Company Overview (M-Tech Industrial)

- ISO9001 accredited multi—disciplinary engineering company headquartered in South Africa
- 20 full—time support personnel and a core group of 35 engineering consultants, programmers and technicians.
- Founded 1987
- Annual Turnover R 350m

Products

- Flownex Simulation Environment
- Enerflow Heat Pumps for industrial, commercial and residential applications.

Services

- Specialised Consultation and Owners Engineering
- Demand Side Management and Energy Efficiency
Flownex® Simulation Environment enables engineers to predict, design and optimize for flow rates, pressures, temperature and heat transfer rates in fluid systems. Such systems include anything from ventilation systems and water and gas distribution systems up to boiler designs and complete power generation cycles. The ability to simulate systems with any combination of liquid, gas, two phase, slurry and mixture flows in both steady state and dynamic cases makes Flownex® the most powerful simulation tool of its kind.
We employ master’s- and PhD-level qualified engineers to develop and support Flownex® guiding you on how to more effectively use our software tools and maximize your return on investment.
OUR REACH
BRINGING NUCLEAR QUALITY AND STANDARDS TO SYSTEM SIMULATION

Flownex is developed in an ISO 9001:2008 and NQA1 quality assurance system environment
2013 CLIENTS
SALES SECTORS AND APPLICATIONS

Sales by Sectors 2014

- Industrial
- Fossil Fuel
- Nuclear
- Oil and gas
- Academic
- Mining
- Safety and Health
- Ship building
- Turbine
- Water

Sales by application in 2014

- Boiler
- Consultation
- Power sub-system design
- Nuclear Power Cycle
- Oil and gas
- Hydraulic equipment
- Process design
- Safety
- Ship building
- Turbine design
- Ventilation
- Defense
AGENT SALES CYCLE

2010 2011 2012 2013 2014

CMSI PADT

$- $50,000.00 $100,000.00 $150,000.00 $200,000.00 $250,000.00 $200,000.00

CMSI PADT

FLOWWEX Simulation Environment
QUESTIONS TO BE ANSWERED

1. Introduction to Flownex® Application & Benefits
2. How do I simulate a simple problem in Flownex®?
3. How does the library structure work?
4. Do I know about all the phenomena calculated in Flownex®, like slurry, forces, phase change & water hammer?
5. What is the designer, optimizer & sensitivity analysis & where can I apply it?
6. Running transients and various scenarios.
7. Show me how to add visualization to my network.
8. Is it easy to integrate Excel, Scripting & EES?
WHAT IS FLOWNEX®?

• Software designed to assist with the development of simulation environments that require a fast, reliable and accurate total system and subsystem approach to simulation.

• Simulations can be created to take into account dynamic simulations, thermal inertia, plant scenarios such as accidents and plant shutdowns, branching of flows as well as buoyancy driven flows.

(Conservation of Mass, Momentum & Energy)
APPLICATIONS OF FLOWNEX®

• Variety of industries.

• Used successfully in Power Generation, Mining and Process systems as well as military, shipping and aerospace applications.

• Designed within an **NQA1** and **ISO9001** environment to ensure the best standards of quality compliance.
BENEFITS OF FLOWNEX®

• Enables engineers to predict, design and optimize for flow rates, pressures, temperatures and heat transfer rates in fluid systems.

• Includes anything from ventilation systems and water and gas distribution systems, up to boiler designs and complete power generation cycles.
BENEFITS OF FLOWNEX®

• The ability to simulate systems with any combination of liquid, gas, two phase, slurry and mixture flows in both steady state and dynamic cases makes Flownex® the most powerful simulation tool of its kind.
FUNDAMENTALS OF THE FLOWNEX® SOLVER

- Network entities:
  - Elements
  - Nodes
  - Boundary conditions

- Graphical representation of Nodes and Elements & Boundary conditions:
Flownex® contains a large and extendable library of components to allow users to quickly setup and model flow systems.
COMPLEMENTING SOFTWARE

• 3D – Computational Fluid Dynamics (CFD)

  • Component boundaries generated in Flownex® SE are useful in CFD simulation.
    • Inlet velocities, pressures, temperatures, mass flows.

  • Flownex® can be used to validate & test components characterized in CFD simulations on a system level with dynamic variations.
    • Valves, Heat exchangers, Compressors, Pumps turbines, etc.
COMPLEMENTING SOFTWARE

• Pipe Stress Analysis
  • Flownex® calculates forces & loads on pipes and bends due to changes in pressure and velocity which can be used as inputs to pipe stress analysis software.

• Control
  • With the ability to simulate systems dynamically Flownex® can be used to validate, develop and optimize control systems.
“It is unbelievable what we have achieved in the last 12 months; our approach of working closely with our clients and industry professionals to enhance Flownex ®’s capabilities has once again proven itself and allowed us to deliver a product that is well aligned to the ground-breaking advances our users are achieving”

Tiaan Dercksen – Principal, Software Development
OIL & GAS ENHANCEMENTS

GIS IMPORTING AND COORDINATE SYSTEM DRAWING

- The ability to import GIS data substantially reduces the time required to setup and define pipeline systems.
- Thousands of kilometres of pipelines can be modelled in Flownex® within seconds.
- Location of components can be specified using GPS latitude and longitude coordinates and overlay networks on maps.
TURBO MACHINERY ENHANCEMENTS

SECONDARY FLOW ANALYSIS & STEAM TURBINE MODELLING

• Enables users to apply the unparalleled stability, solution speed and accuracy to detailed modelling of secondary flow in gas turbines.

• Key features:
  – Swirl solver,
  – Rotating cavities,
  – Vortices,
  – Seals
  – Rotating channel modelling.
INTEGRATION

FLOWNEX® – ANSYS – MATHCAD INTEGRATION

VISUALIZATION & GRAPHING

• 3D graphing is now available for components. Users can plot the distribution of properties on a 3D graph. This is particularly useful when visualizing heat transfer and heat exchangers.

3D DRAWING & IMPORTING

• After importing DXF files and shape files, users can visualize and modify systems using our new 3D drawing canvas.
CAPABILITIES

SIMPLE/COMPLEX SYSTEMS SIMULATION
Single-phase / Two-phase, Liquids,

COMMISSIONING ASSISTANCE
Temperature and pressure set points, Process parameters for new/existing plant.

TECHNICAL FEASIBILITY STUDIES
Plant/System modifications.

THERMAL-HYDRAULIC DESIGNS

SYSTEM OPTIMIZATION
System modification / Process modification.

INVESTIGATIVE SIMULATIONS
Problematic systems/ components. Poor design/Poor operating.

CONCEPT DESIGN
Plant architecture, System specifica-

ROOT CAUSE ANALYSIS
System / Component failure.

COMPONENT PERFORMANCE ASSESSMENT
Assessment of design/operation.
Understanding the ever growing demands, shorter lead times and increased performance requirements associated with every day business, Flownex® provides a complete thermal fluid simulation platform to meet these challenges.

Flownex® provides users with the ability to:

- Seamlessly design and validate new concepts while ensuring the highest quality and standards are met.
- Efficiently test and evaluate planned upgrades by effortlessly running multiple scenarios to ensure every possible angle is investigated.
- Quickly determine the root cause of system inefficiencies and unexpected response.
- Accurately predict system response to operational procedures, control scenarios and accident scenarios by running transient simulations.
- Confidently make calculated decisions during operation.
- Skilfully evaluate, optimize and make informed decisions on existing systems.
# FLOWNEX® Application in Renewable Energy Systems

## Concentrated Solar Power
- **Thermal Storage Systems**
  - Charge / Discharge transients.
  - Feasibility studies.
  - Thermal distribution.
  - Direct / indirect storage.
- **Collector & Heat Transport System**
  - Inherent transient nature.
  - Charging & discharging.
  - Feasibility studies.
  - Heat transfer / losses.
- **Power Cycles & Steam Generators**
  - Heat & flow distribution.
  - Variable heat input.
  - Accident scenarios.

## Wind Power
- **Lubrication Oil Cooling System**
  - Flow distribution.
  - Oil temperature variation.
  - Oil pressure distribution.
- **Hydraulic Unit**
  - Hydraulic line.
  - Flow losses.
  - Abnormal scenarios.
  - Feasibility studies.
- **Generator Cooler**
  - Water circuit flow.
  - Control logic.
  - Blockages & pump failures.

## Biomass Gasification
- **Integrated Gasification Combined Cycle Plants**
  - Root cause analysis.
  - Verify control strategy.
  - Fluid and heat flow distribution.
- **Reciprocating Gas Engines**
  - Safety systems.
  - Evaluate valve geometry.
  - Mass and inertia.

## Geothermal Thermal Power
- **Electricity Generation**
  - Integrated dynamic responses.
  - Characteristics & component operation.
  - Plan plant changes.
  - Evaluate control systems.
- **Direct Usage**
  - Varying loads.
  - Daily demand cycles.
  - Heat losses.
  - District heating flow distribution.
# FLOWNEX® Application in Coal Energy Systems

## Steam Circuits
- System heat loss.
- Start-up & shutdown scenarios.
- Complete cycle.
- Turbine trip control.

## Gland Steam System
- Steam delivery.
- Pressure distribution.
- Evaluate seal wear.

## Deaerator / Feedwater Tank
- Steam / Air mixture.
- Track condensate levels.
- Venting capacity.

## Boiler Water Circuits
- Natural convection.
- Drum level tracking.
- Phase changes.

## Boiler Steam Circuits
- Attemperation control.
- Steam system reaction.
- Operational changes.

## Lubrication and Control Fluid Systems
- Flow distribution.
- Oil pressure distribution.
- Logic control systems.

## Cooling Water Circuits
- Cooling capacity.
- Identify leaks.
- Water hammer.
- Expansion planning.

## Condenser
- Heat Transfer degradation.
- Air leaks into system.
- Condenser (P, T, Level).

## Feedwater Pumps
- NPSH System integration.
- Pump switch-over.
- Pump sizing.

## Boiler Draught System
- Flow distribution.
- Damper control.
- Air leaks.

## Feedwater Heaters
- Accident scenarios.
- Operating conditions.
- Vent capacity.

## Ash Removal
- Ash water flow.
- Slurry pipeline planning.
- Pump capacity.
- Settling velocity.
FLOWNEX® APPLICATION IN MINING

CHILLED WATER RETICULATION

- Chiller Plants
  - Compression cycles.
  - Cooling towers.
  - Bulk air coolers.
  - Water circulation networks.

- Chilled Water Transport
  - Pumps.
  - Turbines.
  - Spot coolers.
  - Water storage dams.
  - Mining machinery.

- Spot Coolers
  - Vapour compression cycles.
  - Compressor.
  - Condenser.
  - Expansion valve.
  - Evaporator.

VENTILATION

- Ventilation System Control
  - Bulkheads.
  - Ventilation doors.
  - Regulators.

- Heat Loads
  - Auto-compression.
  - Heat flow from surrounding rock.
  - Heat flow from fissure water.

- Ventilation System
  - Booster, aux and main fans.
  - Heat exchangers.
  - Air coolers.
  - Main & ventilation shaft.
  - Underground tunnel network.

SLURRY

- Backfill transport in deep mines.
- Hydraulic materials transport.
- Hydraulic transport of fine ore.
- Transport of processed ore to tailings dams.

COMPRESSED AIR

- Compressor lines.
- Air Distribution networks.
- Pneumatic Machinery.
FLOWNEX® APPLICATION IN CARBON CAPTURE & SEQUESTRATION (CCS)

CARBON CAPTURE

Pre-combustion capture
- Insulation temperature distribution and variation over water wall.
- Optimize pump, compressor and turbine operation.
- Verification of operating feedstock supply (fuel, oxygen).
- Dynamic effects of compression & pipeline transportation of CO₂.
- Feasibility studies on plant changes.

Oxy-fuel combustion capture
- Heat transfer flow distribution in the air separation processes.
- Flow balances involved with the use of a flue gas recycling system.
- Condensation of water vapor from the CO₂ stream, as well as for the compression.
- Feasibility and optimization studies.

CO₂ TRANSPORTATION

Ship transport
- Variations in gas temperature and pressure during transport.
- Investigate and optimize flow at the start and end of loading.
- Loading and unloading procedures during which transients are present.

Pre-combustion capture
- Mass and heat flow through the capture system during changing load conditions.
- Gas blowing and cooling capacities for varying loads.
- Multistage compression and condensing before CO₂ transportation.
- Effects of component failures or sub-optimum operations on the system’s overall efficiency.

Pipelines & Sequestration
- Optimize pump station sizing and energy consumption to minimize pumping costs.
- Predict pressure surges to ensure safety and pipe integrity.
- Evaluate full operating envelope for systems during startup and shutdown scenarios.
- Pipeline heating and cooling scenarios for distribution.
- Offshore and land based piping and reservoir sizing and design.
- Pipeline leak detection and leak position verification.
Mud circulation systems. Prevent solid deposition. Pressure delivery.

Blowout scenarios. Well kick (water hammer).

Hydraulic systems. Cooling systems lubricating and hydraulic oil.

Heating and pumping capacity. Recovery systems.

Identify chocked flow conditions. Dynamic system effects. (pressure relief, regulating and control valves)

Tank level tracking. Production and storage scheduling.

Evaporation, condensation, heating and cooling of pure fluid streams.

Design and simulation of thermo hydraulic systems and components associated with cracking. Optimization of control and production philosophies.

Refinery blending and storage. Operating and pumping procedures. Tracking tank levels and flow rates.


Operation and control philosophies regarding supply systems.
FLOWNEX® APPLICATION IN RENEWABLE ENERGY SYSTEMS

MANUFACTURING

Compressed air systems
- System sizing.
- System optimization.
- Fault finding and maintenance.

Washing bay
- Sizing system components.
- System optimization.
- Fault finding and maintenance.

SERVICES

Fuel stations
- Dynamic simulations.
- System sizing.

SYSTEMS IN MOTOR VEHICLES

Engine cooling system
- Heat transfer transients.
- System optimization.
- Thermal distribution.
- System sizing.

Air-conditioner system
- Heat transfer transients.
- System optimization.
- Thermal distribution.

Exhaust system
- Component and layout feasibility studies.
- System pressures and flow losses.

Fuel system
- System sizing.
- Dynamic simulations.
- System optimization.
THANK YOU

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