

Power Management in a “Green Factory”

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Power Management Challenges in a “Green Factory”

The current factory predicament

Electricity price and consumption increase result in production cost increase

Power Quality Management Presents Challenges to Factory Owners

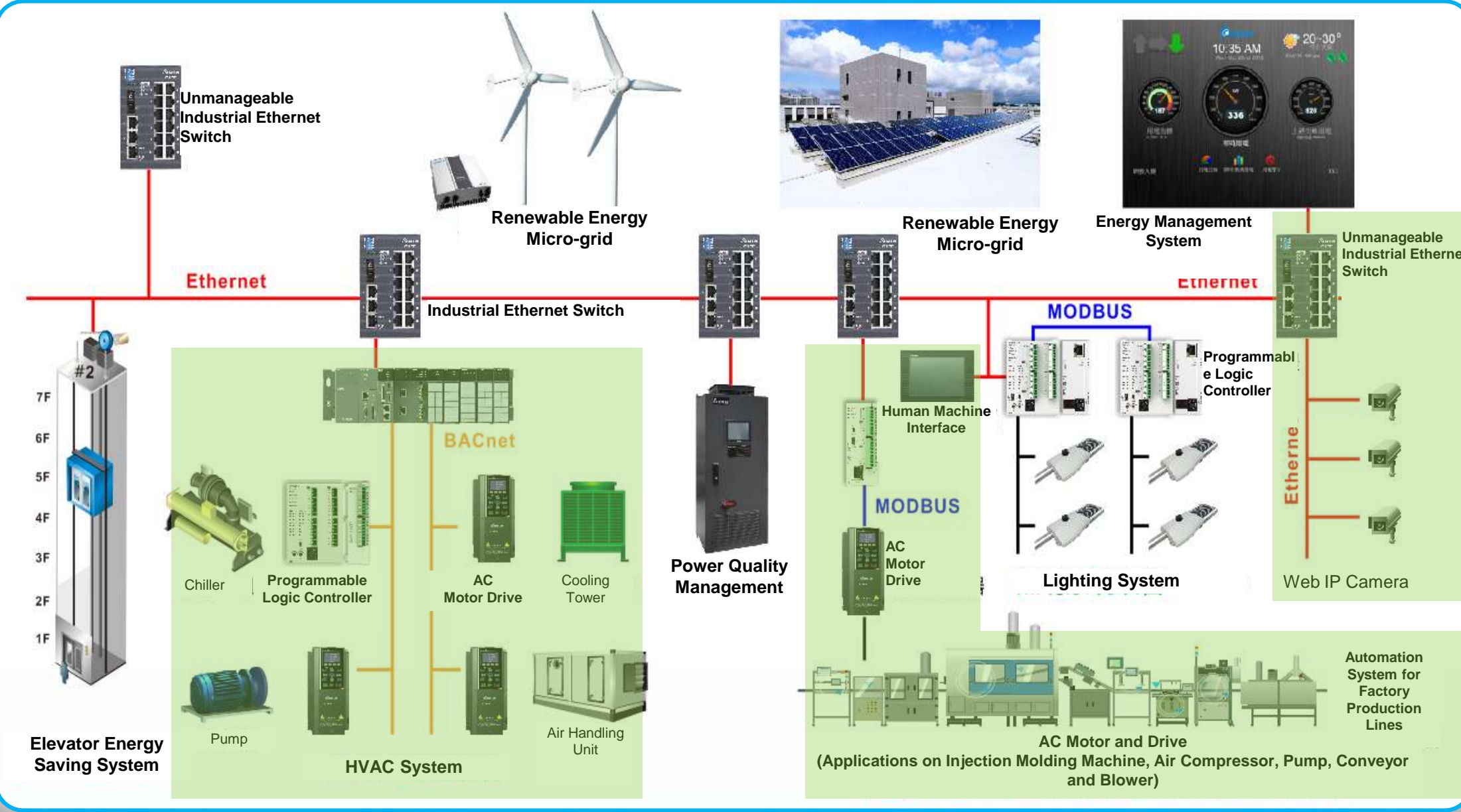
Governments set up energy saving policy and environmental requirements for industrial factories and equipment

Factory Automation helps tackle increasing labor costs and production efficiency

EMS

Green Factory Automation

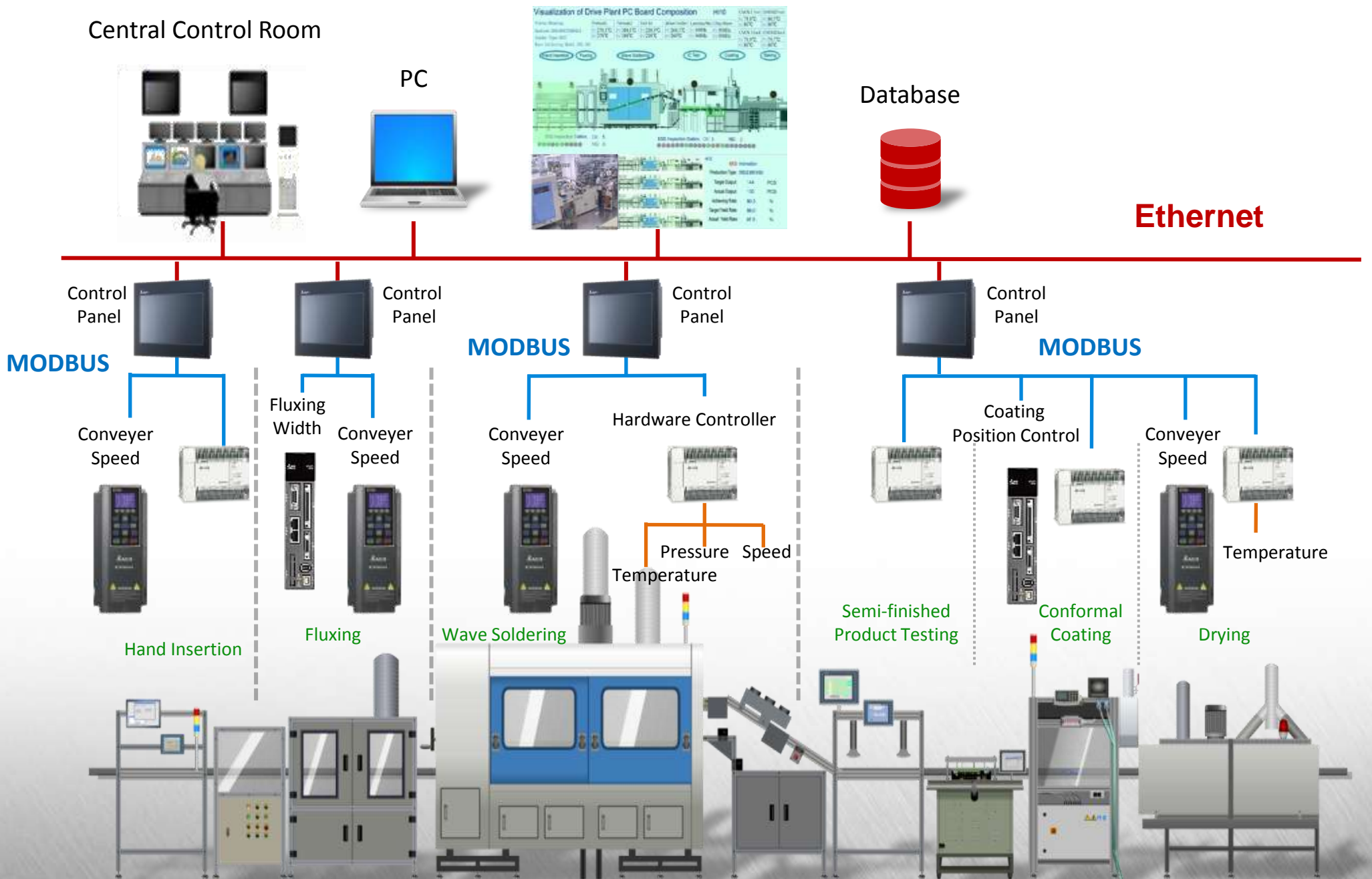
Factory Energy Saving Solutions



Green Factory Automation

Real-Time Factory
Production Line

Assembly Line Structure



Power Quality Management in a “Green Factory”

Power Quality Issues at a Green Factory



Grid / Transformer



VFD



UPS



Motor



Thyristor Rectifier



Renewable Energy

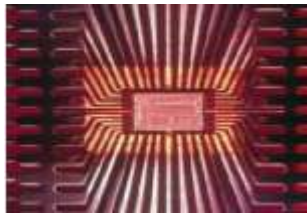


Switching Power Supply

No-Linear Load



Oil & Gas Industry



Electronics Industry



Steel Industry



Process Plants



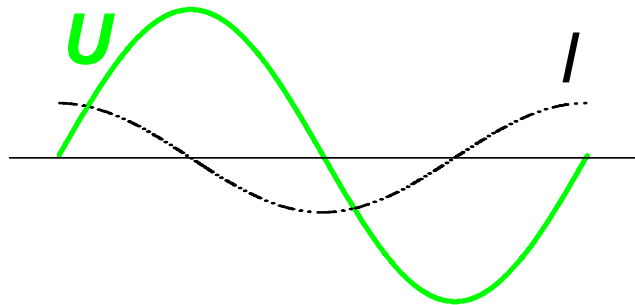
Automotive Industry



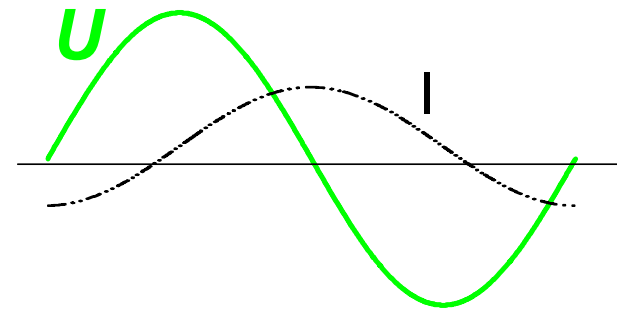
Reactive & Harmonic

What Is Reactive Power

Capacitive, inductive, and transient load cause the reactive power



Leading
Capacitive Current



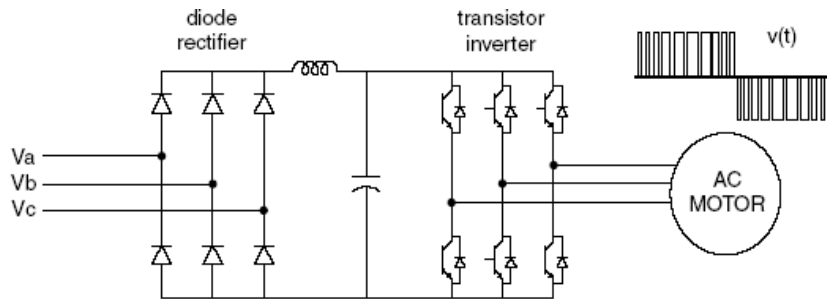
Lagging
Inductive Current

- **Fundamental Reactive Power:**

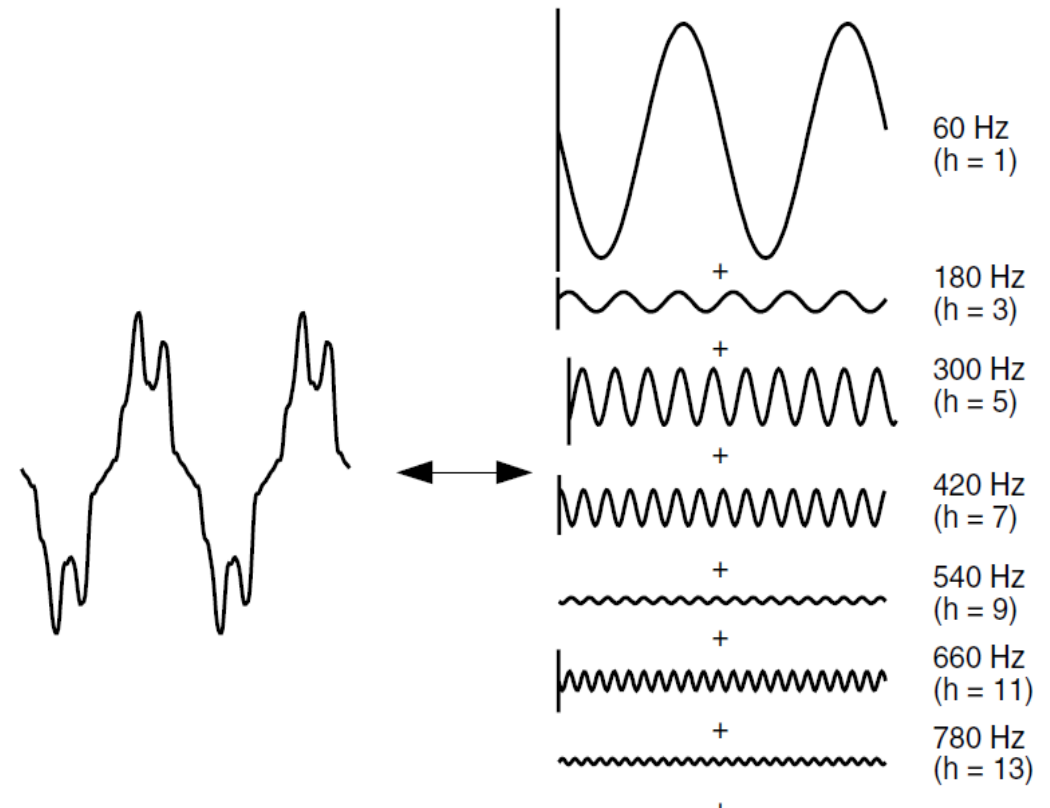
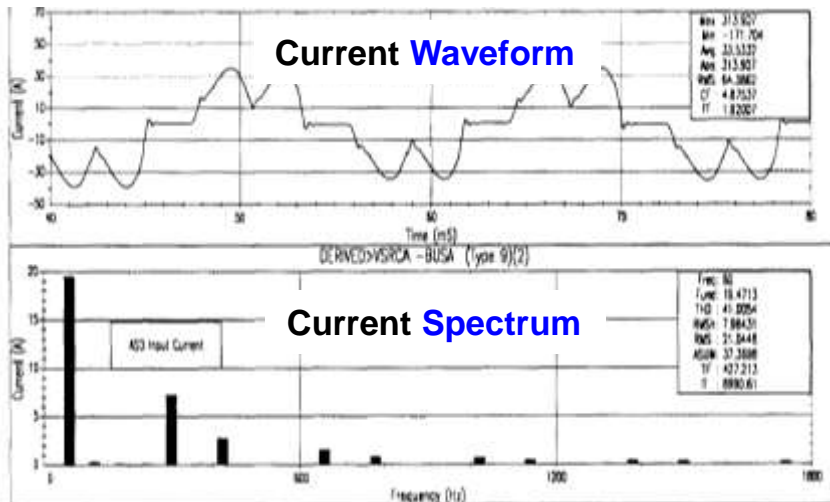
- Current is leading $\frac{1}{4}$ of the power cycle relative with the voltage -----Capacitive
- Current is lagging $\frac{1}{4}$ of the power cycle relative with the voltage ----- Inductive

What Is Harmonic

No-linear device or load cause the harmonic current and voltage



ASD (Example of No-linear Load)



- **Harmonic:**

- Sinusoidal voltages/currents that are integer multiples frequency of the power frequency
- Described by the complete harmonic spectrum with magnitudes and phase angles

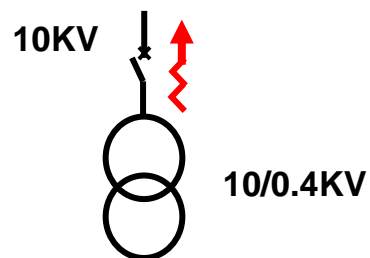
Current Power Quality Challenges

Building , IDC、 Industrial Field.....

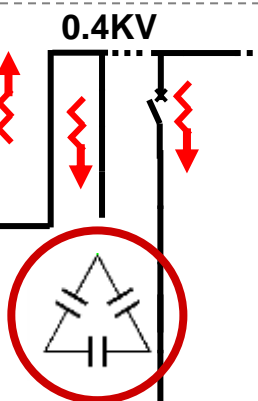
Main load :
Rectifier (VFD , UPS)
Motor, Linear PS

Power Quality Issue :
Harmonic + Reactive ,
Dynamic Reactive

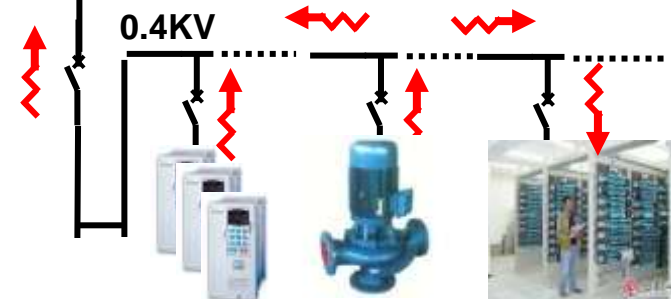
Cap Cabinet:
Can not solve issue
But generate new problem



HV/MV Power Distribution



LV Distribution

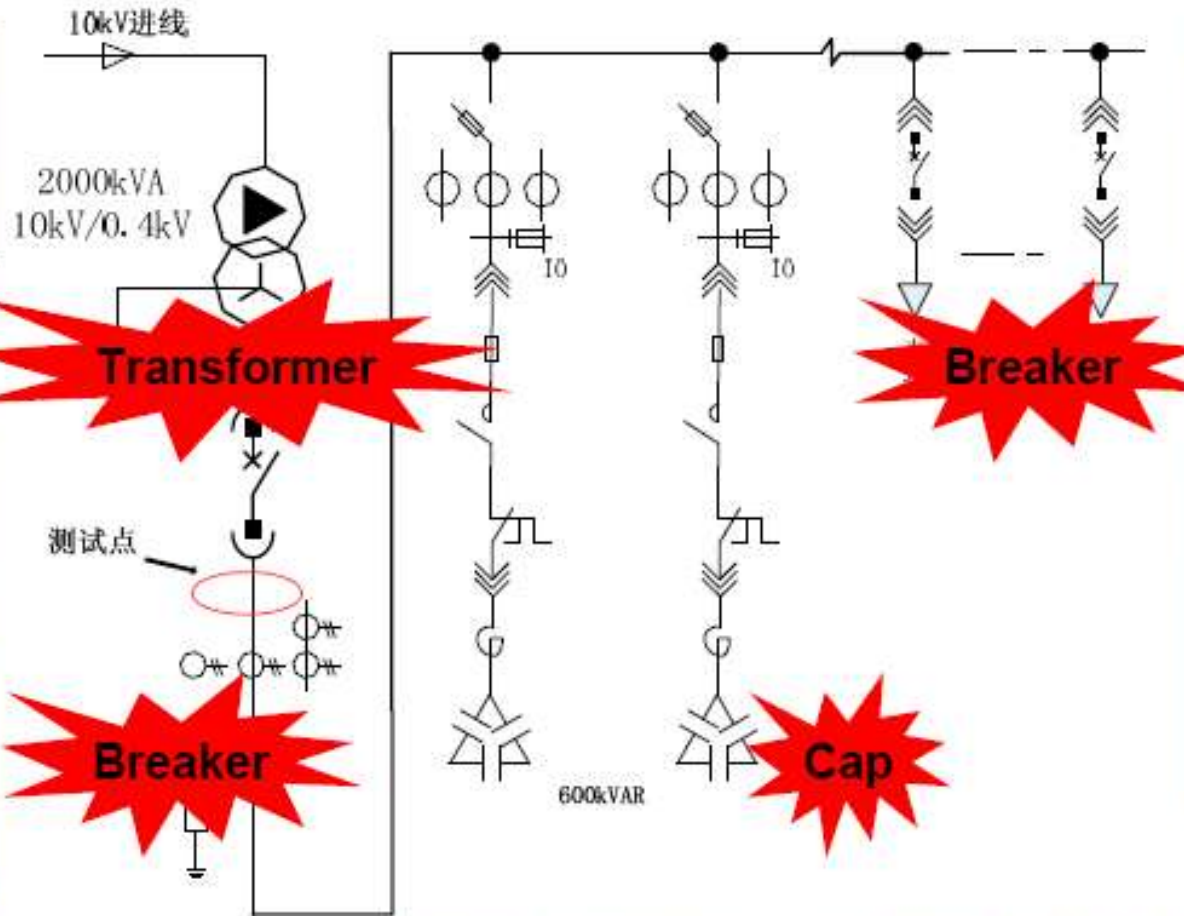
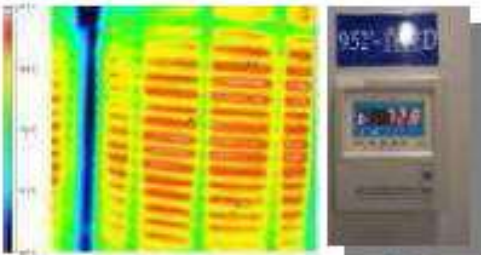


**VFD
UPS**

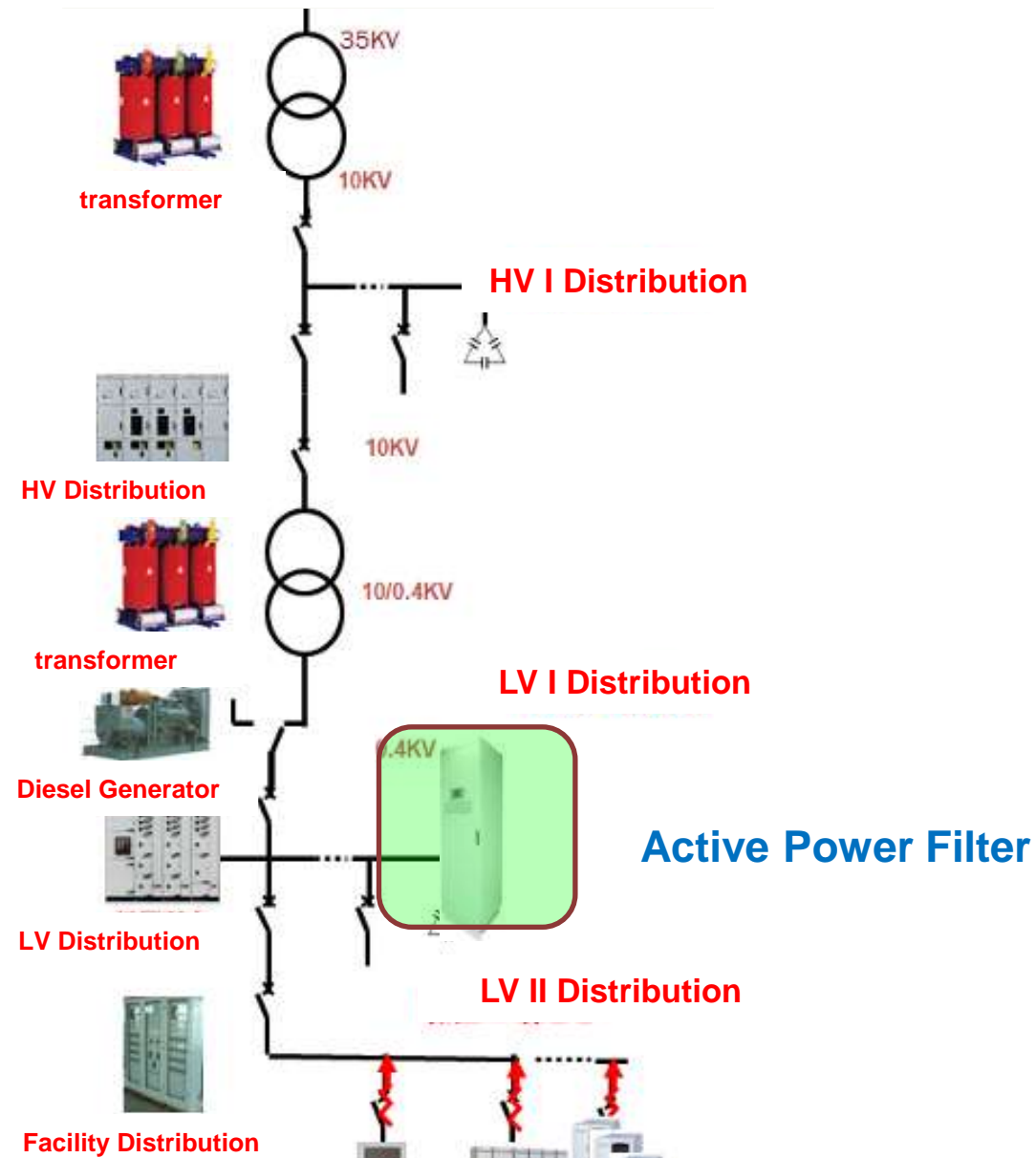
Motor

Control Device

Current Power Quality Issues

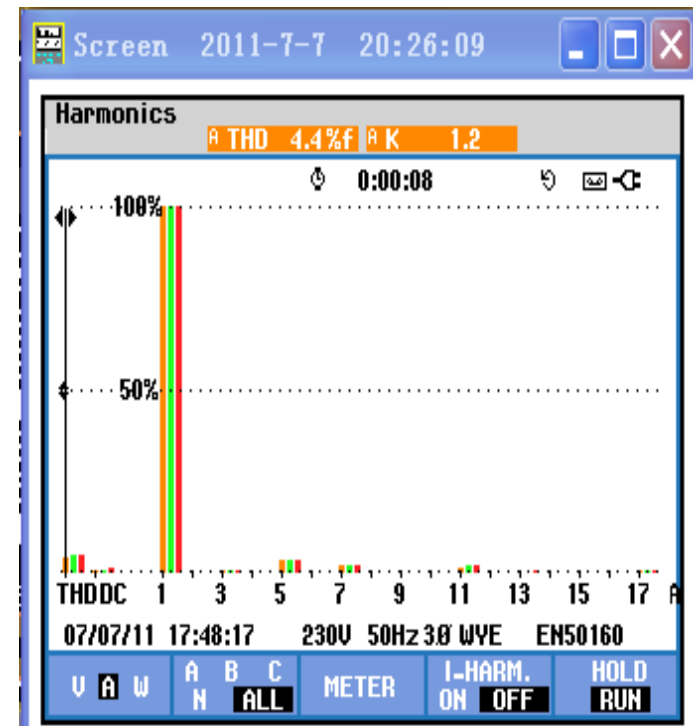
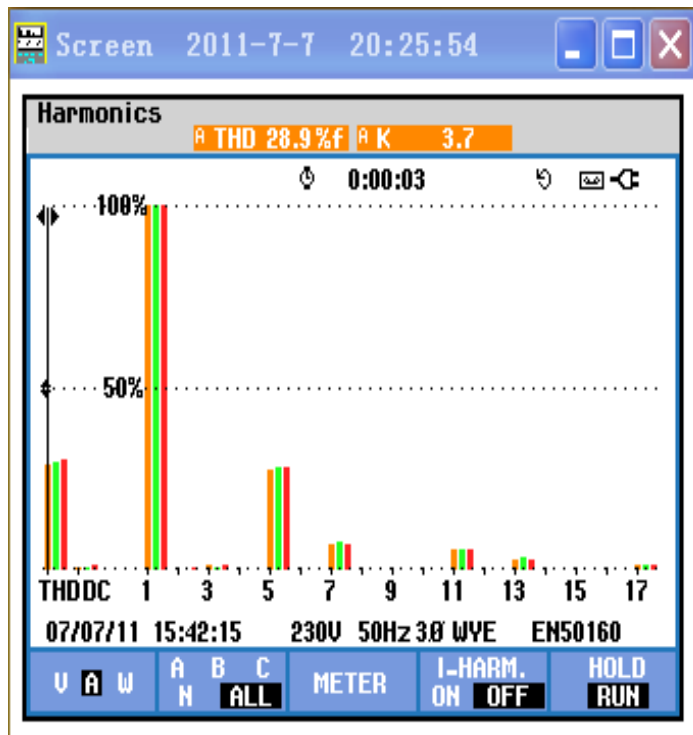


Case Study I: Active Power Filter Solutions in a Copper Metallurgy Company

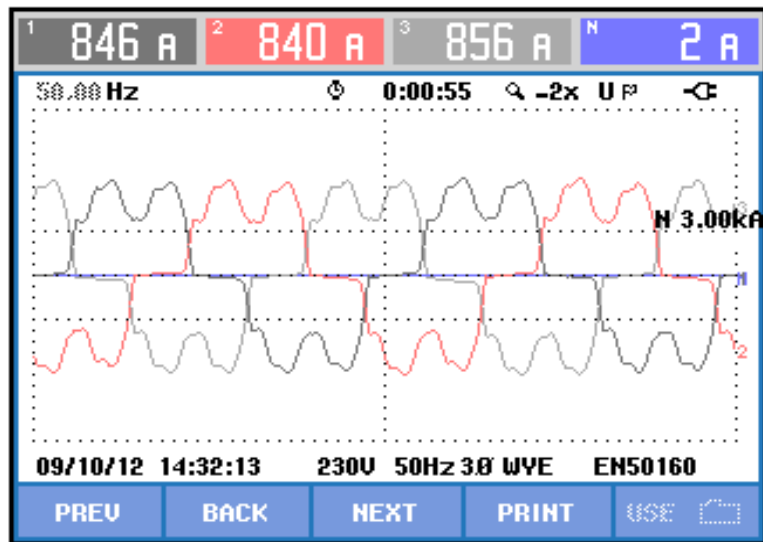


Case Study I: Active Power Filter Solutions in a Copper Metallurgy Company

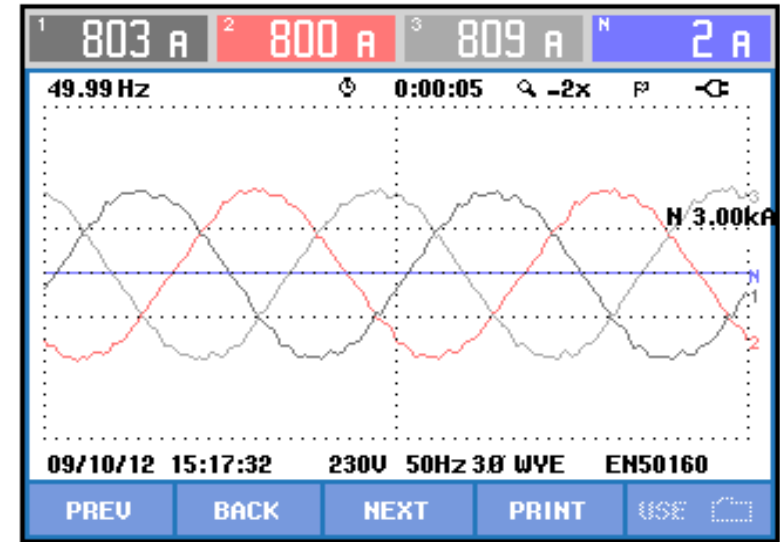
Location	Before/After	Total Voltage	Total Voltage THDV	Total Current	Total Current THDi	PF
		(V)	(%)	(A)	(%)	
	Before	221.13	6.5	941	28	0.84
	After	220.79	2.3	685	4.4	0.98



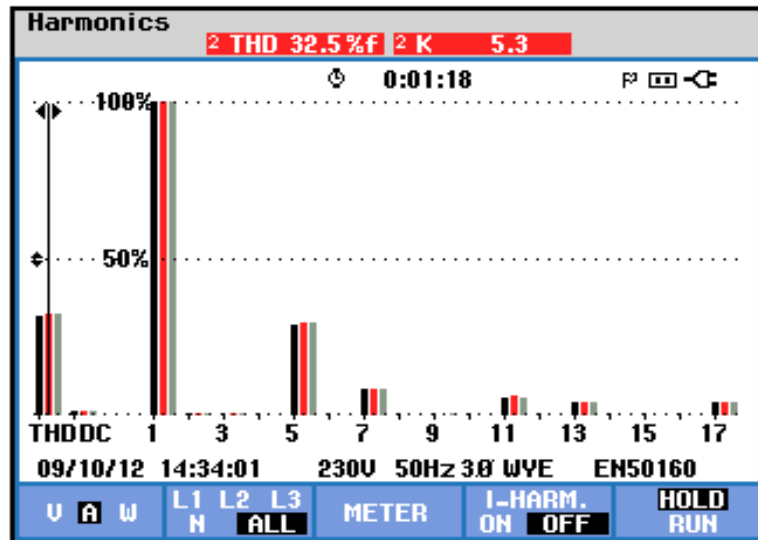
Case Study II: Active Power Filter Solutions In a Chemical Factory



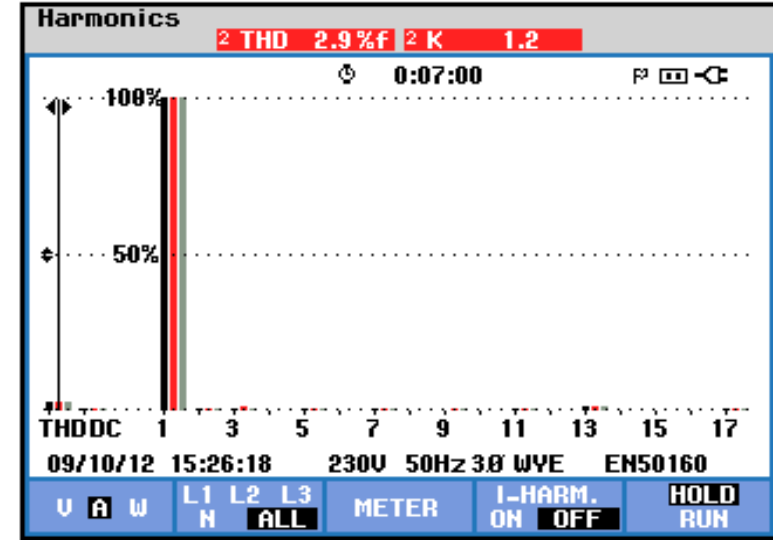
Current without APF



Current with APF



THD without APF

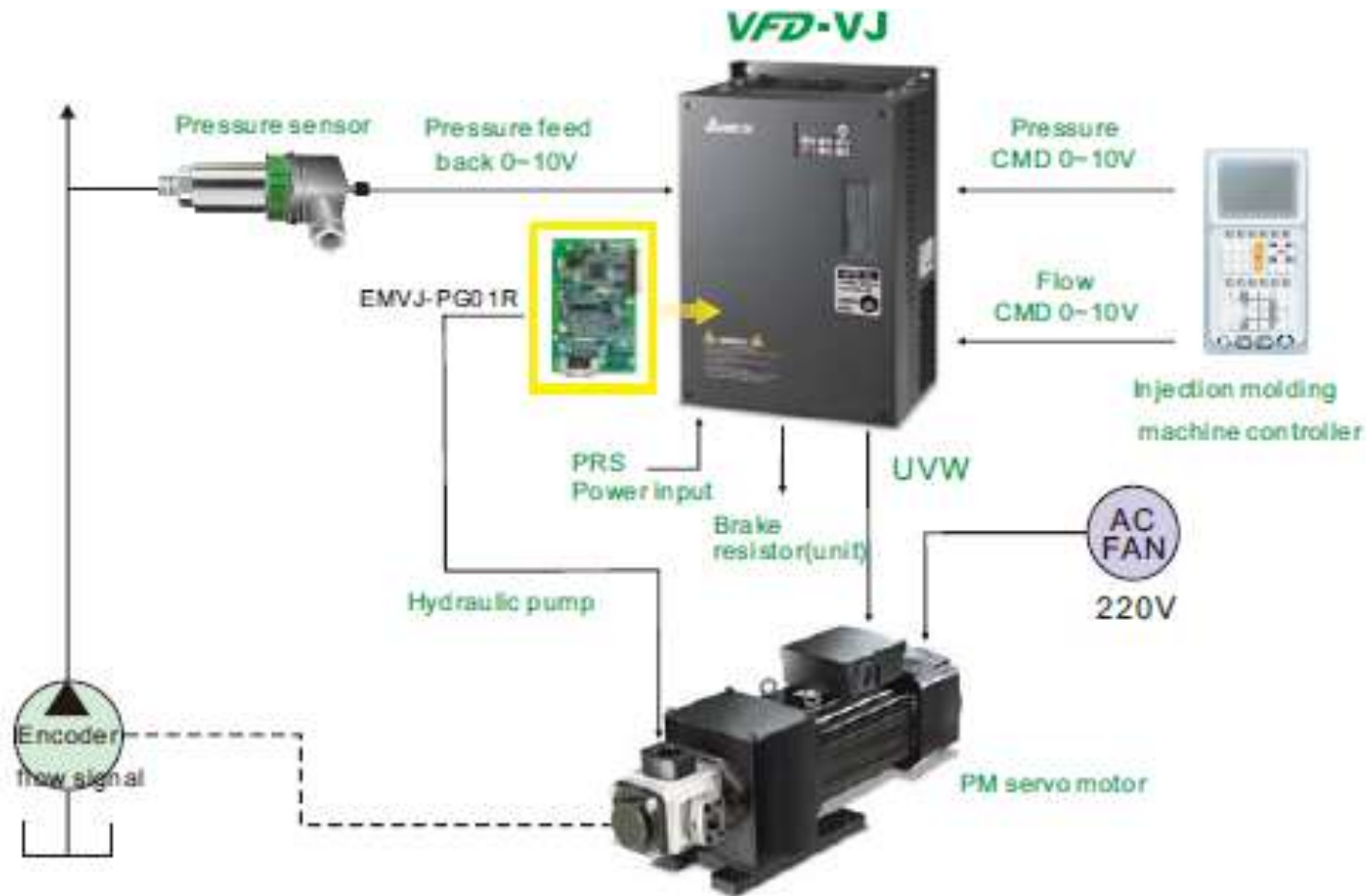


THD with APF

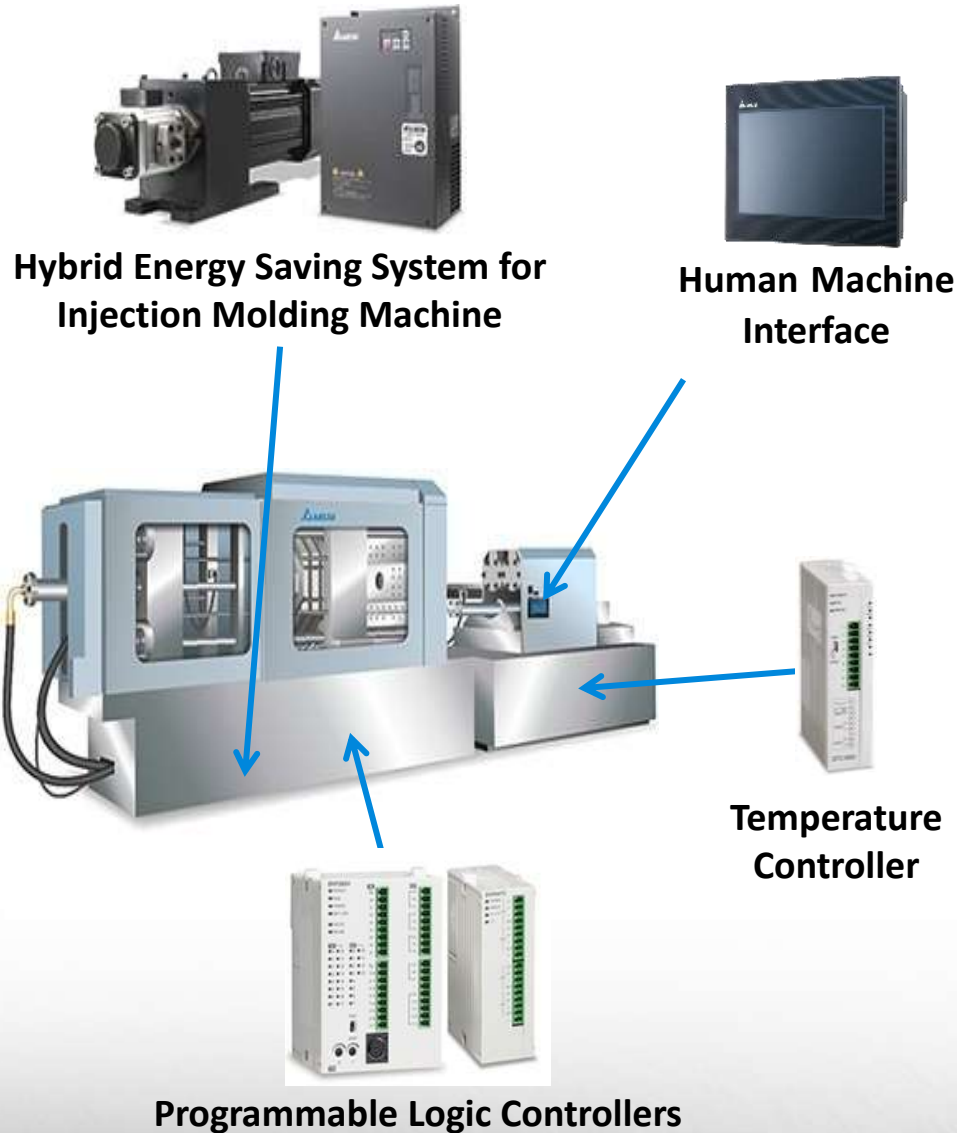
Factory Energy Savings

- Injection Molding Machine
- Air Compressor
- Robotics
- Factory Waste Water Treatment
- Elevator

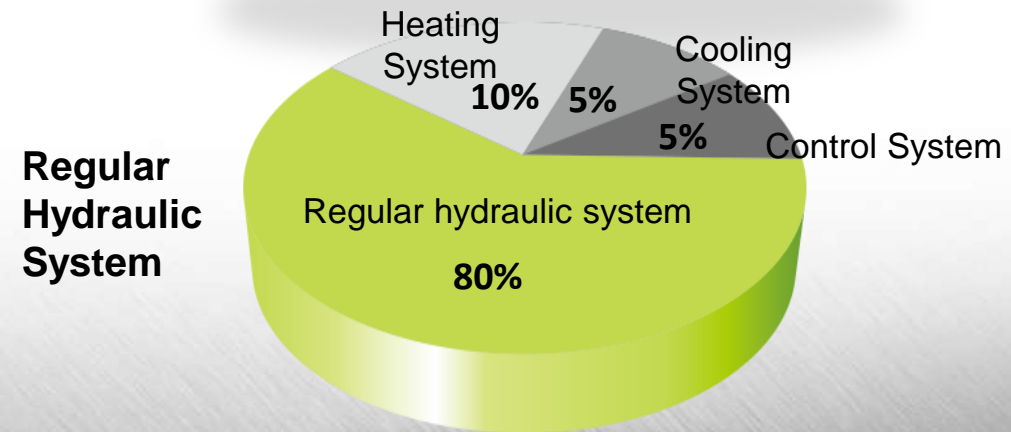
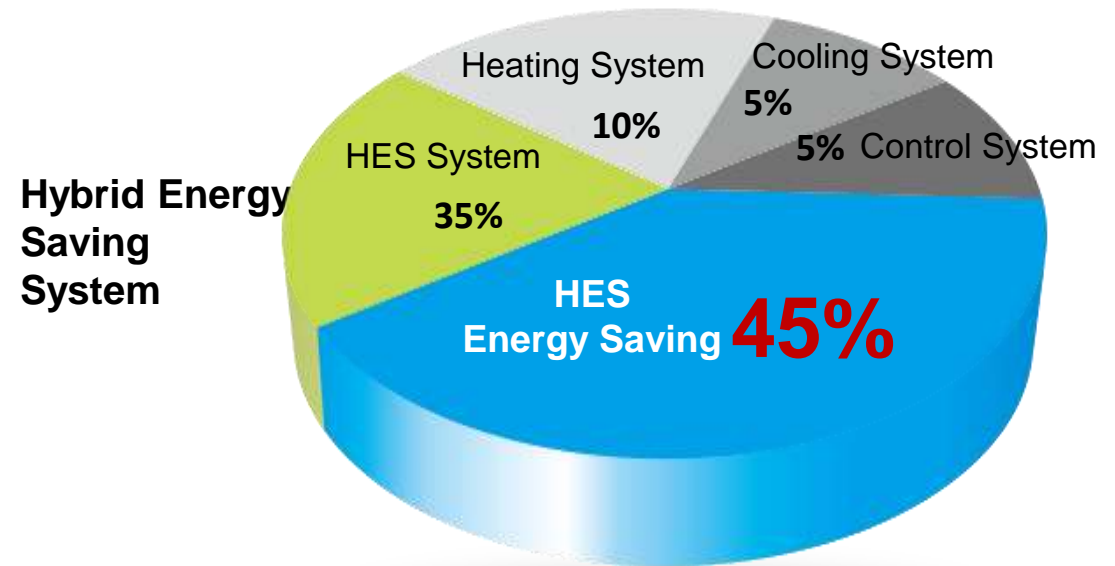
Injection Molding Machine Solutions



Injection Molding Machine Solutions



The energy consumption analysis



Air Compressor Solutions



Human Machine Interface
DOP-B Series



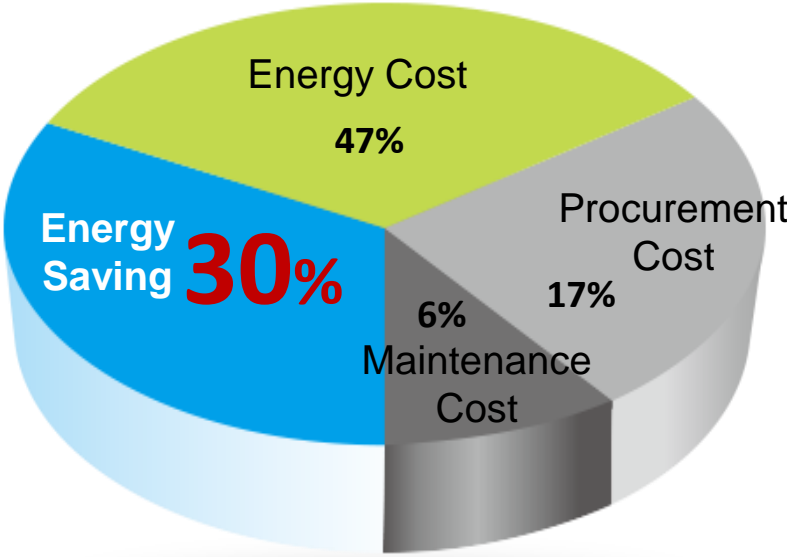
Programmable Logic Control



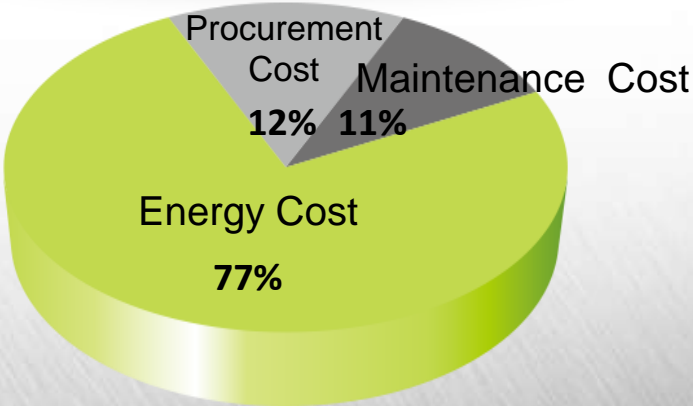
AC Motor Drive
C2000

PLC inside

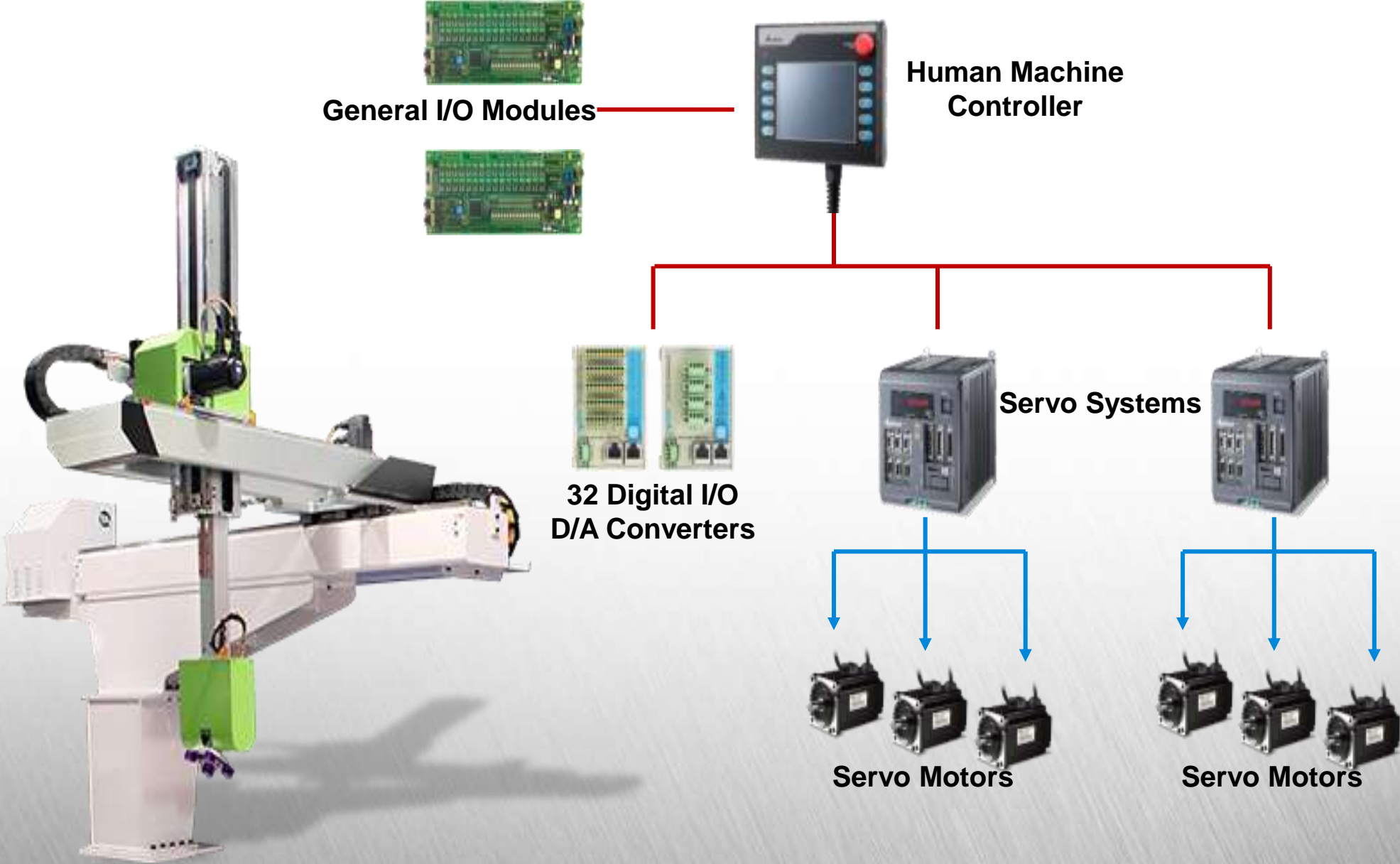
Cost Analysis for
Air Compressor
with Drive



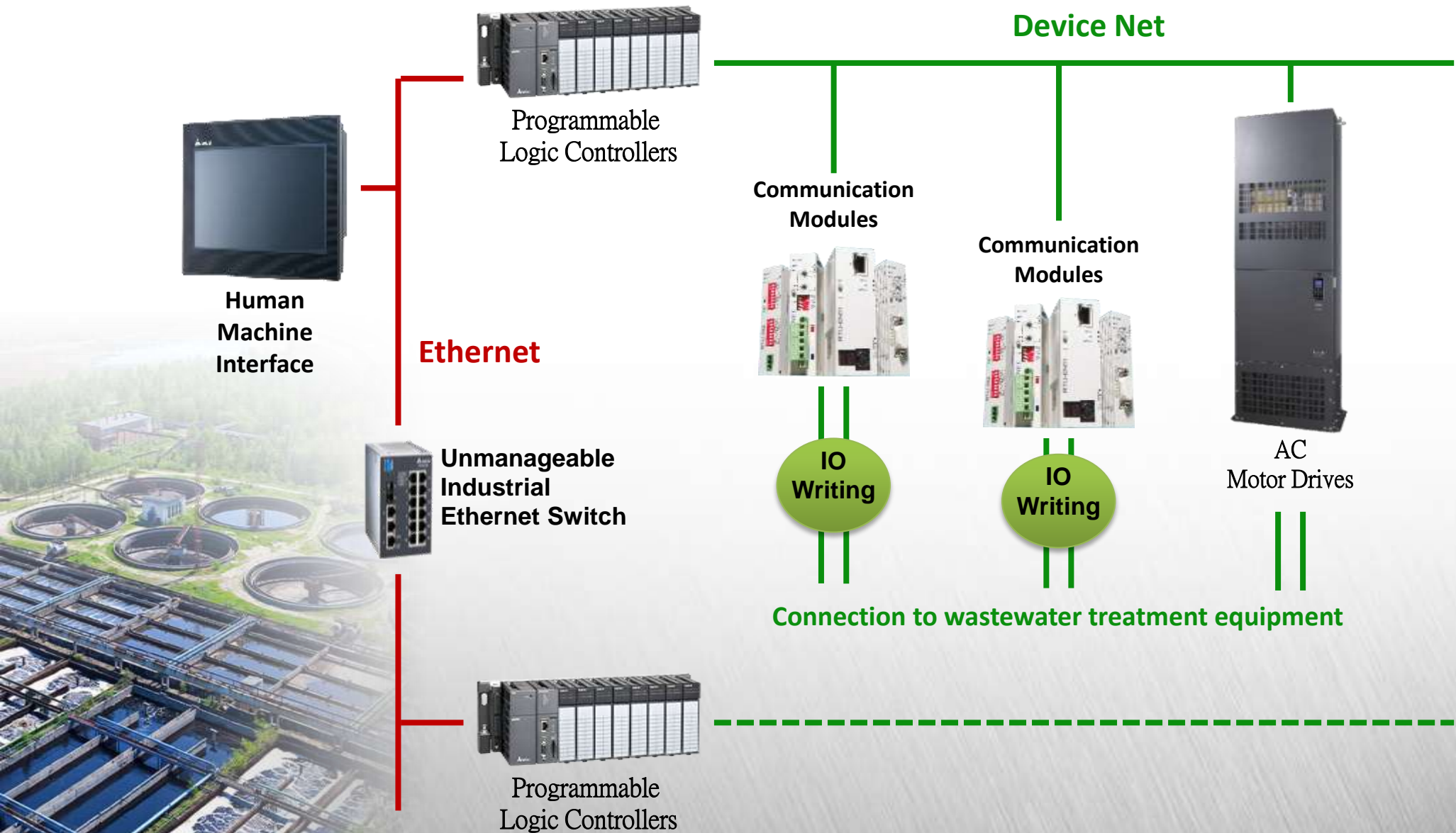
Cost Analysis
for Traditional
Air
Compressor



Robotic Arm Solutions



Factory Waste Water Treatment/Recycle Solutions



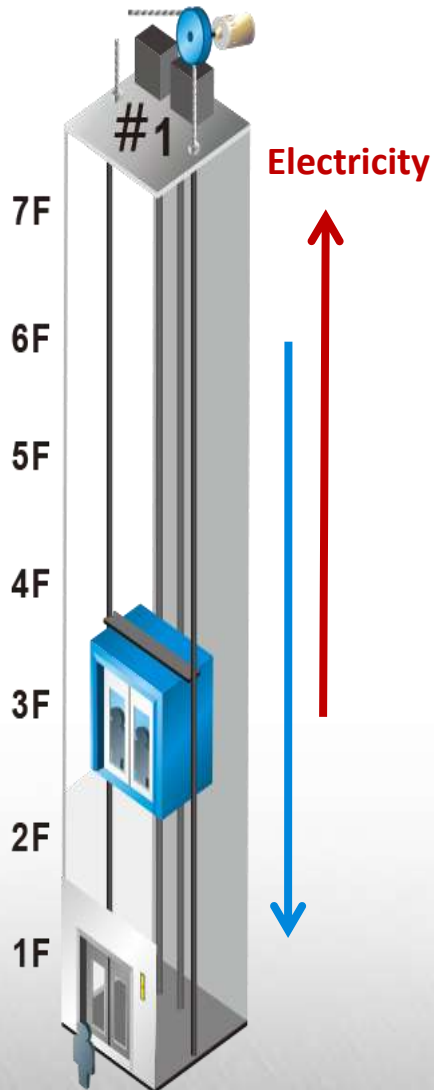
Elevator Energy Saving Solutions

- Energy-saving benefit (a green factory in Taiwan)

Estimated power consumption of traditional elevator: 15,209 kWh

Elevator power consumption: 9,179 kWh

Estimated saved power: 6,030kWh



Energy saving:
40%



Green Factory Applications

HVAC Air Conditioner energy saving successful applications

Rolled steel production line in Steel mill



- ▶ Project name: HVAC
- ▶ Location: Hubei
- ▶ Finish time: May, 2011
- ▶ Products: VFD, PLC

Dairy Group



- ▶ Project name: Ventilation System
- ▶ Location: Jilin
- ▶ Finish time: Jan, 2010
- ▶ Products: VFD

Chemical fiber factory



- ▶ Project name: HVAC
- ▶ Location: Jiangsu
- ▶ Finish time: Oct, 2011
- ▶ Products: VFD, PLC

Pharmaceutical Company



- ▶ Project name: Ventilation System
- ▶ Location: Jilin
- ▶ Finish time: Mar, 2010
- ▶ Products: VFD

Green Factory Solar Rooftop and EV Carport Kits

1) 63.36kW Rooftop Solar System (12 Strings)



2) 5.76kW Carport Solar System (24 panels, 2 EVCS's, 1 LED) and Electric Transportation



Green Factory Smart LED Lighting Retrofit

2x2 40W Troffer
(replacing 80W)



2x4 60W Troffer
(replacing 160W)



2x4 60W Troffer
(replacing 160W)



100W High Bay
(replacing 250W)



60W Garage Light



Summary

