Wireless Solutions in Recycling

Oliver O'Toole

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Wireless Sensing Interest Group

(Sensors and Instrumentation Knowledge Transfer Network)

O'Toole Partners working with
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Agenda

- Recycling and Organics
- An Industrialised Composting Process
- Regulatory Framework – The Challenge
- Sensing and Control Requirements
- The Adaptive Wireless Solution
- Integration
- Business Benefits
- Conclusions and the Future

Recycling and Renewables

- Paper fully integrated with core industry
- Metals traditional and now dominated by big players with sophisticated machinery
- Plastics – ship to China (subject to price)
- Black Bins – Inert / Organic Separation
- Waste to Energy – Complex Plants – Incinerators, gasification, eflux scrubbing
- Organics – approximately 3million Tonnes pa
- Renewable Energy – Wind, water, biomass
- Biofuels – Fischer-Tropsch, syngas, hydrogen

Organic Processes

- Landfill – LATS and Generation Targets 2XROCs
- Windrow Composting
- In Vessel Aerobic Digestion – Category 3
- Anaerobic Digestion – Methane and Electricity
  - Mesophillic – slurry / liquid handling
  - Thermophillic – porridge plug flow
- Combined Heat and Composting
- Rendering – Category 2 Wastes
- Incineration – Category 1

Industry Statistics

Statistics difficult to ascertain, however, indicators include:

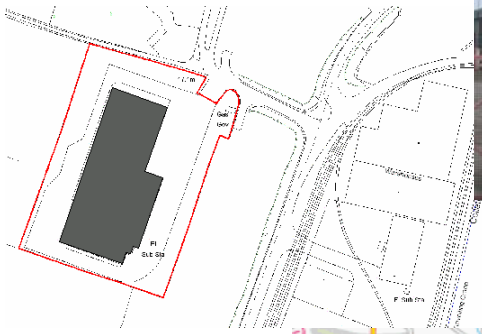
- Environment Agency estimates that England produces > 6m tonnes of “Animal and Drink” waste of which less than 50% currently recycled. 3m tonnes equates to 60 plants similar to Sharpness
- Local Authorities must reduce land-filled Biodegradable Municipal Waste from13m tonnes in 2006 by 3m tonnes to 10m tonnes in2010 and reduce by 10m tonnes to 6m tonnes by 2016. Target equates to additional 140 Sharpness plants

Regulatory Framework – The Challenge

- Environment Agency – “No odour shall be detectable outside the site boundary…”
  - Fully indoor process
  - Building run at negative pressure – 100,000m3/hr fans
  - 24/7 Environmental System Availability
  - 2 stage Wet Scrubbing, Biofilter, ‘Polishing / Carbon’
- Animal By-Products – “Category 3 waste shall be pasteurised for a minimum of 1 hour at 70^{o}C
  - Rotating homogenous 60T batches
  - 5 location rotating temperature sensing
  - Individual interpretation – 71oC for 75 mins

Aerobic Digestion Plant

Sharpness Docks
Gloucestershire
GL13 9UN



Site area	4 acres
Plant area	60,000 sqft
Current capacity	48,000T pa
Potential capacity	100,000T pa
Grid connection	1 Mw
EAWML	48059
ABPR	Cat 3 approved
Inputs	Green, Kitchen and Food Waste
Output	Nutrient rich organic fertiliser (Hi-N compost)

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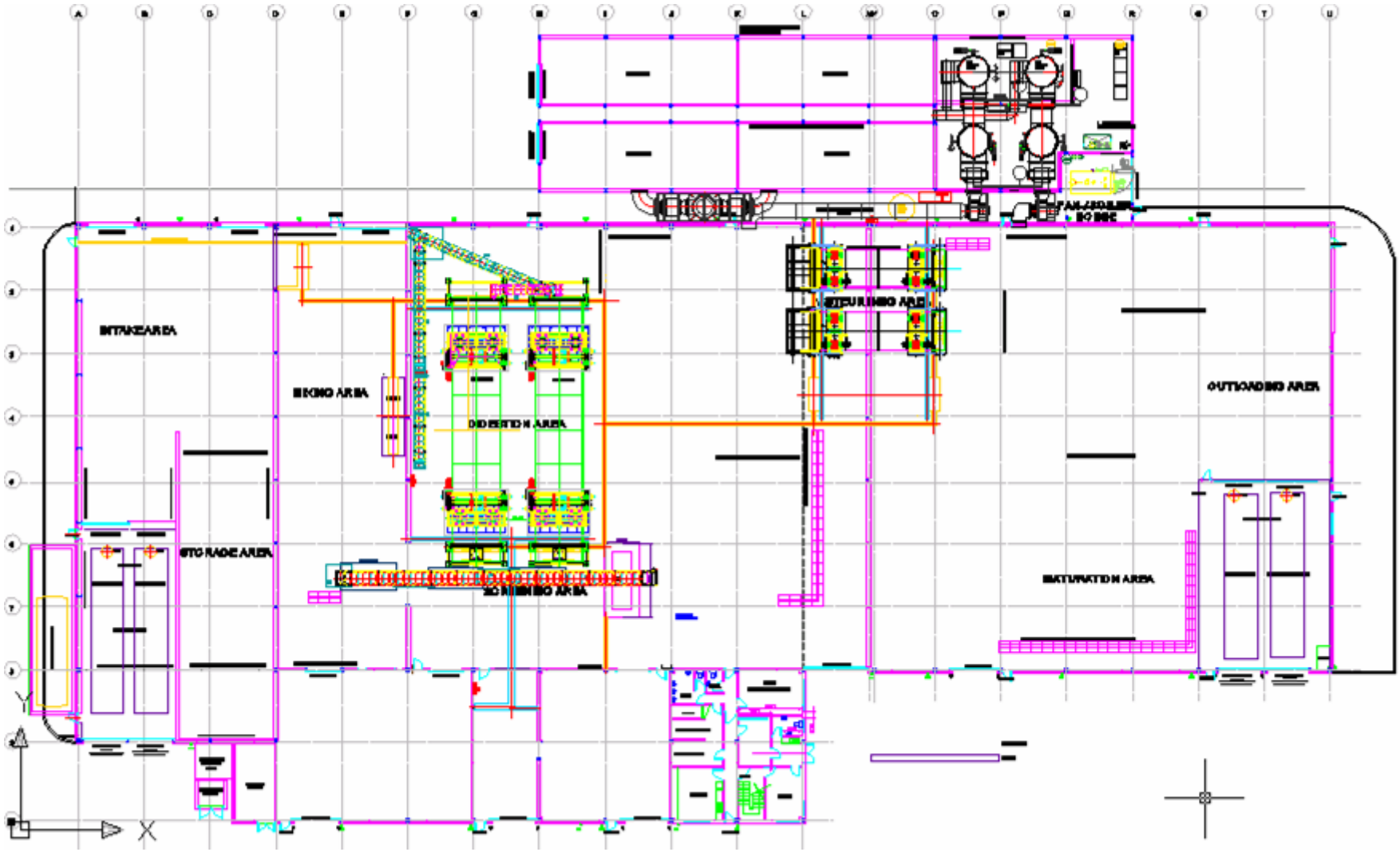
Sharpness Plant Design



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In-vessel Process

- Weighbridge
- Reception
- Mixing
- Conveyors
- Digestion
- Screening
- Pasteurisation
- Maturation

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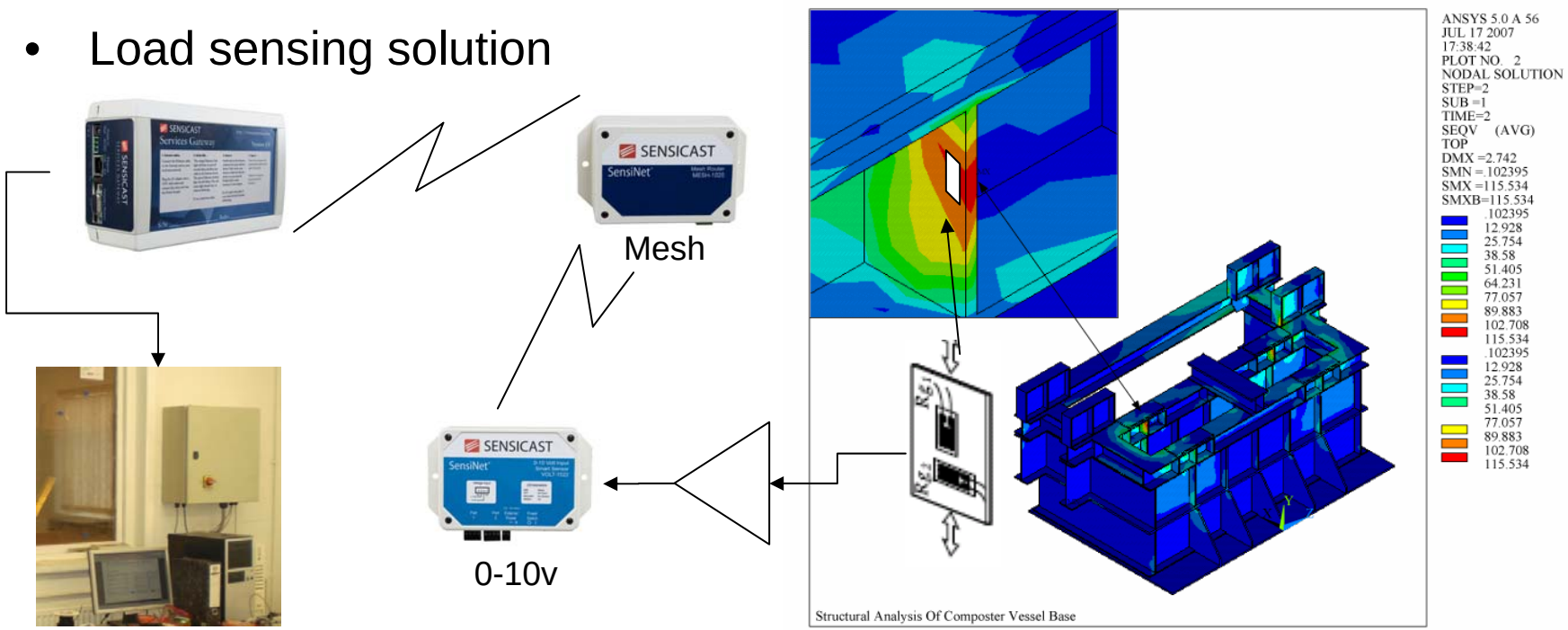
Wireless Solutions – Digestion / Load Sensing

- Load sensing solution



- Temperature sensing
- Note barrels could be positioned at lowest potential energy position for maintenance
- Fill weights or processing gradient measurements

FUTURE – Biological process measurement O_2, CO_2

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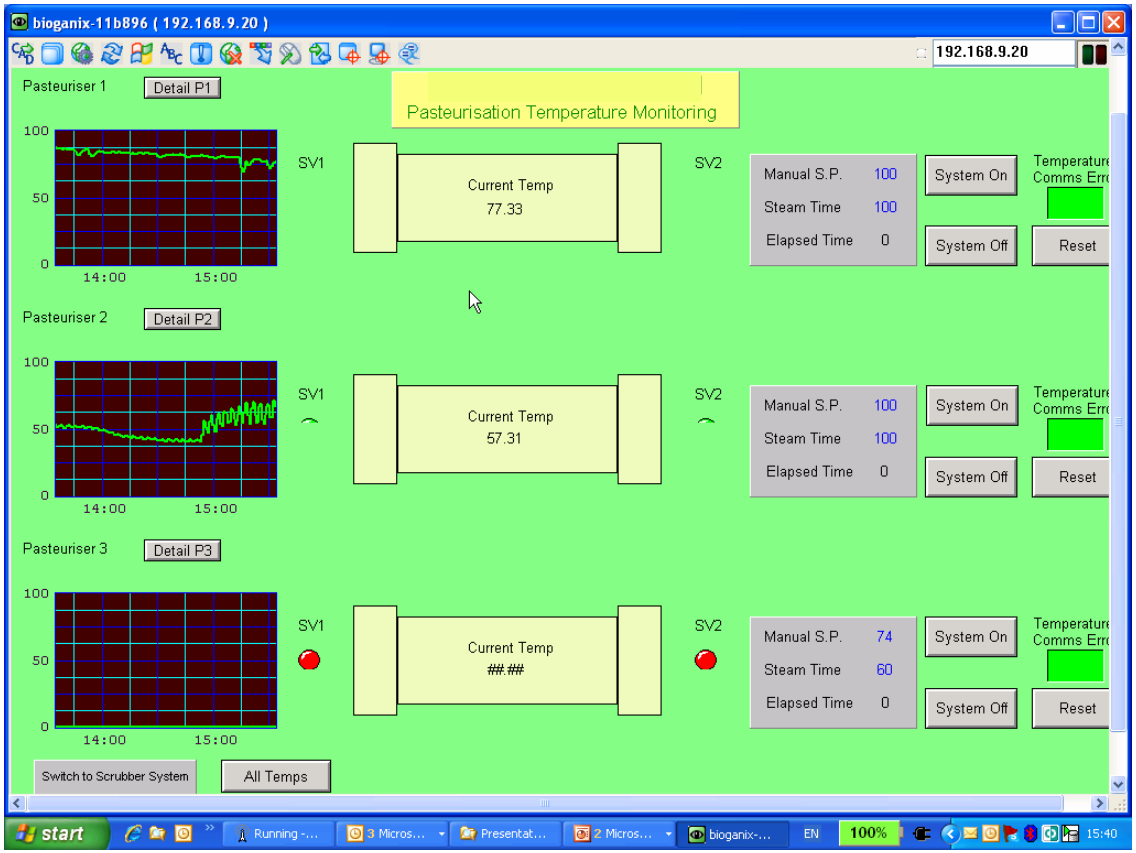
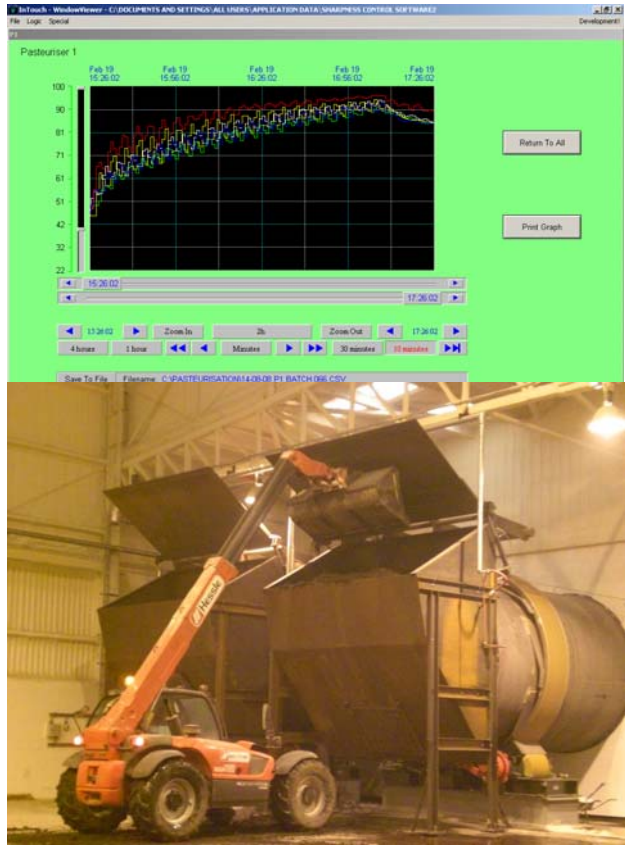
Wireless Solutions - Pasteurisation

- Wireless Temperature Sensing
- Hostile Environment





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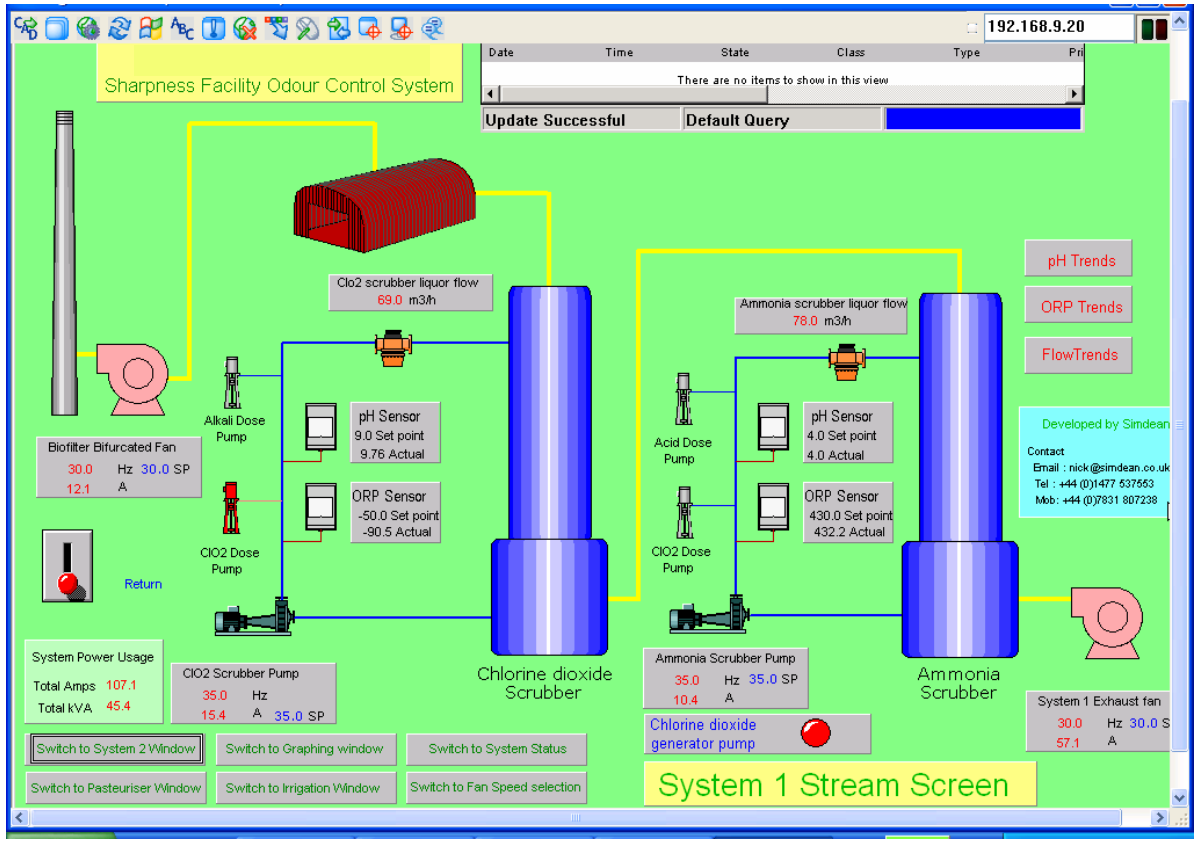
Wireless or wired - Environmental Management

- Wet Scrubber Systems
- Biofilter, watering and fertilisation



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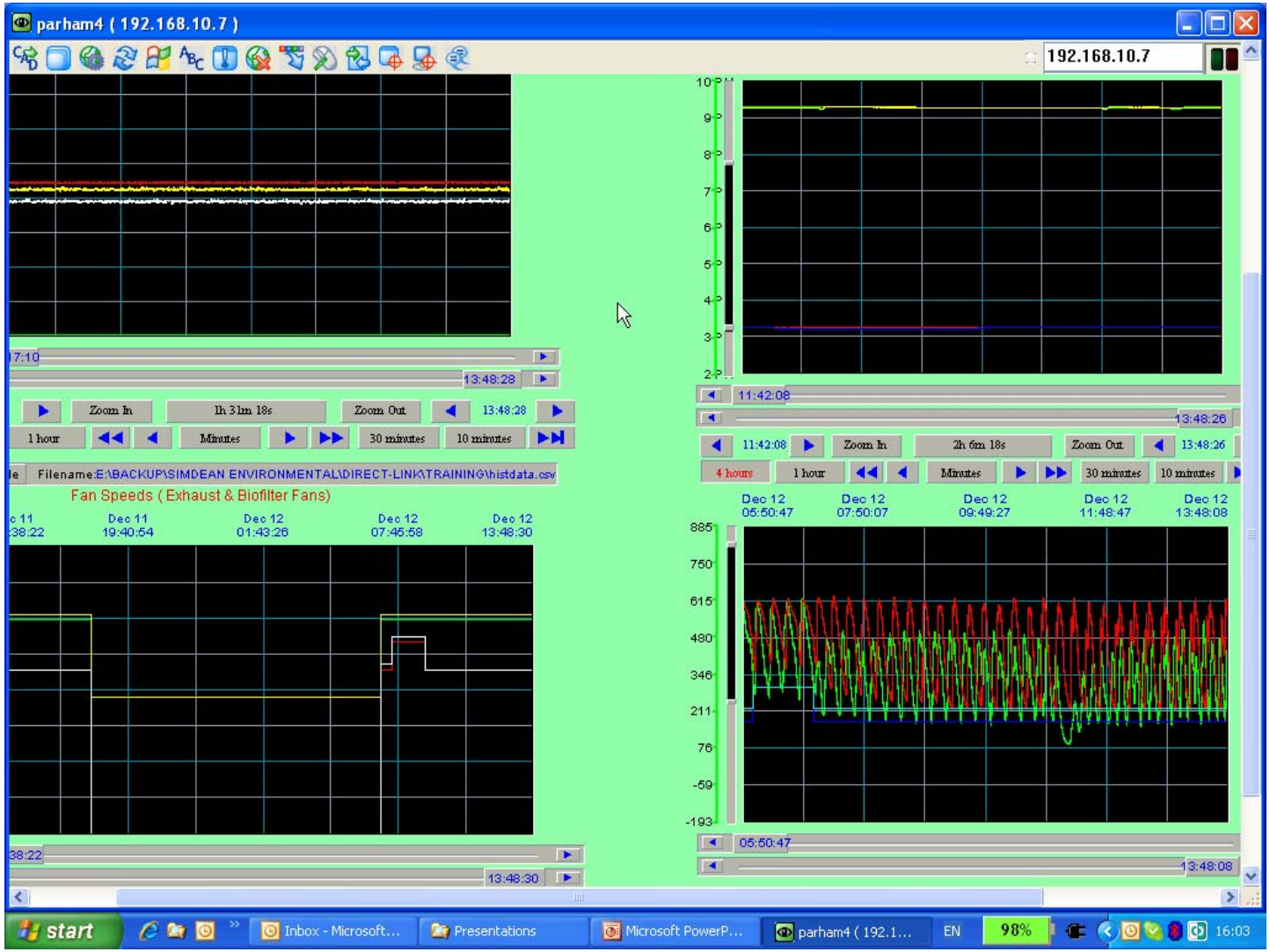
Remote Monitoring Systems



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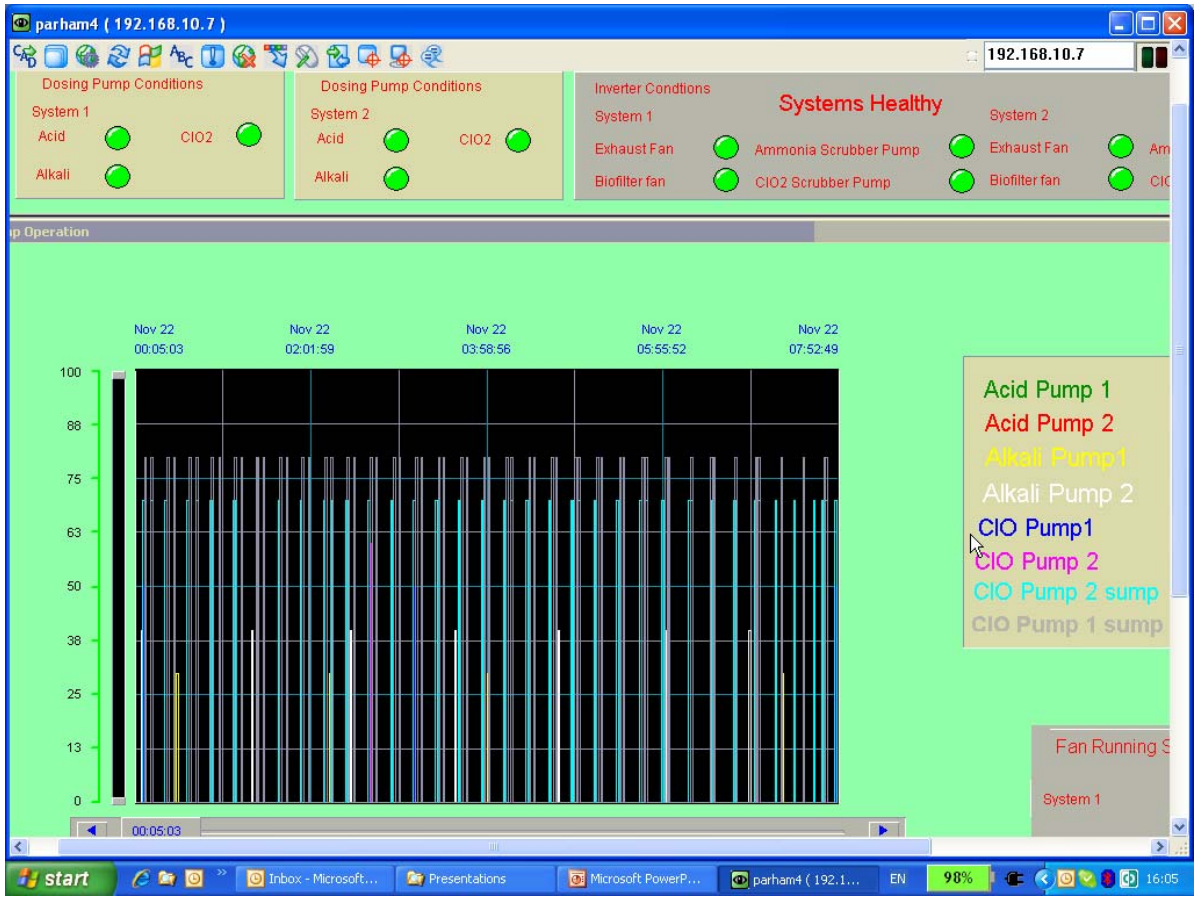
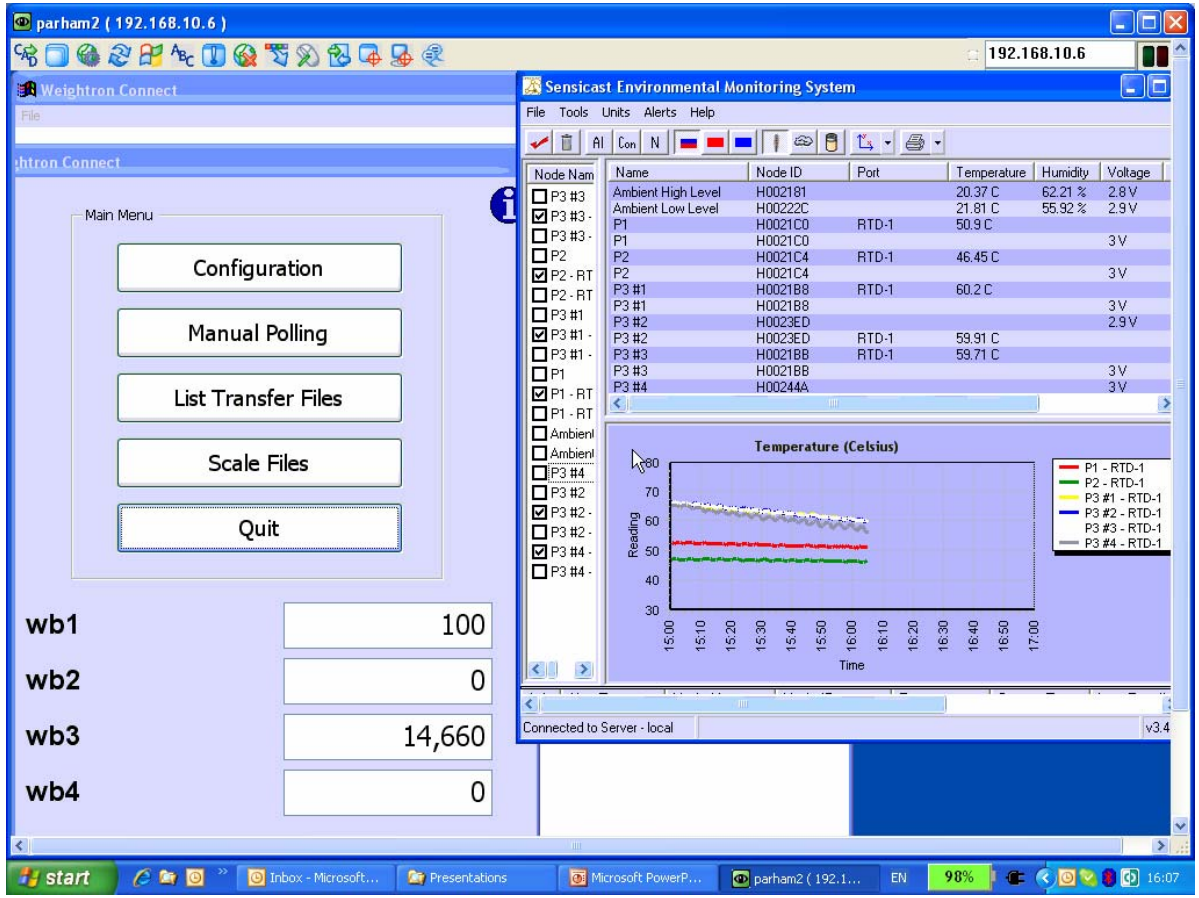
System Health Monitoring

- Fans and pumps condition monitoring
- Dosing pumps, frequency



Plant Systems

- Intake weighbridges to daily invoicing
- Outputs
- Product Cooling



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Wireless Solutions – Knowledge Gained

- Resilience – The need for multiple paths
- Power consumption – Batteries and chargers
- Environment – Robust enclosures
- Sensors – Calibration and reliability
- Integration – Modbus TCPIP
- Control Systems – Functionality and support

Adaptive Wireless Technical Solution

- We have been working with Adaptive Wireless Solutions for over two years on 3 different plants.
- Mesh radio solutions have provided us with a quick and robust sensing network in a very harsh environment
  - Temperatures 30-50^{o}C
  - Humidity 70-80%
  - Ammonia levels 6-10ppm
- Ease of use, configuration and integration
- The importance of picking the right wireless technology for the application - Adaptive

SENSICAST SensiNet® Solution Overview

Services Gateway / Enterprise Gateway / Supervisory Gateway

Secure
Browser Apps
ODBC, SNMP
Modbus TCP
OPC Server
Web Services
API

Mesh Routers

Smart Sensors

0-10 V

4-20 mA

RTD Temperature

Contact Closure

Integrated Temperature And Humidity

Our Requirements

Load Sensing,
Strain gauges
O_2, CO_2

pH
ORP
Fluid Flow

Temperature
25-100°C
Voltage

Relay
Control

Human Factors

Popular Applications

Wonderware (invensys) · National Instruments · ICONICS · facility monitoring systems · GE FANUC · Microsoft Office · Honeywell · Citect · OnCall

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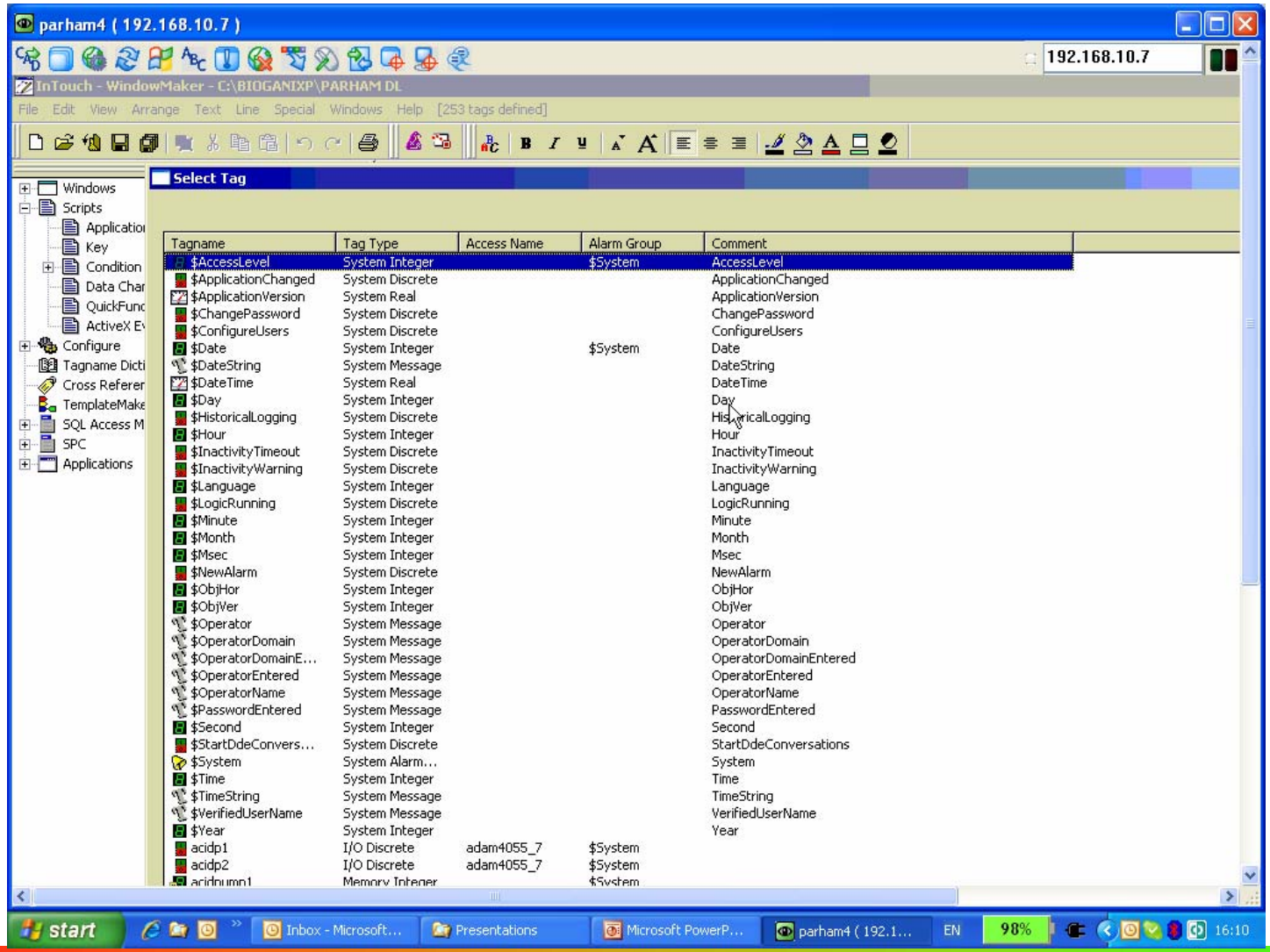
Integration – Sensicast to In Touch

- IEEE – 802.15.4 radio standard
- Sensicast Gateway with Proprietary Mesh Protocol
- Modbus TCP data interface
- Wonderware, InTouch SCADA system
- 24/7 operation
- Remote monitoring via VPN / VNC
- Available to manager over Cellular Broadband!

Control System Maintenance



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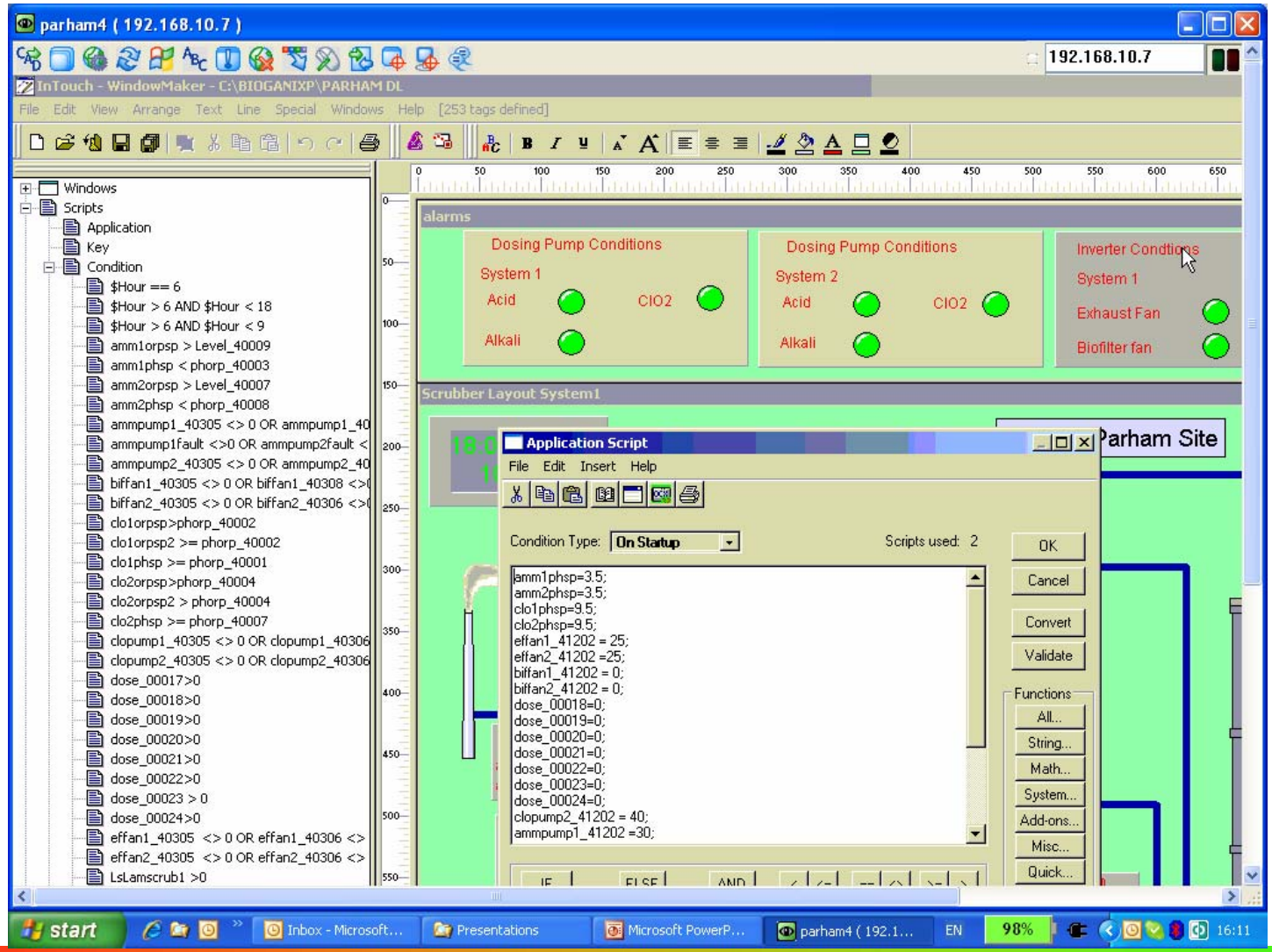
In House Application Development



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Business Benefits

To Date

- Health and Safety – Load monitoring
- Animal Health compliance – 100% pass rate
- EA compliance “No odours outside site boundary”
- Productivity - Steam energy optimisation

The Future

- Availability – Condition monitoring
- Energy Cost Saving - Power monitoring and optimisation
- Capacity Improvement - Biological process optimisation i.e. O_2 and CO2 monitoring
- Control – Materials handling