ACES POWER MARKETING

Natural Gas & Renewable Energy Dialogue

Implementing Fast Response Technologies

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ACES Power Marketing Overview

- Nationally recognized wholesale energy risk management and transaction execution service company
- Headquartered in Carmel, Indiana, began operations in Feb 1999
- Owned by eighteen (18) power supply cooperatives
- Operates as an energy risk management and hedge manager, developing strategies, implementing trading controls, and managing transaction execution as a legal agent
- Provides services to over 50 customers including cooperatives, municipals, irrigation and public water agencies, financial institutions, industrial companies and independent power producers
- Manage a collective portfolio of approximately 44,000 MW of load and 35,000 MW of resources

Wind Integration Issues

- Need to transition to a sustainable, reliable and affordable energy infrastructure
- Existing power generation capacity is largely based on steam power plants which are not fast enough to respond to continuous changes in wind output
- RPS Standards will only increase the need to transition additional renewable resources onto the electric grid
- Various technologies have been developed or are in development to meet the needs for more rapid response

Natural Gas Integration Issues

- Daily natural gas and power operations must be aligned
- Pipeline services need minimum standards throughout the industry to serve electric generation
- Balancing tariffs/rules and cash outs need to be improved
- Incremental cost of additional pipeline flexibility is costly with no mechanism to share costs

Natural Gas Integration Issues

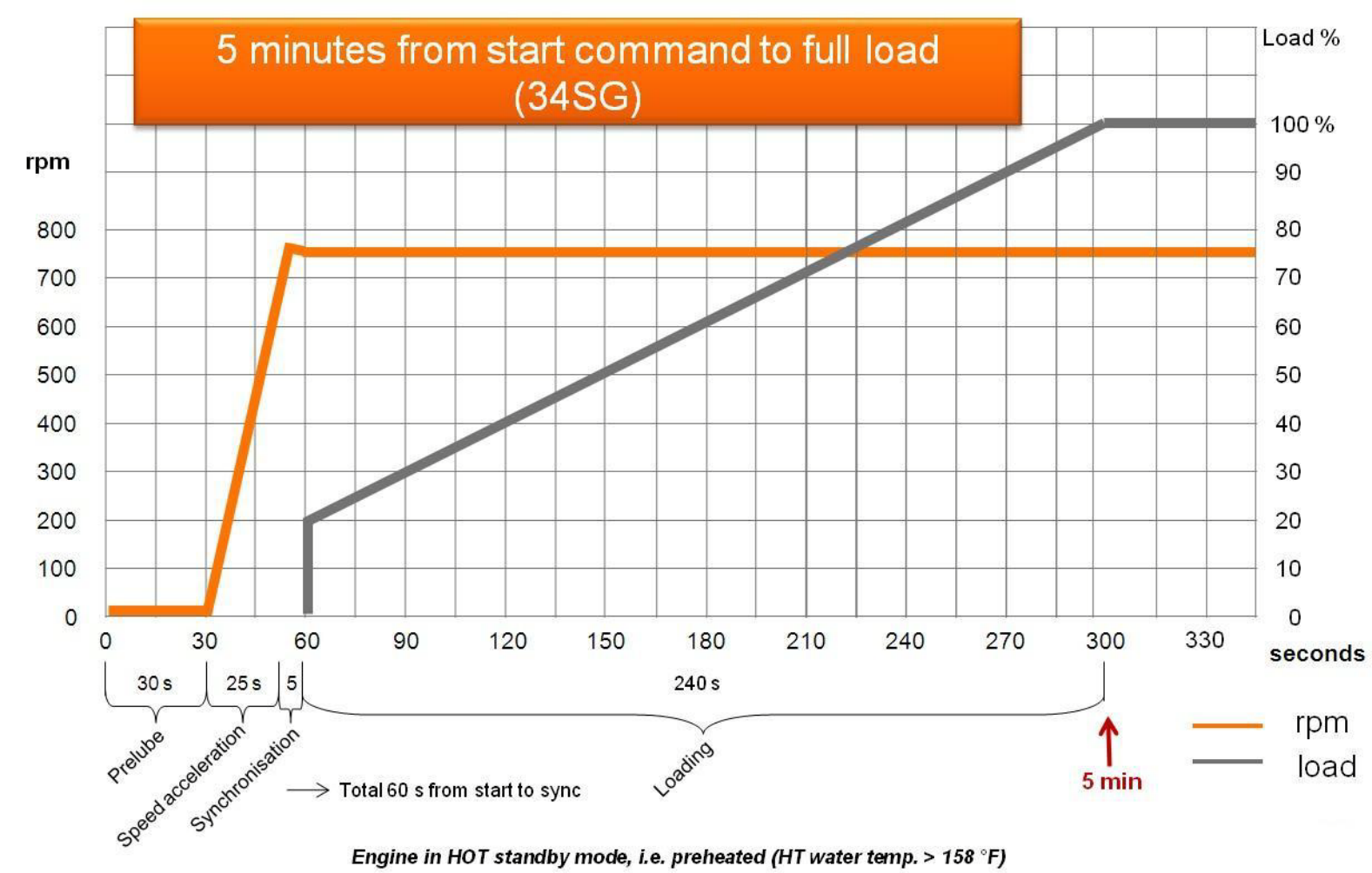
- Some market participants/generators have received low cost expanded services from more flexible pipelines and have not raised issues; however, as pipeline flexibility/services decrease there costs and issues will increase

- Pipelines and RTOs are afraid to talk to their consumers and each other for fear of FERC violations or penalties for anti-competitive discussions

Technology Overview – Wärtsilä

- Smart Power Generation can operate in multiple modes, from base load power production to ultra fast dynamic system balancing
- Megawatts to grid in 1 minute from start
- 5 minutes to full load from start
- Fast shut down in 1 minute
- Fast ramp rates up & down
- Units can be cycled on and off individually
- Multi Fuel Capability
- Low/No water consumption

Wärtsilä – 5 Minute Start

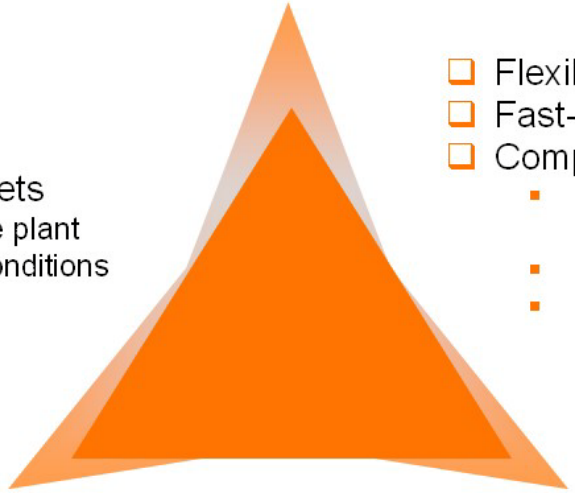


Source - Wärtsilä

Wärtsilä – Feature Summary

Independence = Easy and risk free

- Multi-fuel capability
  - NG, P_{min} = 5 Bar
  - HFO, LFO, LBF
- Easy to locate in load pockets
  - Light industrial look to the plant
  - Insensitive on ambient conditions
  - No water consumption



- Flexible plant size, expandable
- Fast-track EPC
- Competitive O&M cost
  - Unlimited starts & stops, no impact on maintenance schedule or costs
  - 24/7 OEM service
  - O&M contract with guarantees

Multiple operation modes

- Remote start, 30 sec to grid!
- 5 minute to full load from start
- Fast load following
- Peaking
- Base load
- Grid stability operations
- Dynamic wind support

High efficiency = Dispatch

- 45 % electrical efficiency
- Flat efficiency curve over wide load range (30%…100%)
- Multiple independent generation units, 3… 100% plant load with the same high efficiency

Source - Wärtsilä

Technology Overview – GE FlexEfficiency

- Not currently available, but to be deployed worldwide starting in 2014
- Developed in part from GE's F-class legacy power plants
- Increased efficiency through the use of nickel-based super alloys found in jet engines
- Ramping > 50 MW/minute, twice current industry benchmarks
- Can be turned down to 40% of load
- Starts in less than 30 minutes
- According to GE, capital costs comparable to CC technology

Source - GE

Summary

- The challenge of balancing wind and natural gas is not insurmountable but there is a cost ($1,200/kw Wärtsilä,GE ??)
- Quick response technology is evolving and is making progress
- Natural gas pipelines and RTOs/Balancing Authorities need to communicate freely around operationally interdependent processes and functions both for reliability and commercial success
- Natural gas pipelines and RTOs/Balancing Authorities need to coordinate their activities and processes more closely with regards to timing of daily activities
- The glass is half full