Siemens Experiences in the field of Flexible Operation

EEC Seminar
New Delhi | November 1, 2019

Rainer Aulfinger
Siemens Experiences in the field of Flexible Operation
Journey of Coal Fired Power Plants

Operation in Full Load
Focus on High Efficiency and High Availability
Base Load Plants
Middle Load Plants
Peak Load Plants

Operation in Partial Load
Higher Load Ramp
Min Load Reduction
Start Up Optimization

Unit Control
Frequency Control
Automatic Generation Control

Min Load Reduction (<30%)
Less Operating hours
Strategical Power Plants

Poland
Brazil
Chile
India
Australia
Germany

EEC Seminar / New Delhi / 01.11.2019
Successful Min Load Tests in Dadri CFPP Unit 06

Min Load Test on June 21, 2018
- Load reduction from 490MW to 250MW
- Changing from four to three mills operation
- Load reduction in steps of 5 MW
- 195MW achieved and kept for 2.5 hours

Recommended measures to automize 40% min load:
- **Unit Control** to coordinate slow-acting boiler and fast-acting turbine
- **Reheat / Flue Gas / Main Steam Temperature Control**
- **Mill Scheduler** to switch coal mills on/off automatically depending on the firing demand
- **Fatigue Monitoring System** to determine residual lifetime of highly stressed components
- **Replacing of the feed water recirculation valve** by a control valve

Next step:
- Installation of an Online Coal Flow Measurement System

Capacity: 500 MW
Boiler: BHEL
Type: Drum Boiler
Number of mills: 9
Total coal dust pipes: 36
Turbine: BHEL-KWU design
Siemens Experiences in the field of Flexible Operation
Omnivise Performance Coal Flow Measurement Solution

Fuel flow Monitoring for
- Calculation of average coal
- Detection of unbalanced coal flow situations
- Full transparency in coal flow in all pipes over all load cases

Flow Measurement per Mill
- microwave sensor
- Roping detection by three sensor concept and compensation

Monitoring

Optimizing

Plant specific solution
- Adjustment of control strategy
- Compensation of unbalances in air-fuel

Optimized plant economy
- Better efficiency
- Reduction of min. load
- Higher Load Ramps

New

Optimized Combustion via closed loop balancing

Measuring

Acting
Siemens Experiences in the field of Flexible Operation
Poland 200+ Program - Flexibilization of Jaworzno CFPP

Poland 200+ Program
- Program from Polish Government with financing from European Union
- Flexibilization of 50 Units with 200MW
- Cold/Warm/Hot Start Optimization
- 40% min Load
- 4% Load Ramps
- Partial Load Efficiency Increasing

Recommended measures
- Unit Control to coordinate slow-acting boiler and fast-acting turbine
- Temperature Control
- Coal Flow Measurement System to increase partial load efficiency and load ramps

Actually Situation
- Coal Flow System installed in one mill
- Performance tests done

Capacity: 220 MW
Boiler: Rafako
Type: Drum Boiler
Number of mills: 4
Total coal dust pipes: 24
Siemens Experiences in the field of Flexible Operation
Poland 200+ Program – Load ramp tests in Jaworzno CFPP

**Actually Load Ramp**

- Load Ramps with 1%/min
- From min to max

1/2 hours excerpt from load ramp

1 – average feeder speed [%]
4 – generated load [MW]

**Primary Air Flow Test**

- Coal Flow Measurement in Mill1
- Step Change with Primary Air
- Delay of Load ~90s behind Air Flow
- Load ramp with 3,1%

**Conclusion**

- Storage capacity of the mills can be used for load ramp
- CFMS necessary to identify the moment of coal increase-ment

**Next Step**

Extension of Coal Flow Measurement Solution to all Mills

1 – average feeder speed [%]
3 – coal flow measurement
2 - primary air flow mill 1 [m³/h]
4 – generated load [MW]
Siemens Experiences in the field of Flexible Operation
Benefit of Coal Flow Measurement Solution

Higher Load Ramps with less fuel costs / Overfiring

![Graph showing Overfiring 10%]

Higher Partial Load with optimization of air/fuel ratio

Option 1: Adjust Air

- Secondary Air Flap
- CF Sensor
- FD Fan
- PA Fan
- Coal Mill

Siemens Experiences in the field of Flexible Operation
Benefit of Coal Flow Measurement Solution

Higher Load Ramps with less fuel costs / Overfiring

![Graph showing Overfiring 10%]

Higher Partial Load with optimization of air/fuel ratio

Option 1: Adjust Air

- Secondary Air Flap
- CF Sensor
- FD Fan
- PA Fan
- Coal Mill
Siemens Experiences in the field of Flexible Operation
Benefit of Coal Flow Measurement Solution

Higher Partial Load with optimization of air/fuel ratio

Option 2: Adjust Coal

„Effective Investment for the flexibility journey of coal fired power plants!“

Min load 40%
Load Ramps
Higher Efficiency in partial load

Min load <30%
Higher Efficiency
Contact

Rainer Aulfinger
Omnivise P3000 Sales
GP SCD GTM
Siemensallee 84
76187 Karlsruhe

Mobile: +49 162 1025325
E-mail: Rainer.Aulfinger@Siemens.com