers or meeting discussions.

Increasing Operational Efficiency

- Operational characteristics of gas turbine driven compressors
- Characteristics of the Application
- Planning and Operation to Optimize the System.

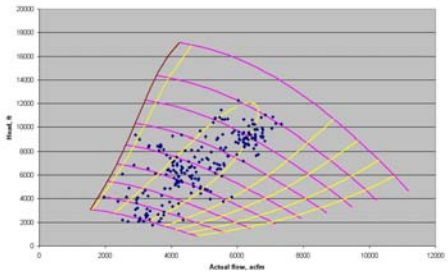
Gas Compressor Improvements





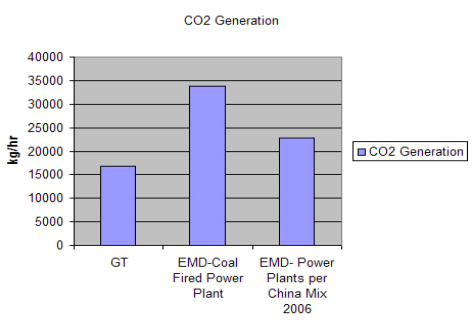
The Planning Conundrum

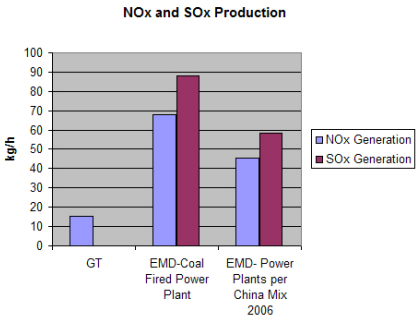
- The ‘Design Point Myth’
- Design Margins and Probability
- Future Conditions: Be prepared



Emissions Footprint

Comparison for a 30MW Compressor Station with either
2 15MW Gas turbine Drivers or 2 15 MW Variable Speed EMDs





Assumptions: -Dry Low Nox Gas Turbine (Solar Titan 130S)
-Power plant Emissions per Klein et al, 2003.
-Efficiency for Electric Drive train: 93%
-Transmission Efficiency for Electric power: 95%
-Power Plant Mix: 65% Coal, 3% Gas, 2% Oil, 30% Nuclear and Hydro

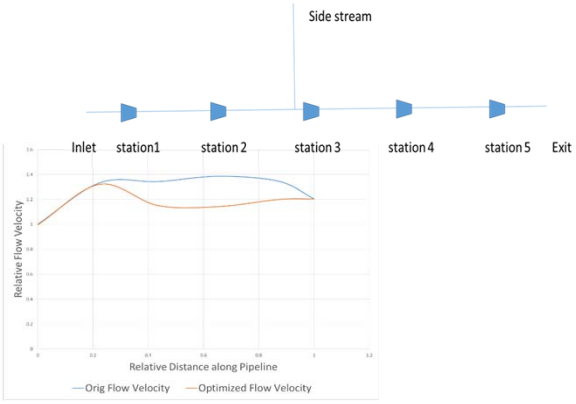
Emissions: CO2?, GHG ?,NOx ?, CO?, VOC?.

GHG Emissions- Methane and all that

- GTCC's have significantly lower Methane emissions than other gas fired concepts
  - Lower UHC/VOC emissions
  - Lower seal leakage (typically less than 0.005% of gas flow for a pipeline compressor)
  - Fewer shutdowns requiring blowdowns

Integrating Pipeline and Equipment Optimization

Hydraulic AND Machinery Optimization for Pipeline with 5 Stations



Station	Number of units running	Avg Load of running units	Number of units running (optim-ized)	Avg. Load of running units(Optimized)
1	0	N/A	0	N/A
2	2	56%	2	70%
3	2	57%	1	94%
4	2	63%	1	83%
5	3	96.6%	1	97%

Optimized Scenario Reduces Fuel Consumption to 74%

Macro System

- Integration with Gas User
  - Pipelines have storage capability
  - Electrical grids don't (except for batteries)
  - Smart cooperation between power plants and their pipelines
  - Hydrogen

Summary

Efficiency and Flexibility gains are possible:

-improved equipment
-improved system integration
-improved system understanding

There are trade-offs

Discussion Points

- Standby power generation for renewables & nuclear
- Offsetting coal power using efficient combined cycle or CHP
- Operating more efficiently (pipeline applications)
- Other GHG reduction opportunities (methane)
- Use of gas pipelines for energy storage (power to gas – H2 enrichment)

Hydrogen In Pipelines

- Transportation Efficiency
- Combustion
- Safety

What's Efficiency- A wider definition