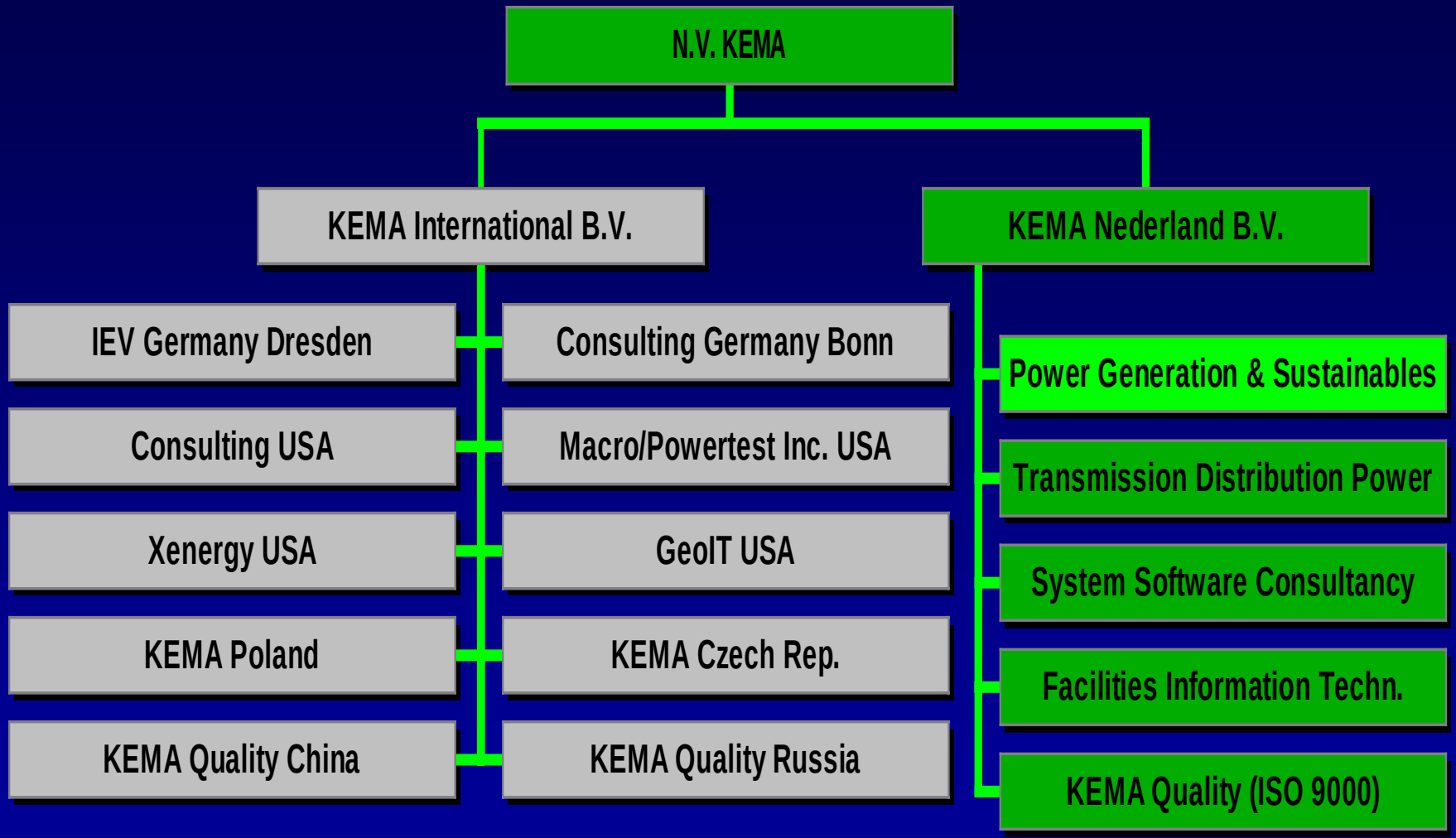
KEMA's Gas Turbine Technology Courses

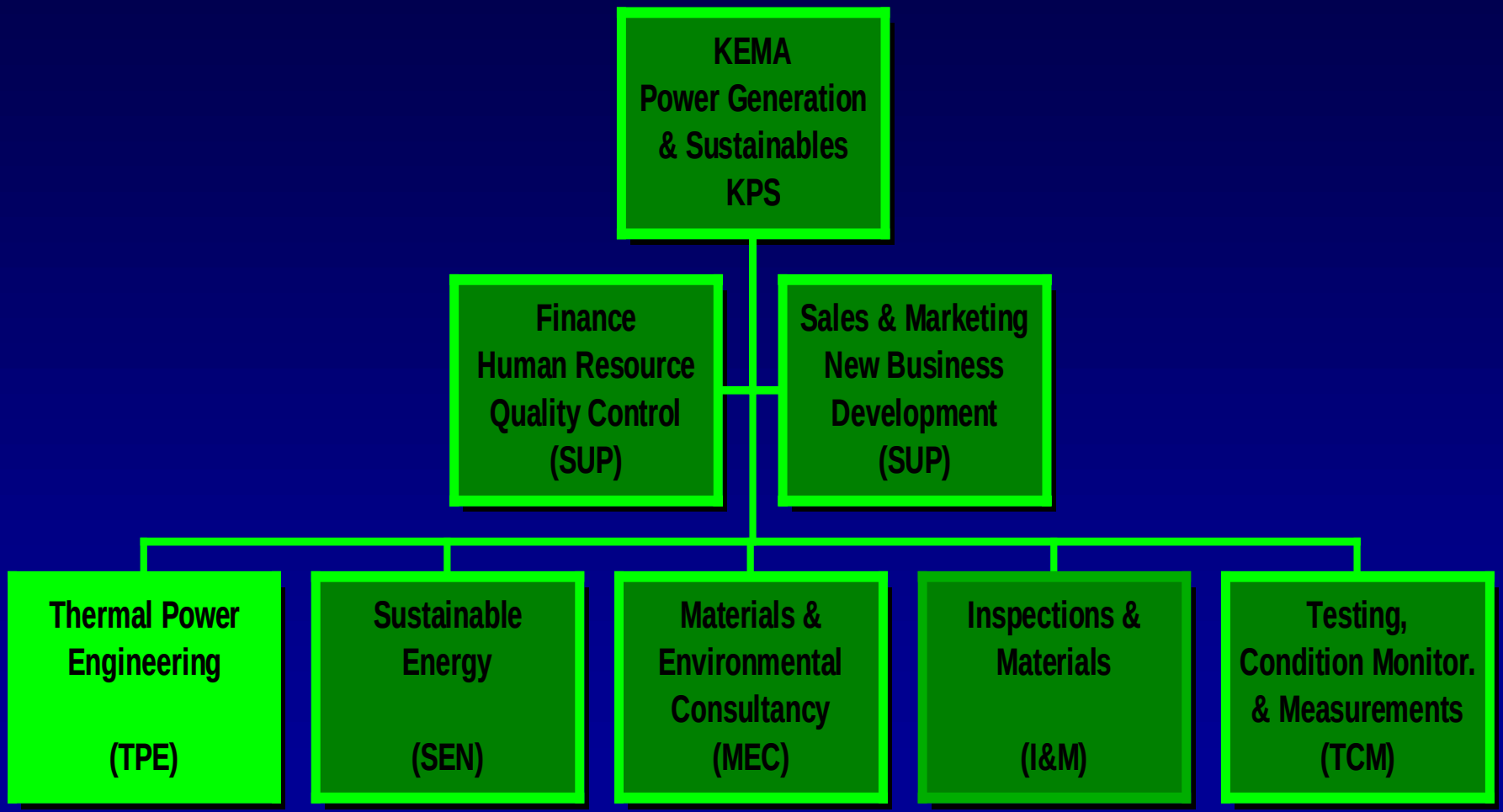
KEMA
business unit
KEMA Power Generation and Sustainables

Paul Welberg, account manager

KEMA organisation



KPS business unit



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KEMA's Gas Turbine Technology Courses

For who?

- Gas turbines and associated machinery (oil and gas utilities, process industry, power generation utilities)
- No formal qualifications required (experience with turbine technology desirable)

KEMA's Gas Turbine Technology Courses

How the course will help you?

- Turbo machinery problems → recognised authorities
- Theory behind many field problems (including failure analysis)
- Most recent research developments concerning operations of turbomachinery
- Unbiased and independent information on experiences with all main OEM gas turbine types

KEMA's Gas Turbine Technology Courses

- Gas Turbine Technology - General
- Gas Turbine Technology - Expert

KEMA's Gas Turbine Technology Course - General

- 3-day course; general operation and maintenance characteristics
- Other topics: instrumentation; air filtration; compressor cleaning; condition monitoring; vibration analysis; materials and coatings; on-line diagnostics
- Emphasis: Practical information with minimal theory

KEMA's Gas Turbine Technology Courses - Expert

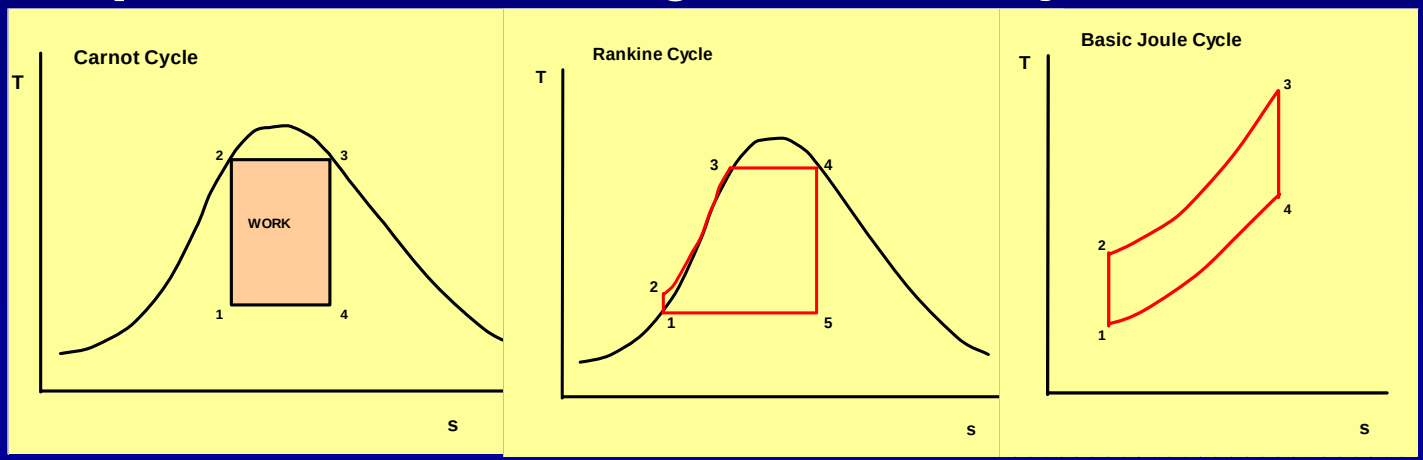
Three modules (per module one specific topic, 2 days):

- Condition monitoring, performance measurements, performance calculations
- New developments to improve output and efficiency of gas turbines (e.g. evaporation, NOx reducing technologies)
- Reconditioning, inspection and life time management of hot gas components

Gas Turbine Technology:

The gas turbine cycle

- principles of turbo machines
- operating characteristics of turbo machines
- themodynamics (cyles: e.g. Carnot, Rankine,Joule(-Brayton))
- improvements of the gas turbine cycle



Subjects General Course - Gas Turbine Technology (2)

- The gas turbine in combined cycle
  - power heat coupling
  - cycle improvements using water and steam
- Emissions (formation and reduction)
- Operating parameters (pollution, erosion, corrosion, dynamic loads, thermal loads)

- Selected, future-oriented gas turbine concepts (e.g. GT cycle using biomass; with PFBC)

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General - Performance analysis and optimisation of power plant cycles (1)

- Design aspects
- Performance
- Optimisation of design
- Performance analysis
- Comparison of gas fired power units
- Development of process combined cycles
- Advanced cycles
- Conclusions

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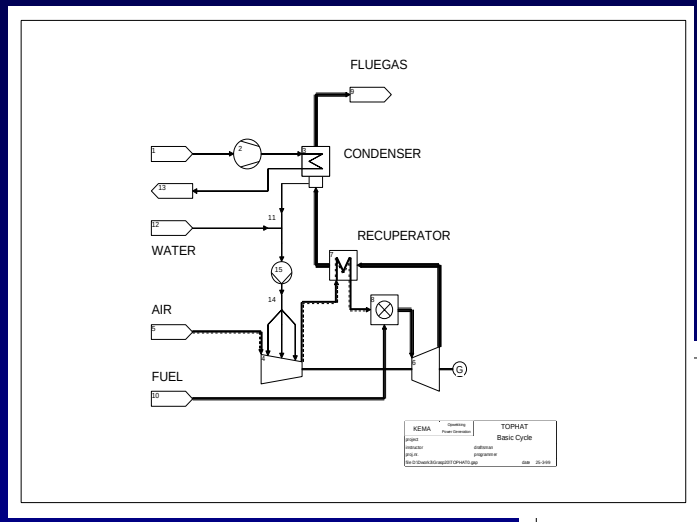
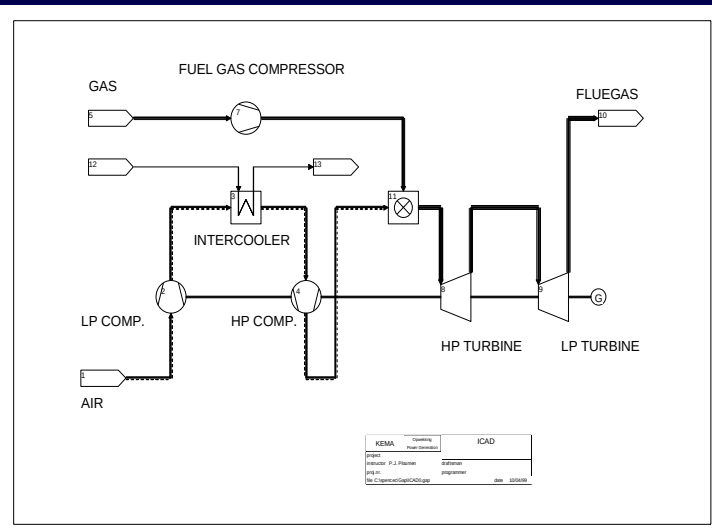
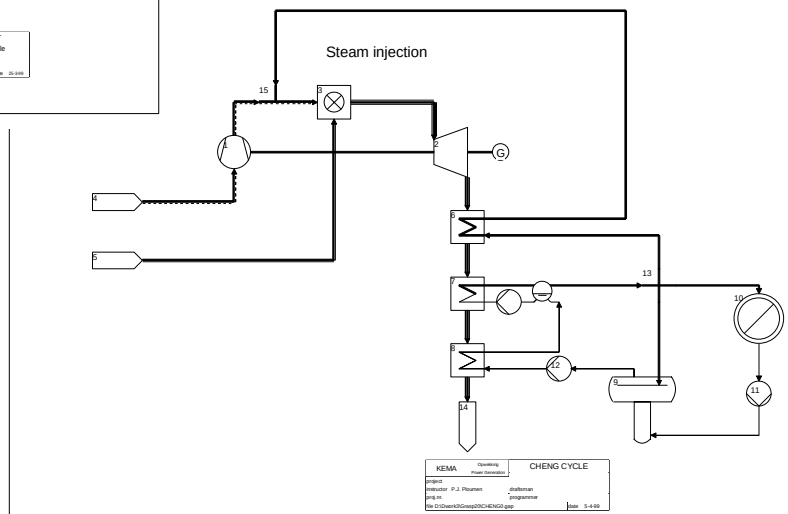
General - Performance analysis and optimisation of power plant cycles (2)

- e.g. TOP-HAT,Cheng Cycle, ICAD







General Course - Performance and condition monitoring (1)

- **Definition of condition monitoring:**

  ‘Assessing the current state and estimating the future state of a system by means of measurements and calculations. The results of condition monitoring can be used to take corrective actions, to plan the availability and maintenance and to optimise the plant’s performance’

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General Course - Performance and condition monitoring (2)

- Condition Monitoring Technologies:
  - visual inspection
  - mechanical monitoring
  - fluid analysis
  - run time analysis
  - performance monitoring

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General Course - Performance and condition monitoring (3)

- Reasons for Condition Monitoring:
  - prevention of damage
  - increasing the availability
  - increasing the reliability
  - increase of life times
  - change to condition dependant maintenance

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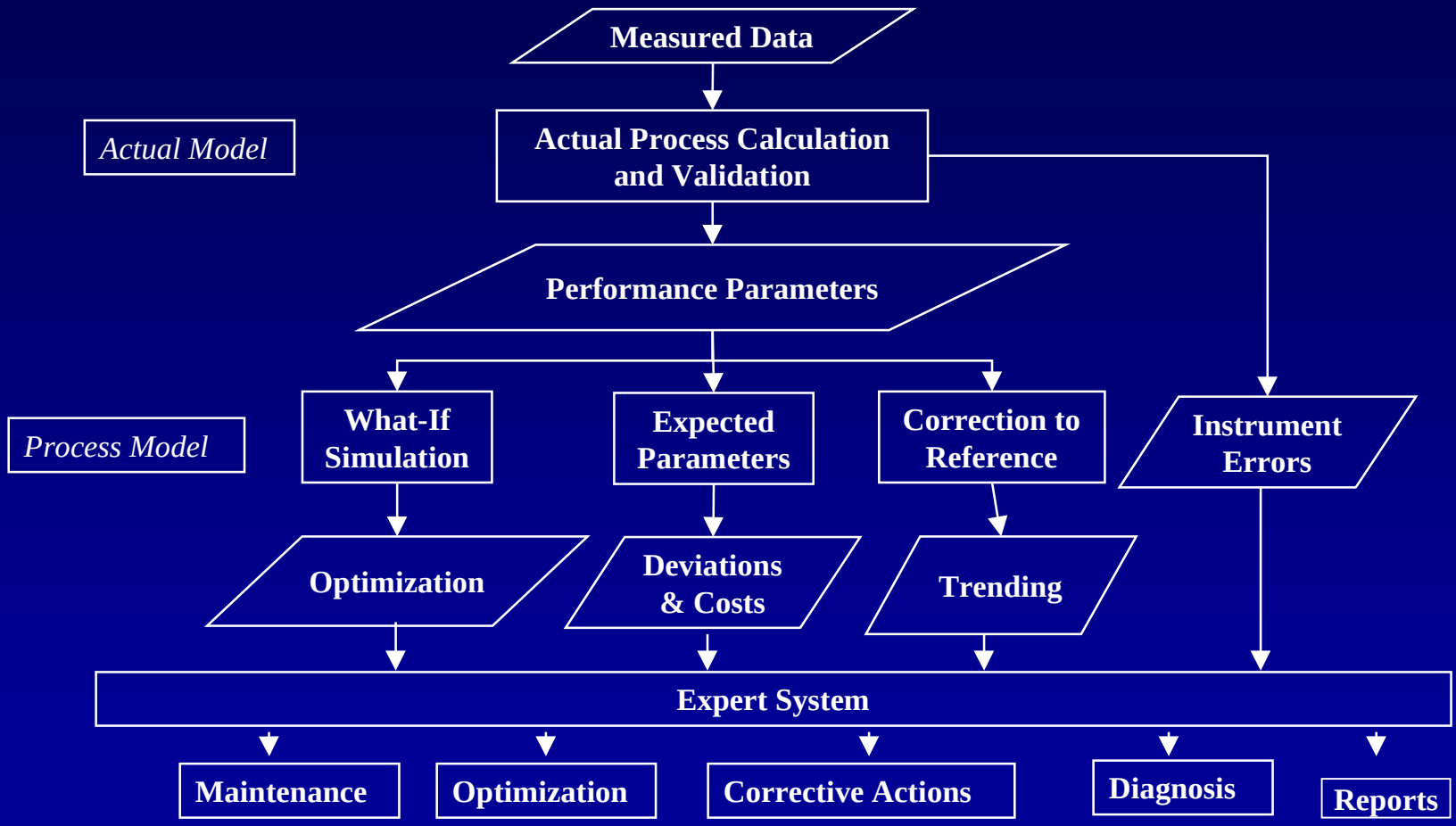
Advanced monitoring system



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General Course - Other Topics

- Air filtration and compressor cleaning
- Rotor dynamics
- Vibration measurements & monitoring protection
- Monitoring and diagnosing electrical equipment (transformers)
- Turbine materials and failures (materials, coatings, component life time, repair & reconditioning, case histories)
- Gas turbine diagnostics (blade temperature, coating condition, combustion instabilities, strain measurements)

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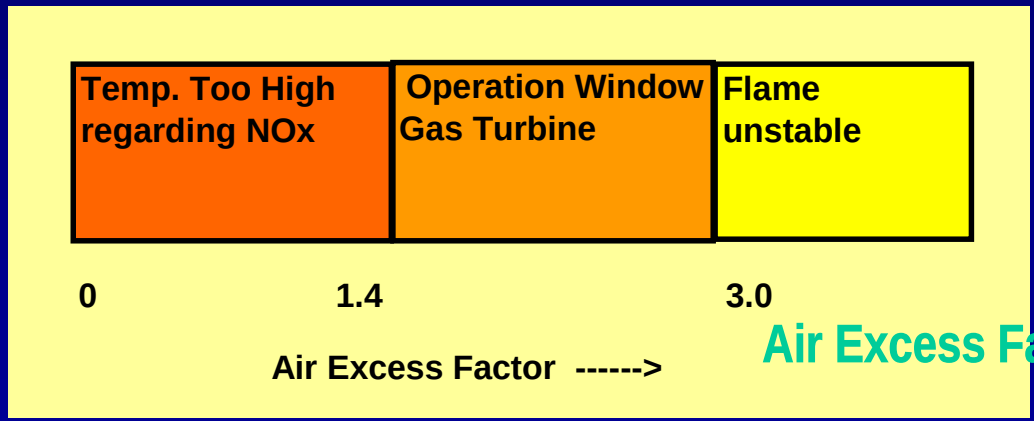
KEMA's Gas Turbine Technology Courses - Expert

Three modules (per module one specific topic, 2 days):

- Condition monitoring, performance measurements, performance calculations
- New developments to improve output and efficiency of gas turbines (e.g. evaporation, NOx reducing technologies)
- Reconditioning, inspection and life time management of hot gas components

Expert - New developments to improve output + efficiency of GT (1)

- Recent developments of gas turbines
- Overview of gas turbine cycles
- Pinch Technology in combined cycles
- Economic evaluation of CHP
- Low NOx combustion in power plants



$$\text{Air Excess Factor} = \frac{\text{mixture(gas+air)}}{\text{stoichiometry(gas+air)}}$$

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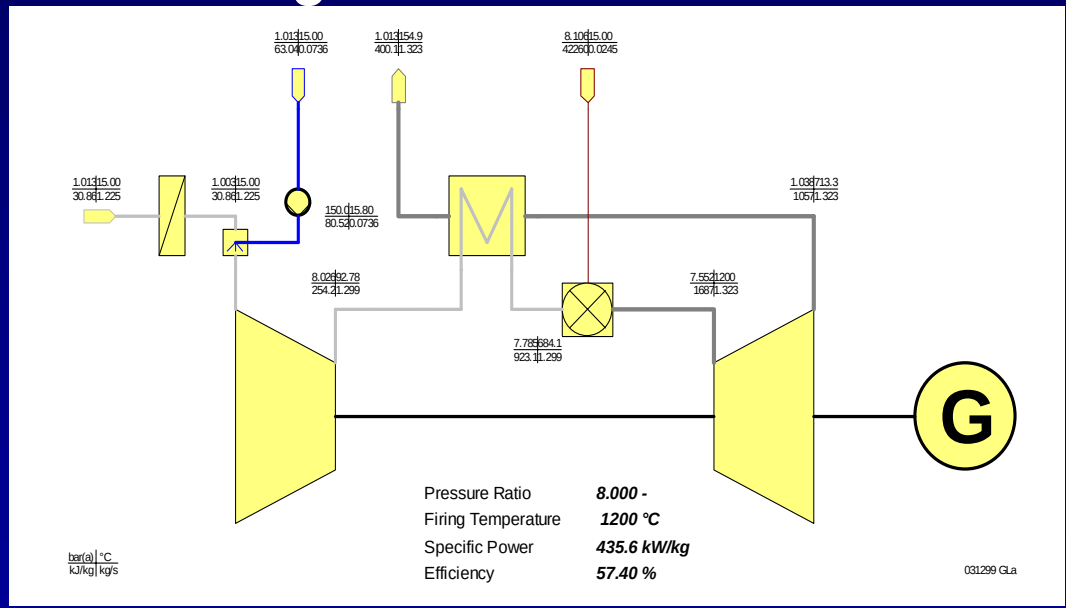
Expert - New developments to improve output + efficiency of GT (2)

- Exergy and gas turbines (analysis method to indicate maximum work potential); thermodynamic concept)
- TOPHAT® and SwirlFlash®: technologies for advanced gas turbines & retrofit for gas turbines



- Process simulation (static and dynamic)

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