

WIA MEETING

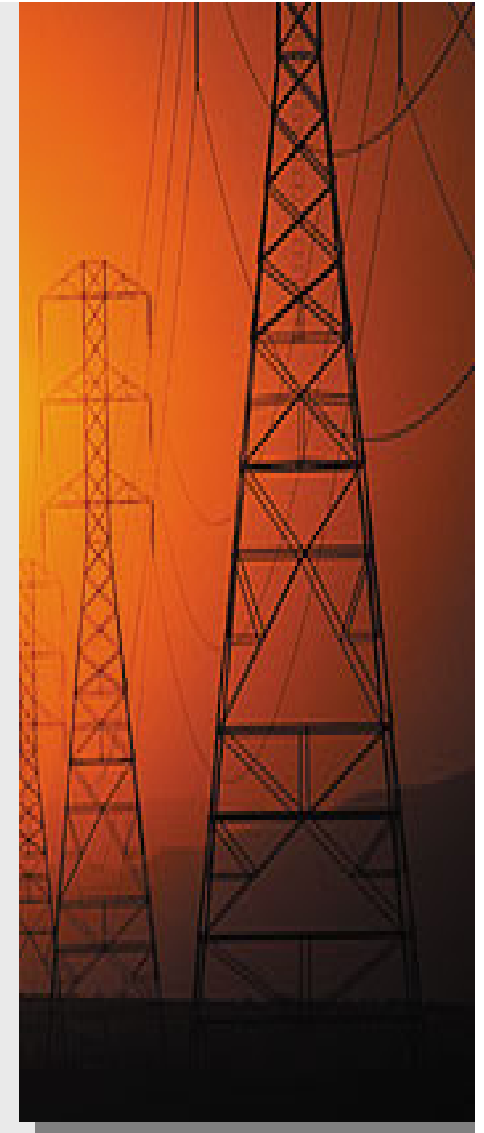
**FIRMING WIND POWER WITH
NATURAL GAS**

**presented by Dennis Finn
Wartsila North America, Inc.**

**Jackson Hole, Wyoming
January 25, 2010**

OUTLINE OF PRESENTATION

- **Wartsila Background**
- **Technical Requirements for Gas Fueled Plants to provide Grid Support**
- **Experience**
- **Conclusions**



Good News! NG FUEL PLANT FOR WEST TEXAS

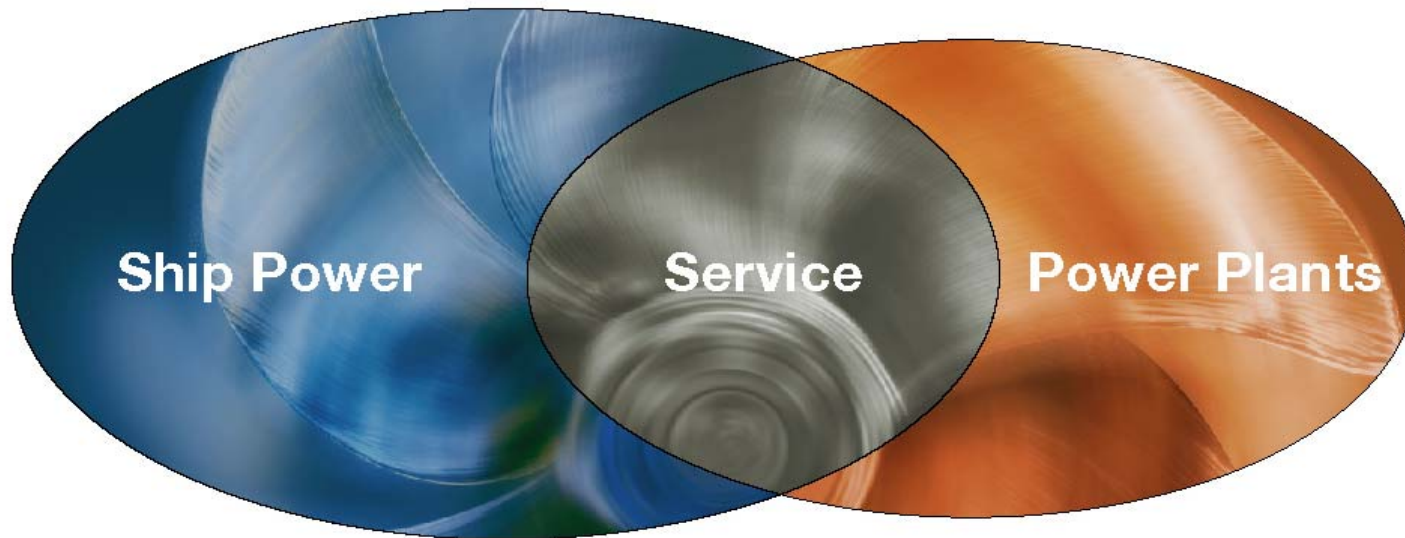
**GSEC PURCHASES
168 MW PLANT TO
SUPPORT THEIR GRID
AND TO SELL INTO SPP AND
ERCOT**

COD JUNE 2011

**18 WARTSILA GENSETS
FOR THE 168 MW PLANT
NET OUTPUT**

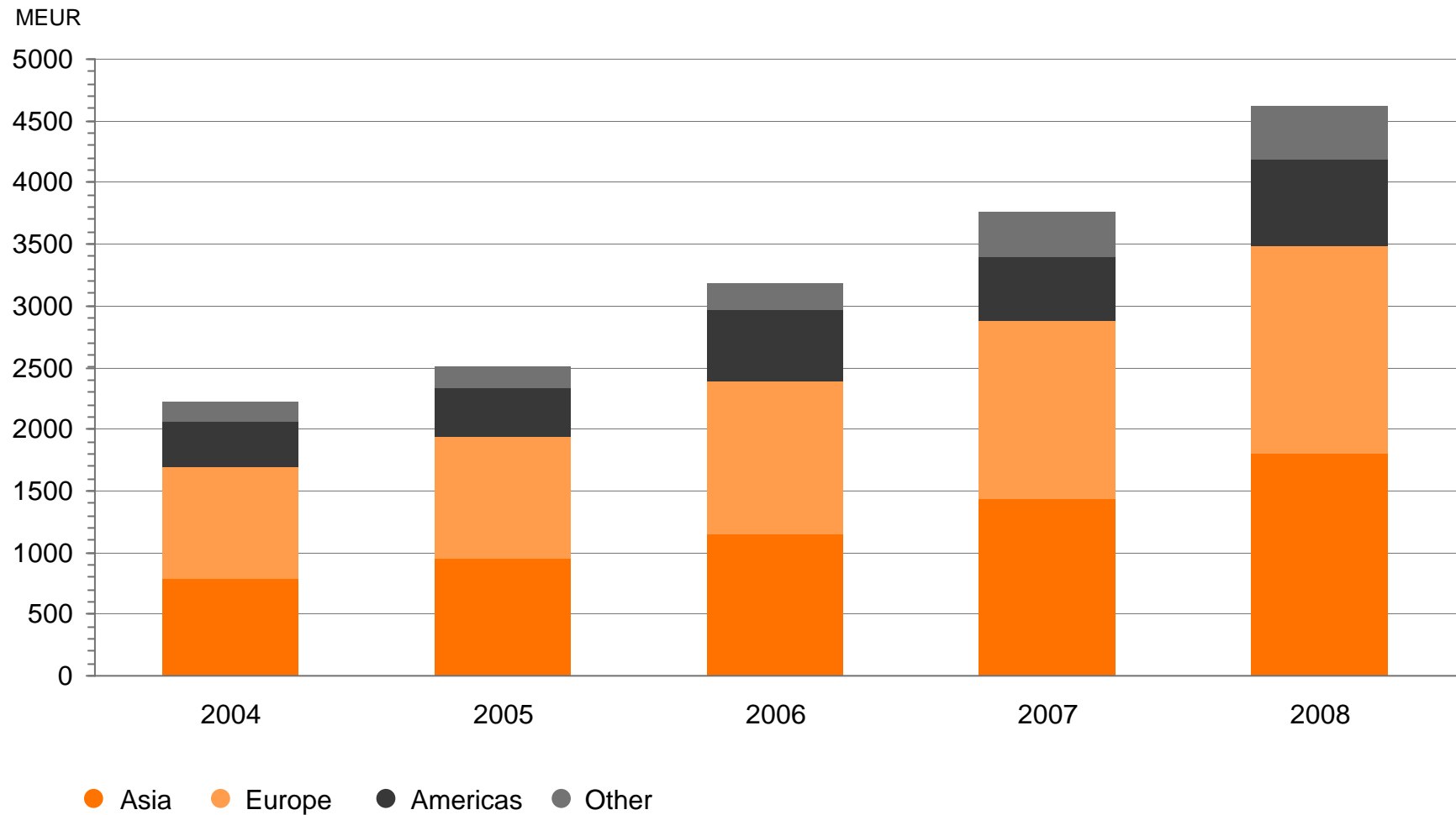


Wärtsilä - 170 Years of Excellence



- World's largest manufacturer of medium speed engines.
- Public company headquartered in Helsinki, Finland.
- 17,000 employees in 70 countries
- ~\$8 Billion USD net sales in 2009
- 150 GW installed base worldwide – 42+ GW of power plants

Net Sales by Market Area



Growing Demand For Grid Support by Quick Start Equipment



- Transmission shortages produce system congestion
- **Increase in installed wind capacity and other RPS assets drives need for “shaping/firming power”**
- Development of regional ancillary services markets.
- Need for efficient, flexible generation injected at load pockets.
- Political demand for reliability and capacity reserves.

Author

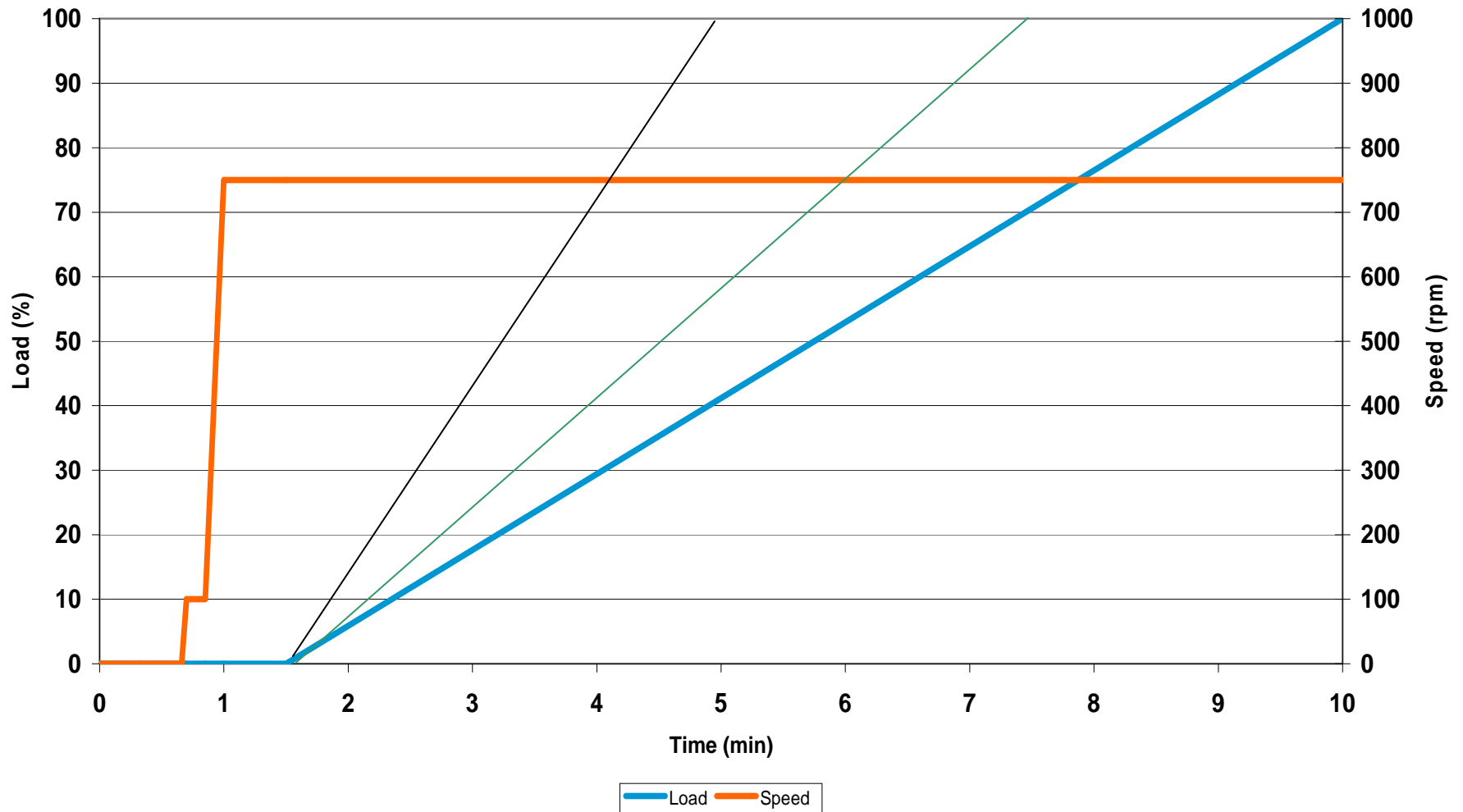
GRID STABILITY REQUIREMENTS SEPARATE FROM TRANSMISSION LINE CAPACITY FIRING

OTHER GRID/UTILITY REQUIREMENTS – ANCILLARY SERVICES

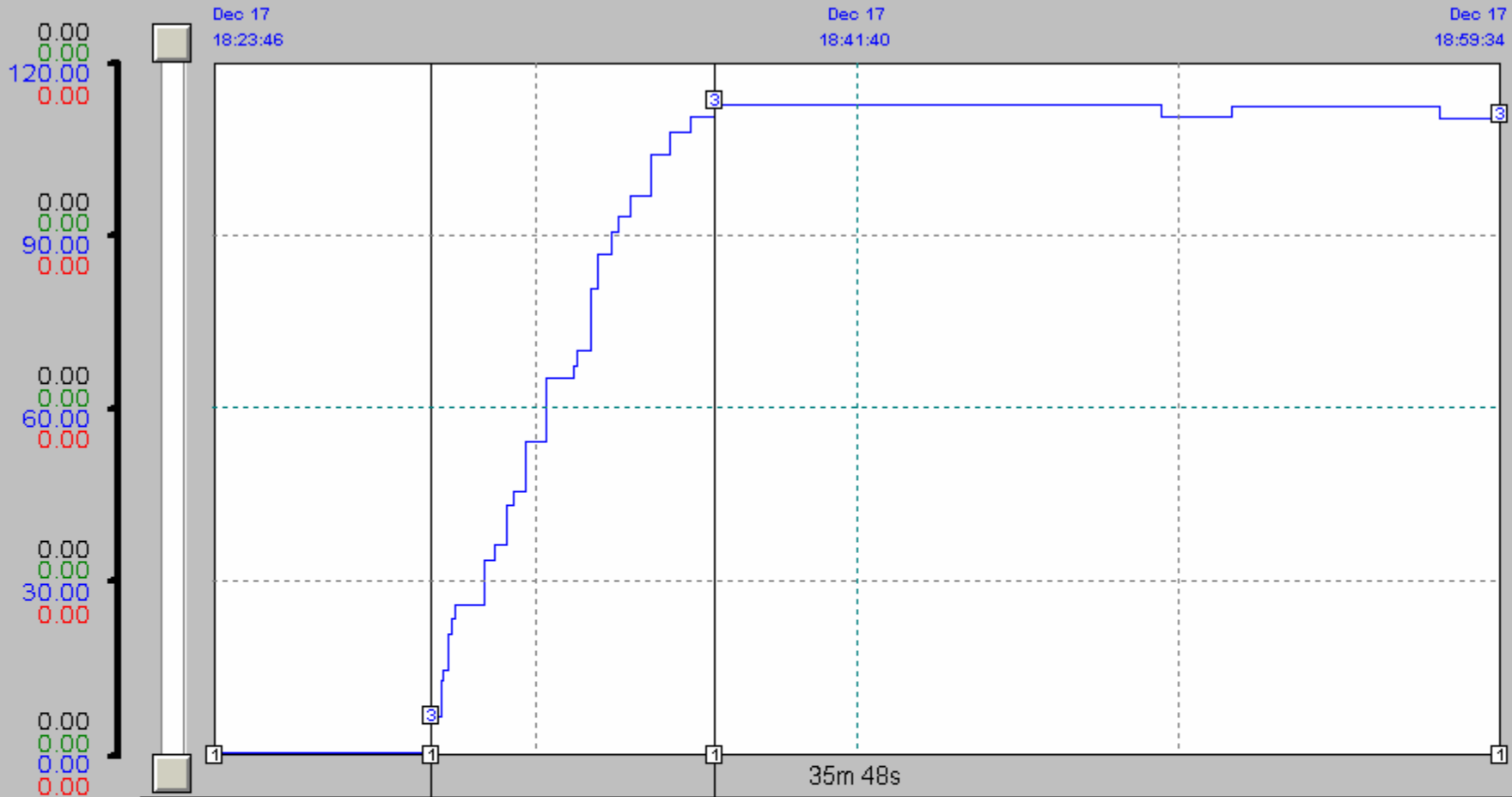
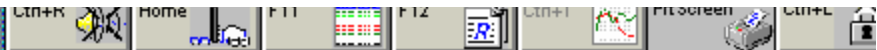
- Ready Reserve**
- Spinning Reserve**
- Regulation Up and Down**
- Black Start Capability**
- Voltage Regulation, Reactive Power resource**
- Ability to respond to large (read wind) changes in minutes**
- AGC capable – not a service but a practical requirement**

Ancillary services are required by grid whether or not wind power is on the grid and the Grid pays for these services

Time Spans from Initiation to Full Plant Output



Historical Trend



18:23:46 60 minutes 1 week 1 day 1 hour 10 minutes 18:59:34

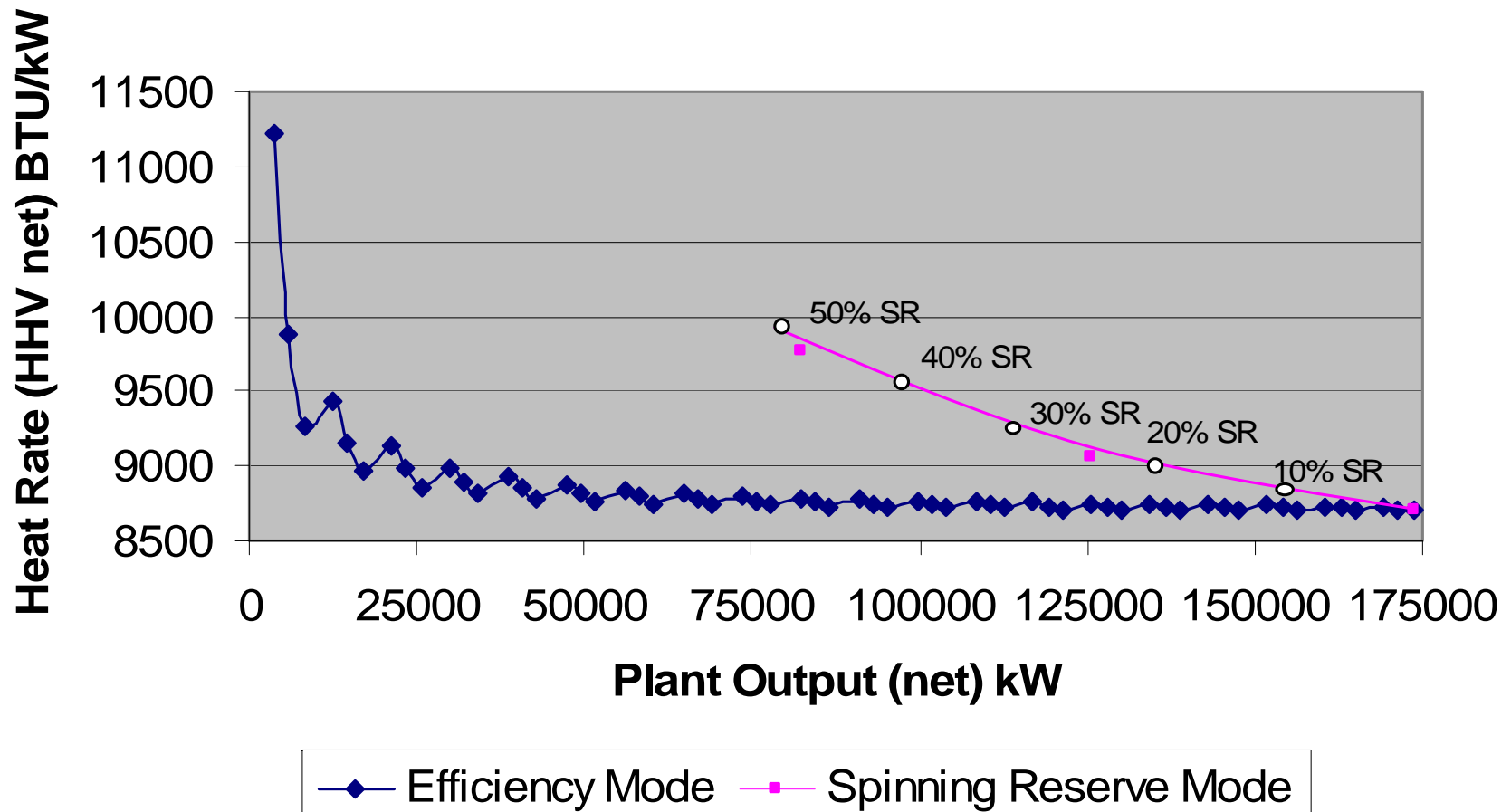
- 1
- 2
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1				
2				
3	CFA902AI01DPC	6.56	113.26	Net active power
4				

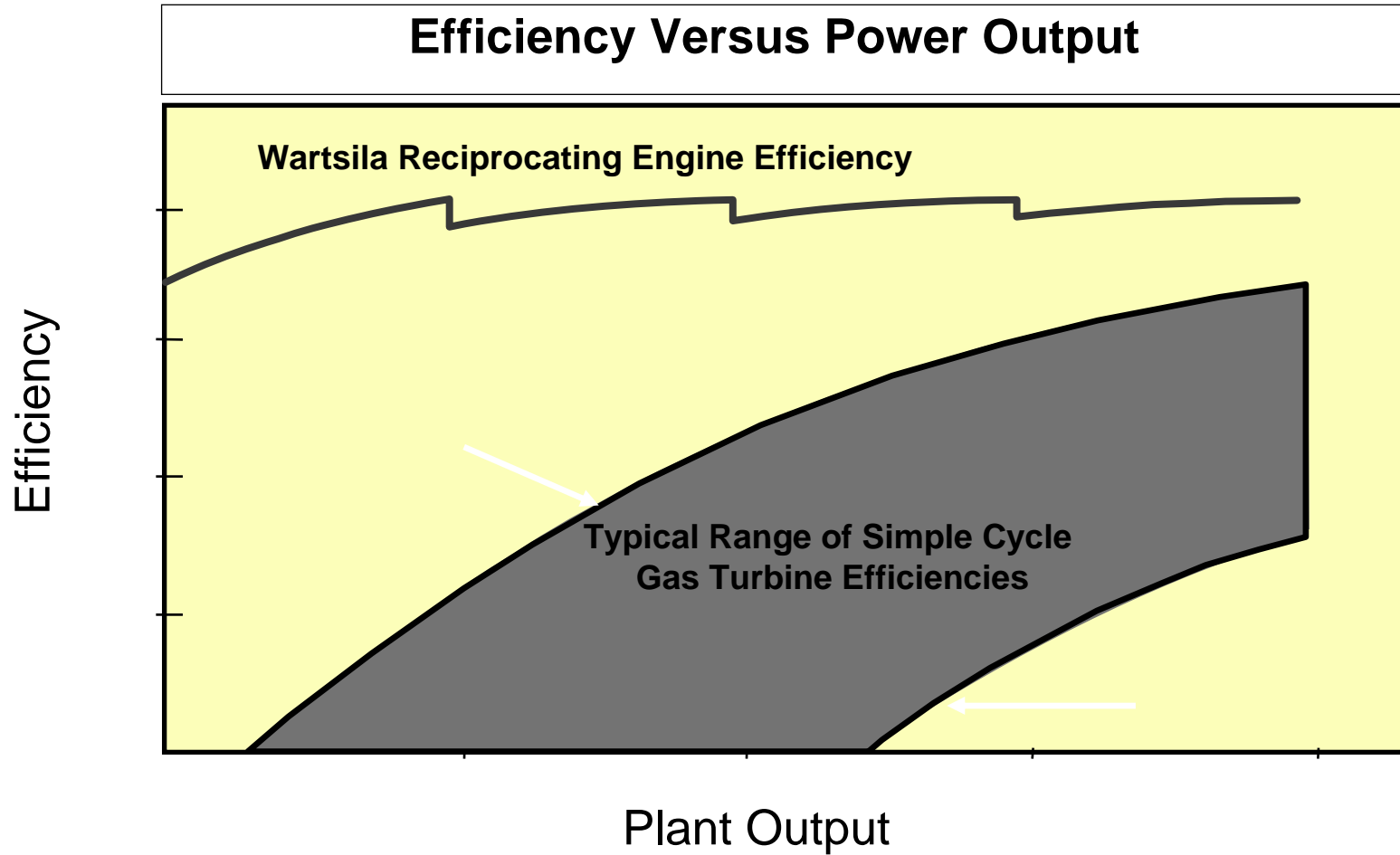
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Recip Technology Advantages for Wind Support

Plant Heat Rate - Efficiency Mode vs. Spinning Reserve Mode



Near Flat Heat Rate Curve



Modern NG Fueled Recip Technology Advantages



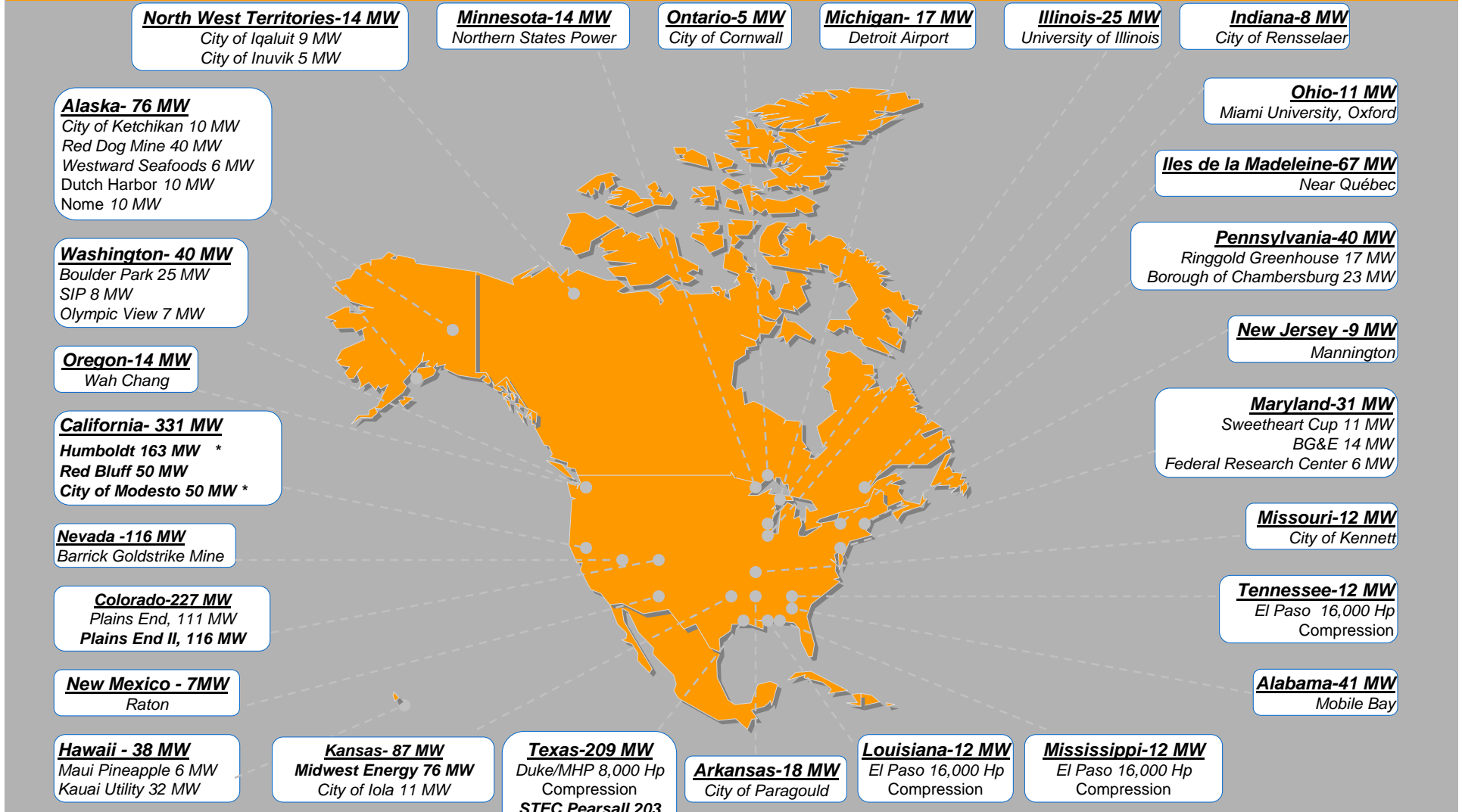
- ✓ Excellent simple cycle efficiency
- ✓ High part load efficiency
- ✓ Full output at high temp and altitude
- ✓ Efficient dispersed generation plants
- ✓ Start to full load in 8 minutes
- ✓ 25% load in less than 2 minutes
- ✓ Unlimited starts and stops each day
- ✓ Excellent load following
- ✓ Operates on low gas pressure
- ✓ Multi-fuel operation
- ✓ Multi-unit plants, better reliability
- ✓ Single digit NOx levels
- ✓ No process water consumption





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Wärtsilä Power Plants in North America - References



Installed Capacity

Recent Projects

- **April, 2006 signed contract with PG&E for the turn-key supply of a 163 MW dual fuel plant in Humboldt, CA as replacement for utility boiler plant. Notice To Proceed received in March, 2008. Plant under construction.**
- **June, 2006 signed contract with Cogentrix serving PSCO for the Plains End II, 115 MW project near Denver, CO. Extension of existing plant.**
- **January, 2007 signed contract with Midwest Energy, KS for a 70 MW project.**
- **January, 2008 signed contract with STEC for a 200 MW project in Texas.**
- **September 2008 signed contract with municipal utility for 50 MW project in California.**

CONCLUSIONS

- **Growing wind penetration into electric grids requires action for grid stability**
- **One viable approach is using natural gas fired quick start generators**
- **Other Options (Fuel Cells, Batteries) are less developed**
- **Wind Farm diversity, better load following characteristics of wind turbines will help**
- **Reciprocating Engine technology will be a major player**



Wärtsilä North America, Inc. is part of Wärtsilä Corporation, the leading global ship power supplier and a major provider of solutions for decentralized power generation and supporting services.

Wärtsilä's North American offices were first opened in 1979. More than 1800 MW have been sold in the North American market and 135,000 MWs globally

WIA MEETING

Thanks for the opportunity to speak at this Meeting

Dennis Finn
Wärtsilä North America, Inc.

Contact Wartsila North America at:

303-660-0528
dennis.finn@wartsila.com
www.wartsila.com/usa

Power for a Changing World.