

PlantPAx® MPC - 在Logix平台上的先进优化控制

PUBLIC

 Allen-Bradley • Rockwell Software

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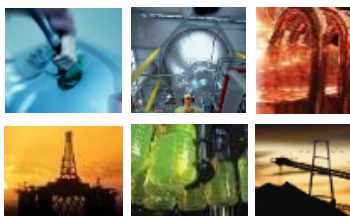
PlantPAx[®] MPC

PAVILION8

助力客户超越业务目标

Pavilion8[®] 模型预测控制Model Predictive Control –MPC 技术
帮助制造业精准的适应动态的市场变化，降低生产过程和产品
质量的波动，提高产能

世界领先的基于模型的软件产品以提高客户的效益



1991年面世

- 技术创新
- 2007年加入Rockwell
- 行业专家以及在模型开发、先进控制和实时优化方面的160+ 专利技术

- 增加效益
- 提高产量
- 降低制造成本
- 改进产品质量
- 降低环境风险



Rockwell APC 软件产品

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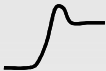
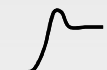
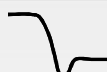
↑ INCREASING EFFORT & INCREASING VALUE	PROCESS ENVIRONMENT	PLANTPAX SOLUTIONS	
	Real-time Optimization	Pavilion Real Time Optimization	
	Model Predictive Control Nonlinear Multivariable Control Linear Multivariable Control	Pavilion8 & PlantPax Dynamic MPC	LEVEL 5
	Inferential Sensors	PlantPax Model Builder	LEVEL 4
	Advanced Regulatory Control	PlantPax Fuzzy Designer	LEVEL 3
		Logix IMC, CC, MMC	LEVEL 2
	Regulatory Control	Logix PID, PIDE, AOI	LEVEL 1

满足不同层次控制要求和不同控制范围的需求



Controller Matrix MPC-MIMO控制矩阵

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	CV1	CV2	CV3
MV1			
MV2	NO MODEL		NO MODEL
MV3			
DV1			
DV2			NO MODEL

MPC控制器由相互关联的MIMO模型矩阵组成，模型代表着输入输出之间的关系...

预测PREDICT

所有 MVs & DVs决定着CVs的未来

提前控制PROACTIVE

将 CV 控制在设定的目标值，防止超出控制范围，从而减少波动

So What Makes MPC Different?

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PID

SINGLE VARIABLE IN & SINGLE VARIABLE OUT-SISO
SP设定根据经验

FEEDBACK CONTROL-反馈控制

控制作用发生在SP-PV有偏差

INDIRECT PROPERTY VARIABLE CONTROL-间接控制质量
通过过程的温度、压力和流量等间接控制

POOR CONTROL QUALITY-控制效果不佳
对于大滞后和复杂的相互影响对象很难控制

PID SET POINTS ARE NOT NECESSARILY OPTIMAL
无优化概念

MPC

MULTIVARIABLE IN & MULTIVARIABLE OUT - MIMO
控制策略基于多变量的矩阵

PREDICTIVE CONTROL – 模型预测控制
动态模型来自于阶跃测试
模型可以预测未来并采取前馈控制

DIRECT PROPERTY VARIABLE CONTROL – 直接控制质量
产品质量指标直接控制

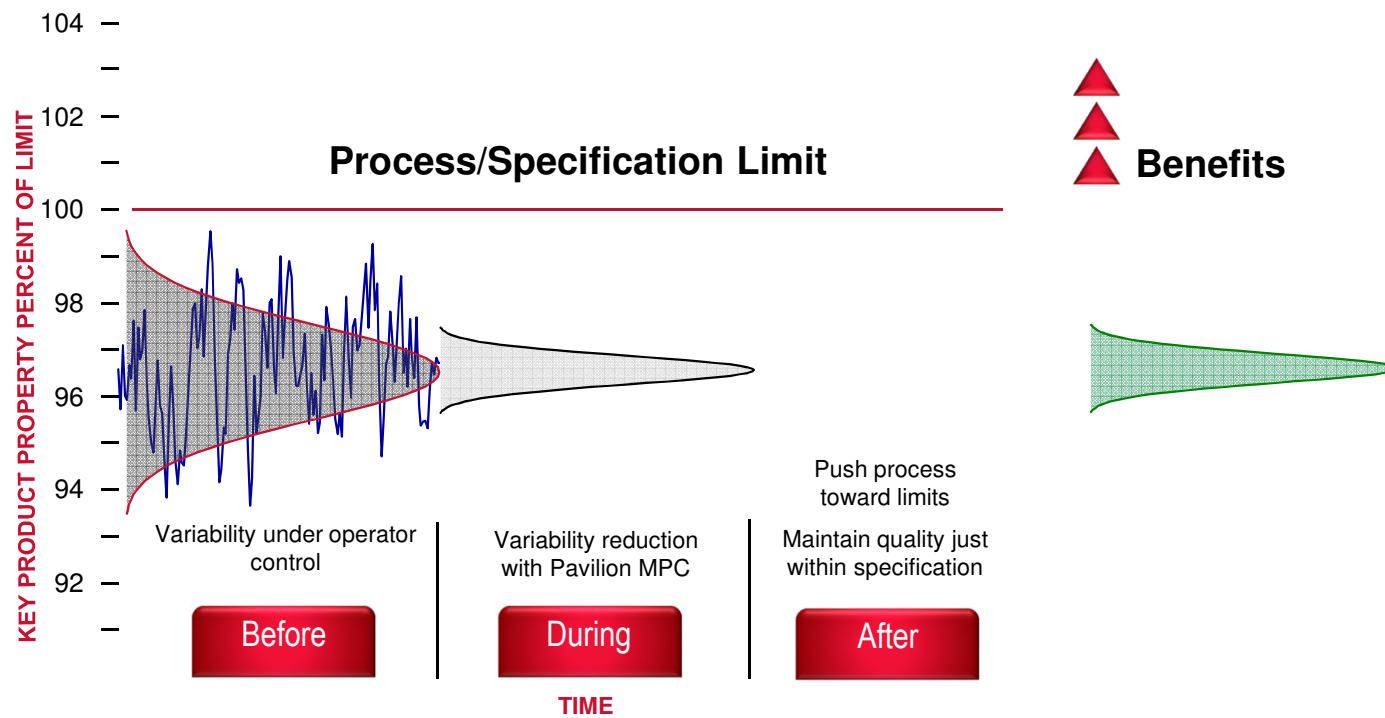
EXPLICIT DYNAMIC MODELS 动态模型一目了然
结合计算机技术实施计算过程控制作用

OPTIMAL PID TARGETS 优化PID目标
连续计算、设定和修改优化值



MPC 如何创造效益

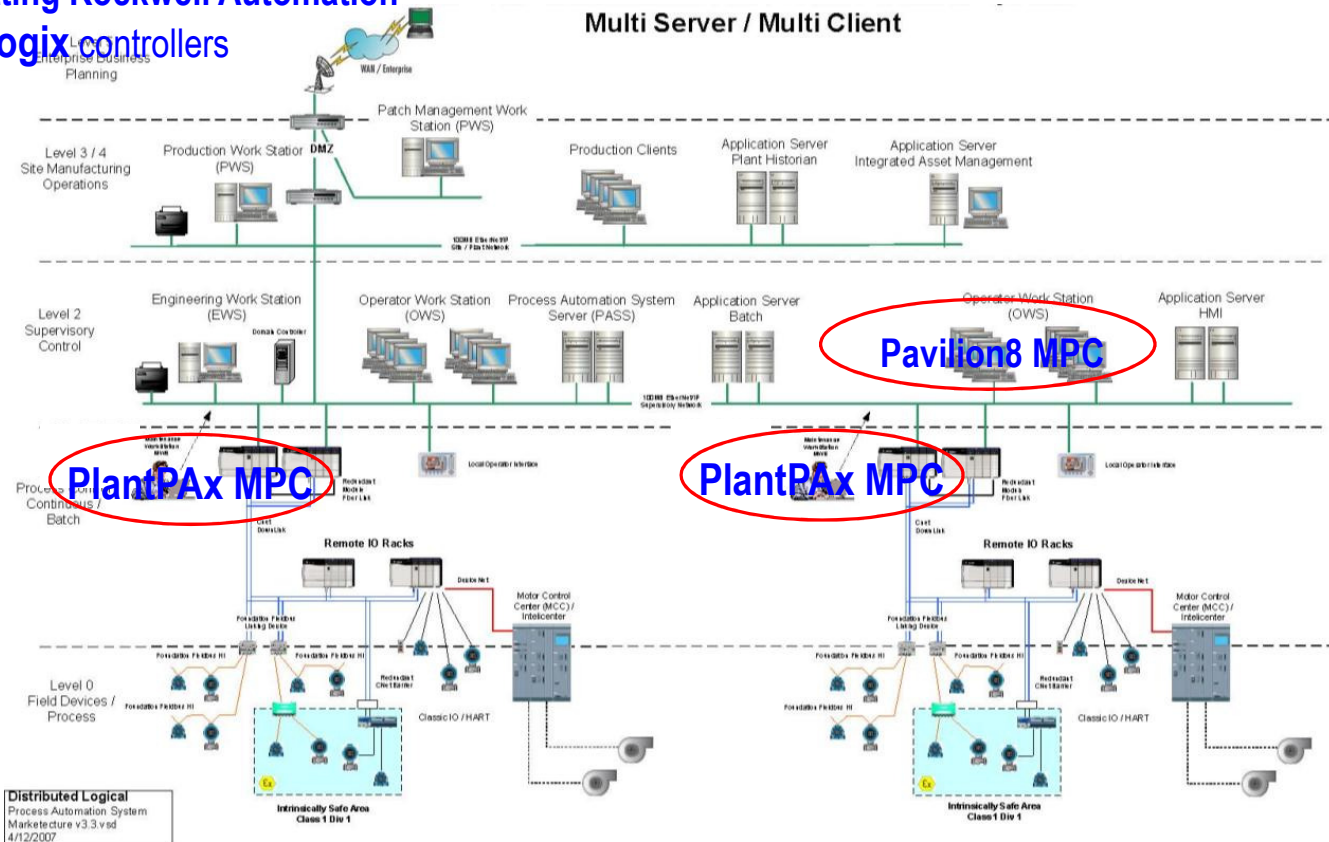
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Where does MPC fit in IA

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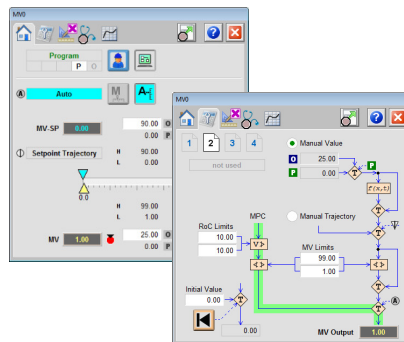
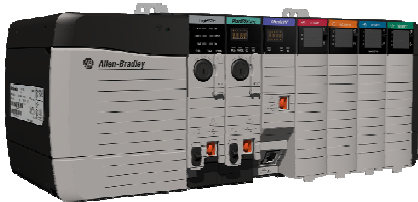
Advanced Process Control fitting Rockwell Automation
Integrated Architecture & Logix controllers



Rockwell 两种MPC产品比较

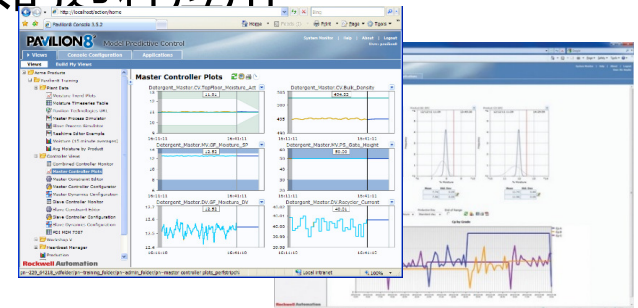
PlantPAX[®] MPC

- 卡槽安装的模块
- 适用于小或中等规模控制器
- 线性过程 (或者在一定条件下的非线性)
- 快速实现



PAVILION8

- 基于服务器的产品，可连接任何DCS厂家
- 适用于中等或大规模控制器
- 线性 - 非线性均可
- 复杂的过程应用

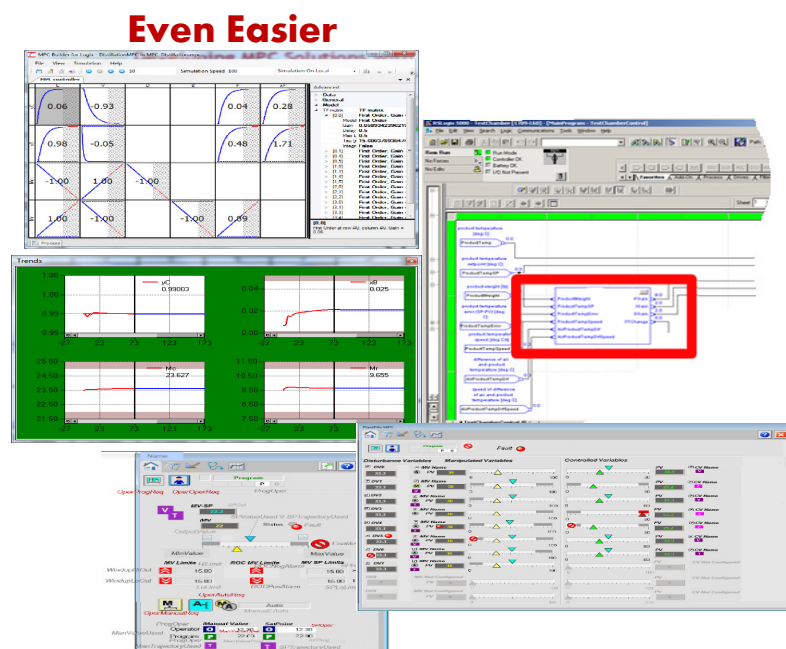


Scalable Products from Integrated to Comprehensive

PlantPAx MPC 功能

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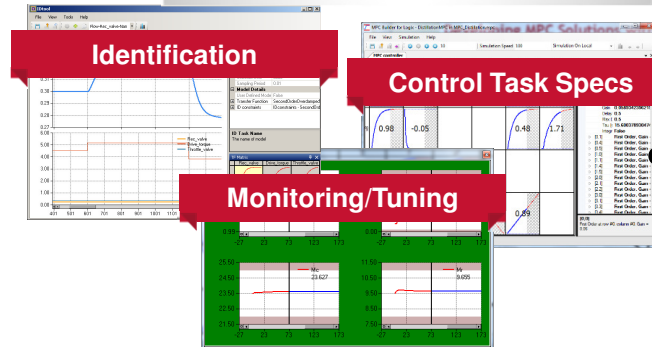
- MPC规模可达10 CV's, 10 MV's 和 10 DV's
- 一个模块可运行五个独立的MPC控制器
- 全功能的 MPC
 - 包含MPC算法解析器和动态约束管理
 - 支持在线模型和参数调整
 - ✓ 支持MPC开环和闭环参数调整
 - ✓ 基于条件的模型调整会降低运算速度，因此不推荐频繁变化模型
 - 模型开发更简便，在线运行速度更快
 - 标准Logix/PID操作画面



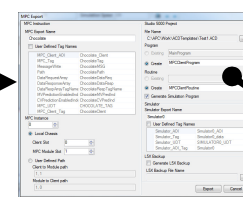
PlantPax MPC – 解决方案开发

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MPC Builder



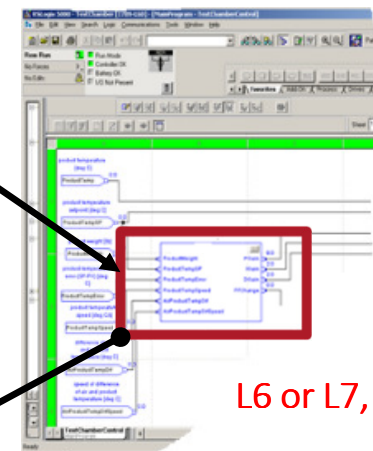
输出



Online change monitoring



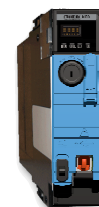
Logix5000



L6 or L7, > Ver 16

Logix5000 程序下装

专门的 MPC 模块
(Co-Processor)
AOI on Controller

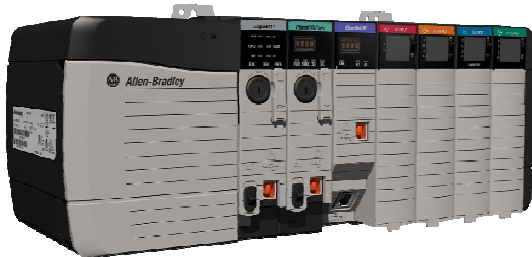


开发过程

1. 确定方案 Identify Process Parameters
2. 确定控制范围和目标
3. 生成 MPC 的 AOI 格式文件
4. 将 AOI 文件输入到 Logix
5. 下装项目文件到 Logix
6. 监视和调试系统

MPC模块灵活安装

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方案1 – Logix Controller and 1756-MPC Module 在一个卡槽内.
Ethernet on control LAN for CIP connectivity to backplane (workstation monitoring).

方案2 – Logix Controller and 1756-MPC Module 在两个不同的卡槽内. Ethernet on control LAN for CIP connectivity to backplane (workstation monitoring).



方案3 – Logix Controller and multiple 1756-MPC Modules 在一个或多个卡槽内.



APC 适用场合

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- » 什么原因装置操作频繁出问题？What keeps you awake at night?
- » 想要产能提高吗？是否能卖掉？Do you want to produce more and if yes, can you sell it?
- » 想要节能吗？Do you want to save energy?
- » 想要质量更好，减少次品吗？Do you want to produce better quality or reduce off-spec?

生产过程是否：

- Use energy 高耗能
- Refine products 高质量要求
- Interact 相互关联
- Take time 生产流程长
- Measure Quality 质量测量

PlantPAx MPC 适用场合

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- Distillation 蒸馏塔
- Evaporation 蒸发器
- Drying 干燥器
- Boilers 锅炉
- Milling 磨机
- Aeration Decks 精确曝气
- Stripping Columns 汽提塔
- Compressor 压缩机
- Reactor 反应釜
- And many more 其它



项目执行方式多样

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Solution Providers/ Customers



Environmental



Mining & Minerals



Soybean



Water & Wastewater

SSB



Pulp & Paper

Pavilion



Food & Beverage



Dairy



Chemicals



Oil & Gas



Biofuels

提供咨询&顾问

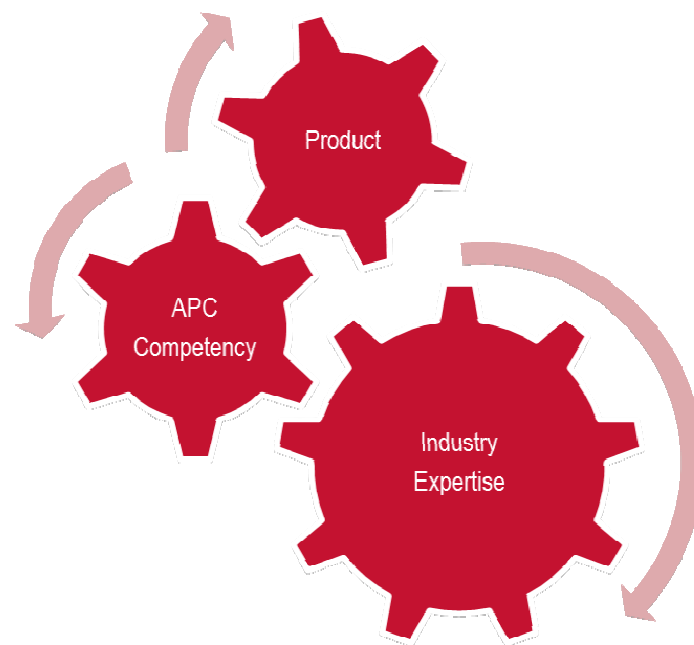
Leverage Rockwell Automation's Partner Network to extend Served Industries



Characteristics of a Solution Provider

- 行业专家
- 过程 & APC 功能
- 效益点

- 产品培训/指导

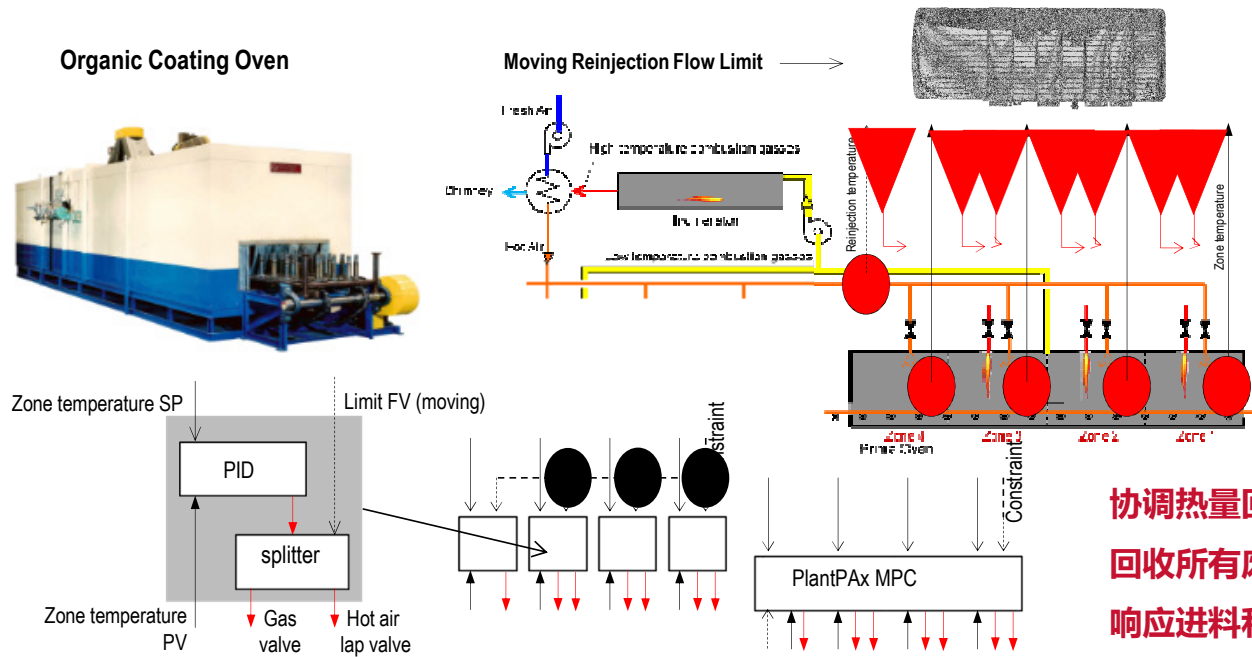


首项目可以合作执行, 能力确认后可自行执行项目

Installation 1: 零件喷漆烘干过程

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Classic Solution



MPC Control

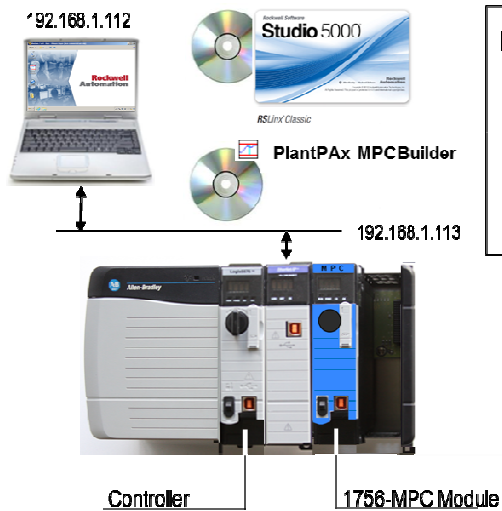
$$CV \times MV \times DV$$

$$4 \times 7 \times 2$$

协调热量回收
回收所有废热
响应进料和加热炉的变化

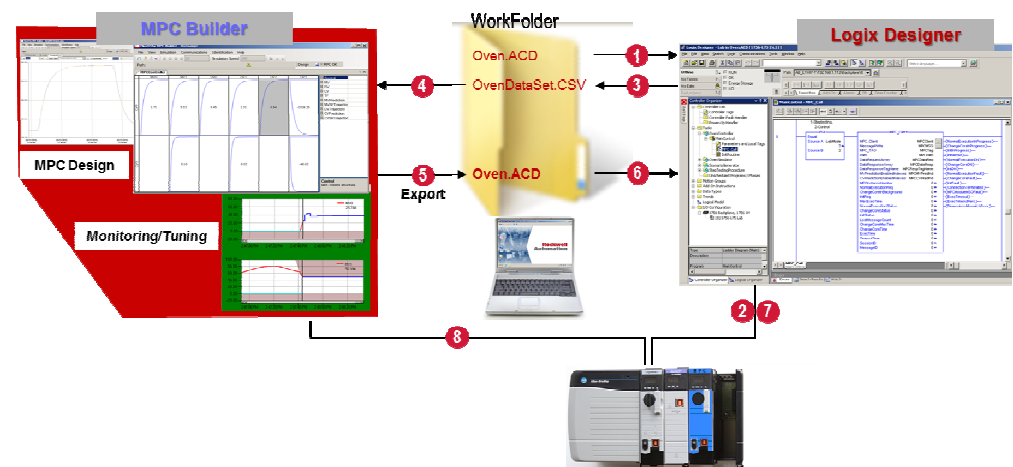
Installation 1 : 系统构成

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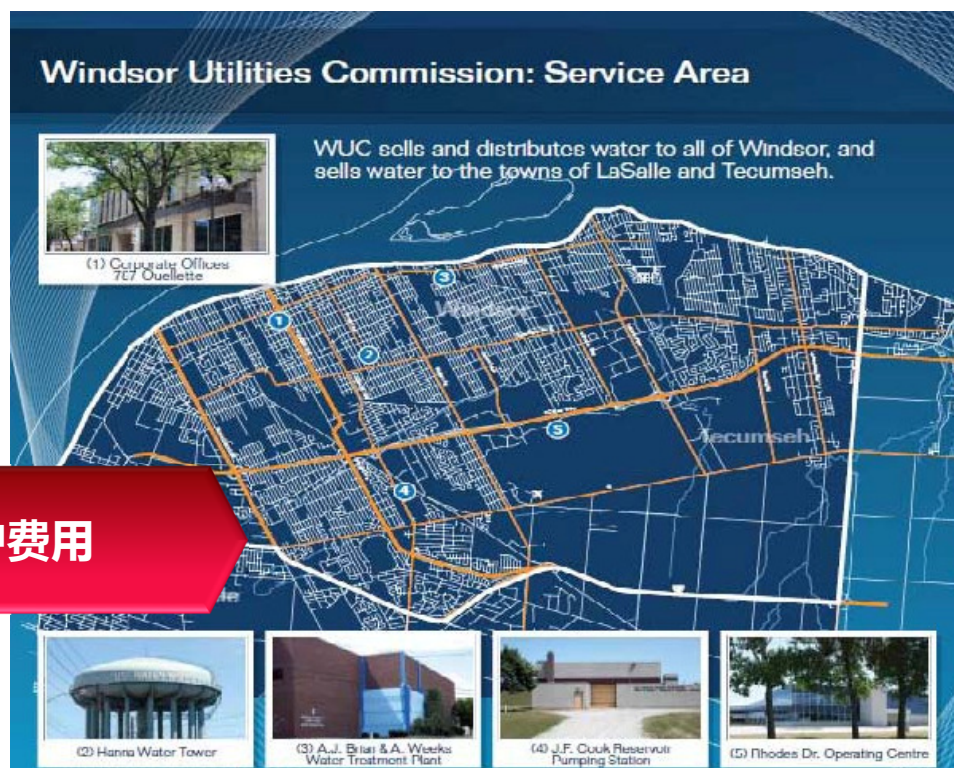
Lab Files:

Oven.ACD
OvenDataSet.CSV
Oven_ModelReady.mpc
Oven_SimulationReady.mpc
Oven_ExportReady.mpc



Installation 2: 自来水管网

- **Minimize Pressure:** Achieve minimum requirements at the end of many lines – but reduce leakage and pipe breaks.
- **Coordinate Pumps:** Respond to pumps turning on and off to meet varied demands.
- **Adapt Model:** to different pump sizes and design (VSD, FCV).



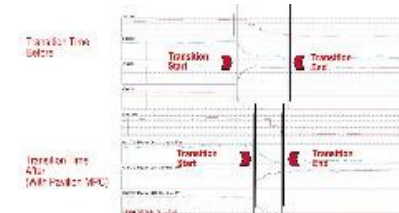
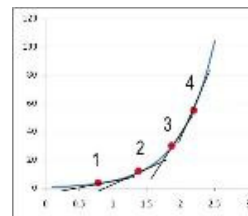
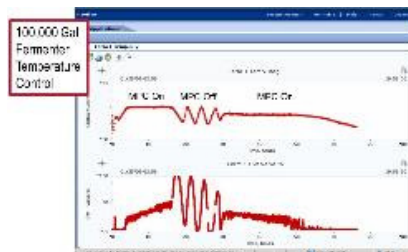
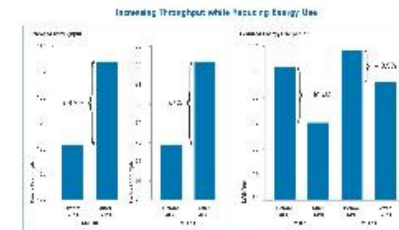
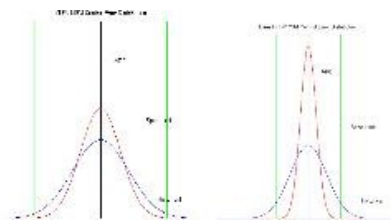
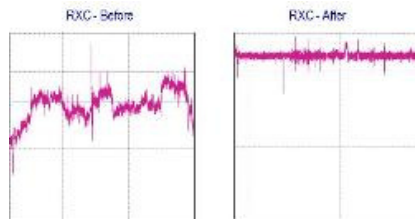
21% 减少爆管以及维护费用

PlantPAx MPC 销售

- 关注目标行业的关键客户
- 评估可行性
 - 了解客户需求 (产能? 能耗? 质量?)
 - 评估效益 (5%-5%-50%)
 - 是否有预算
- 与 PSL/GPTC 联系进行评估
 - PSL 协调确定&项目建议书

Better Models = Better Control

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We install APC because it makes money.
NO ONE WANTS LESS PERFORMANCE!



LISTEN.
THINK.
SOLVE.

谢谢

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