Reducing Energy Consumption Using Artificial Intelligence

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CDM Smith

NEWEA
WORKING FOR WATER QUALITY

Problem statement

Traditional pumping systems are programmed to satisfy operational and process requirements, and they work; however, **energy optimization** and **efficiency** are rarely considered.

This results in:

1) Excessive energy consumption
2) Wasted money
3) Shorter pumping system lifespan

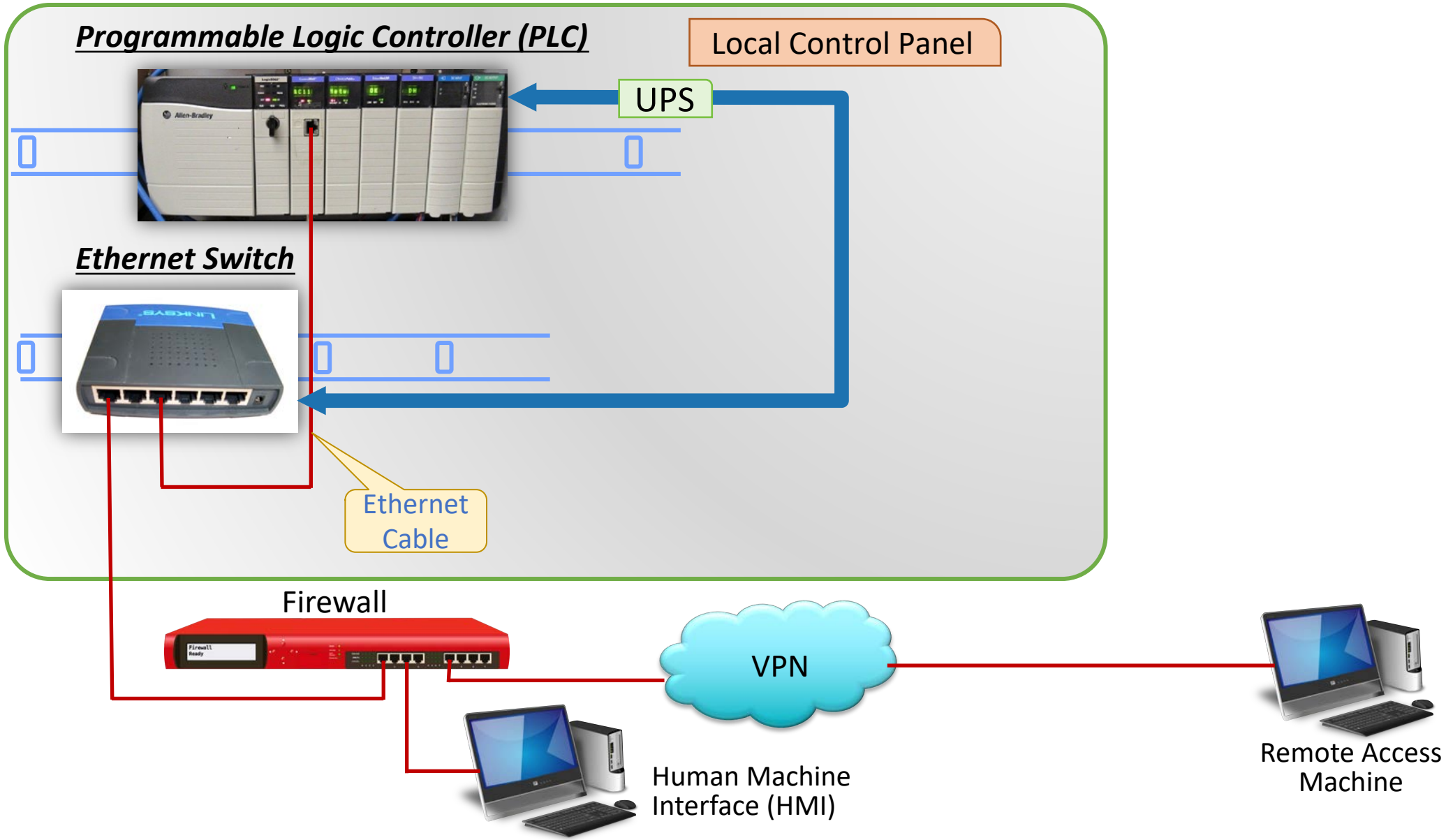
Real-World Example (simulated in the lab)

A four-pump wastewater pump station with identically sized pumps working in a **lead/lag1/lag2/standby** configuration to **maintain** a wet well **level** setpoint. The horsepower of each pump is 139 HP and has a power factor of 0.883.

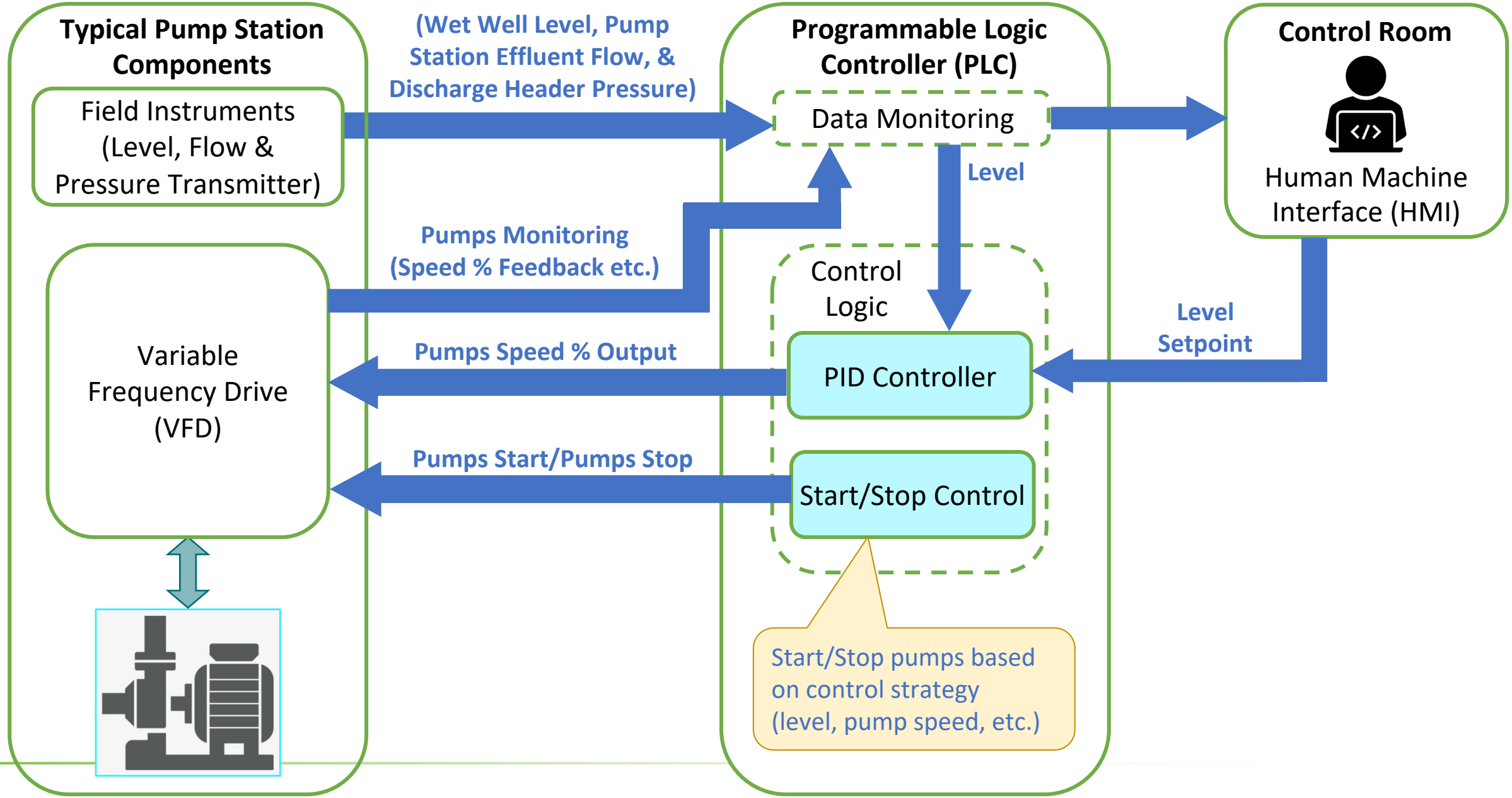
https://images.app.goo.gl/SWmeTvQiuzUBc5y46

Control Strategy – Conventional Method of Programming & Control

Conventional Method System Hardware Setup

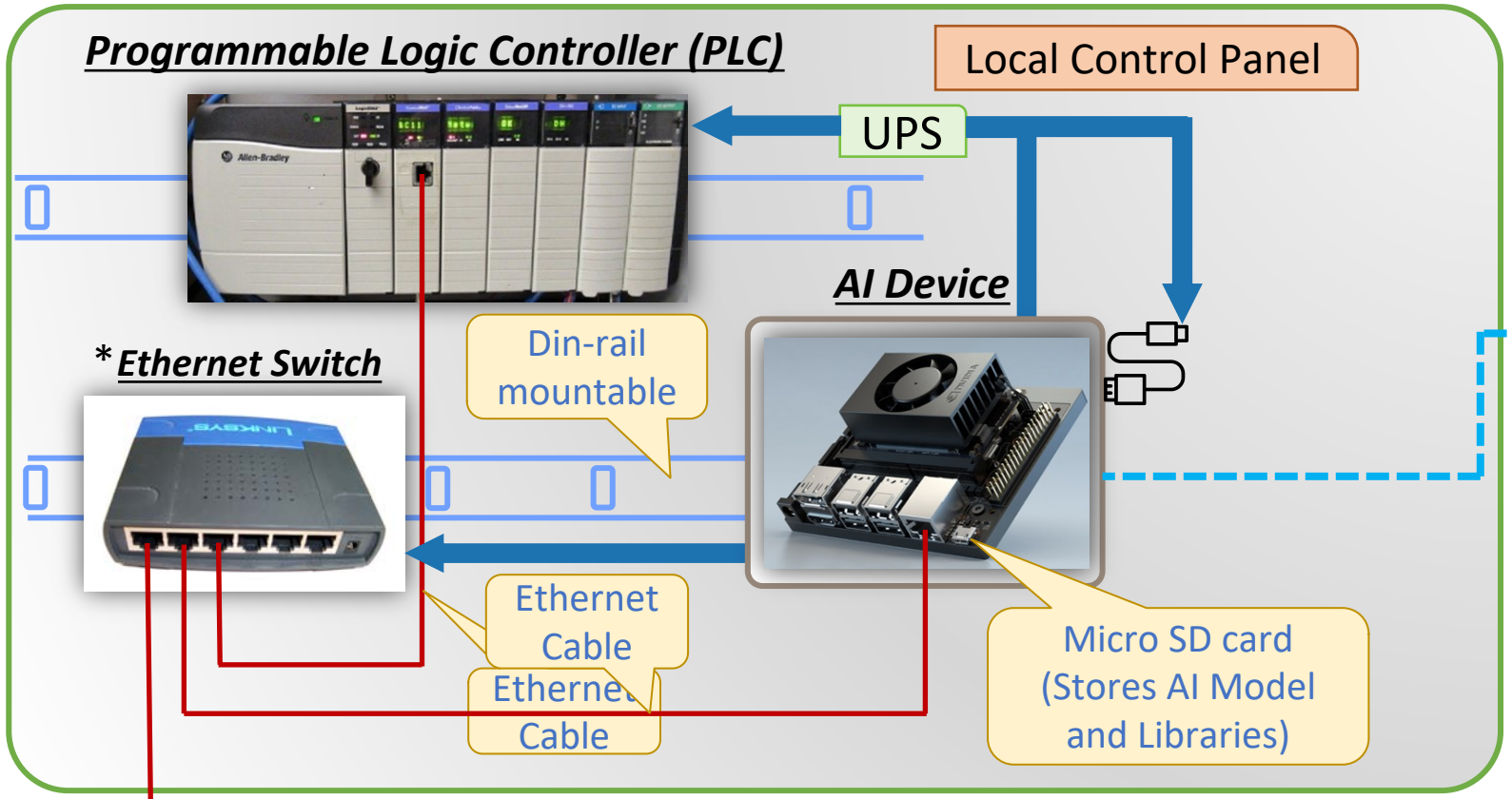


Conventional Method of Programming & Control

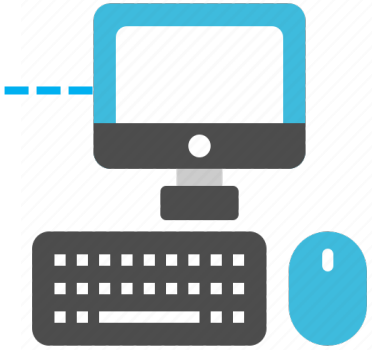


Control Strategy – New Approach Using Artificial Intelligence (AI)

New Approach System Hardware Setup



Monitor & Keyboard Interface (Required only during startup and troubleshooting if remote access is not configured)



Firewall

VPN

Remote Access Machine

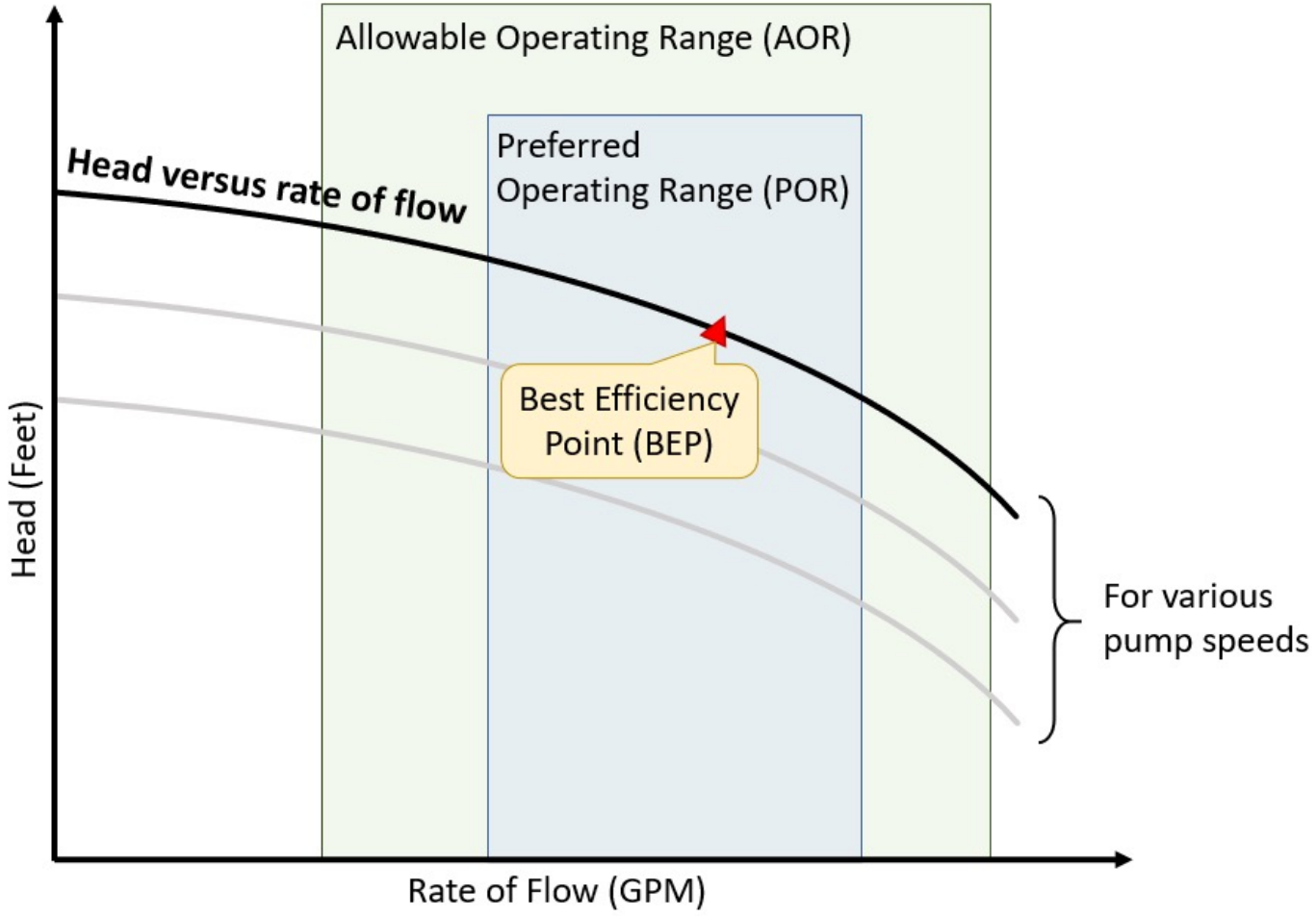
Human Machine Interface (HMI)

* Although not shown, Ethernet switch on UPS power.

New Approach Using AI

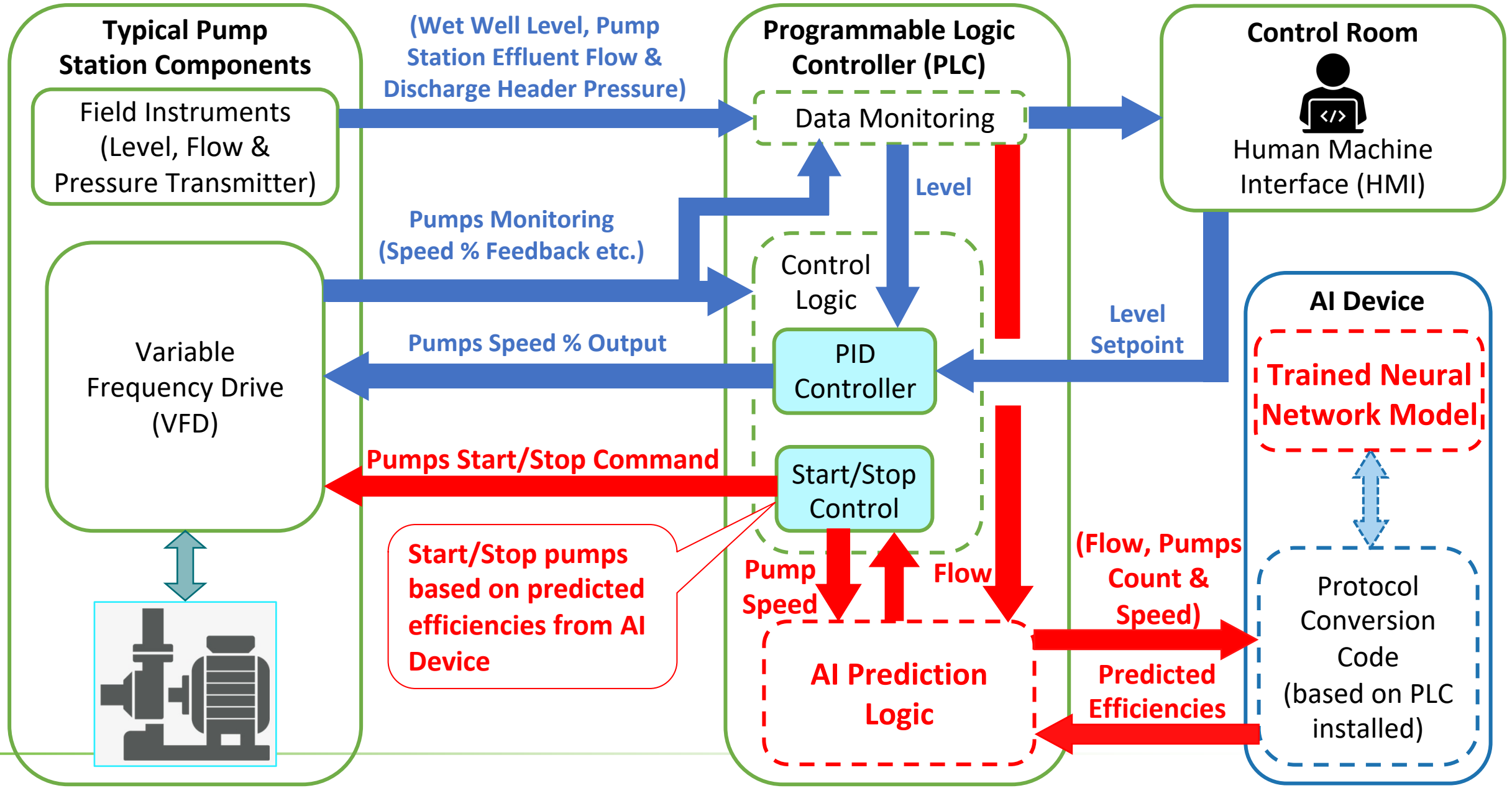
Training Phase

Pump manufacturers provide the following information for each centrifugal pump



New Approach Using AI

Operational Phase



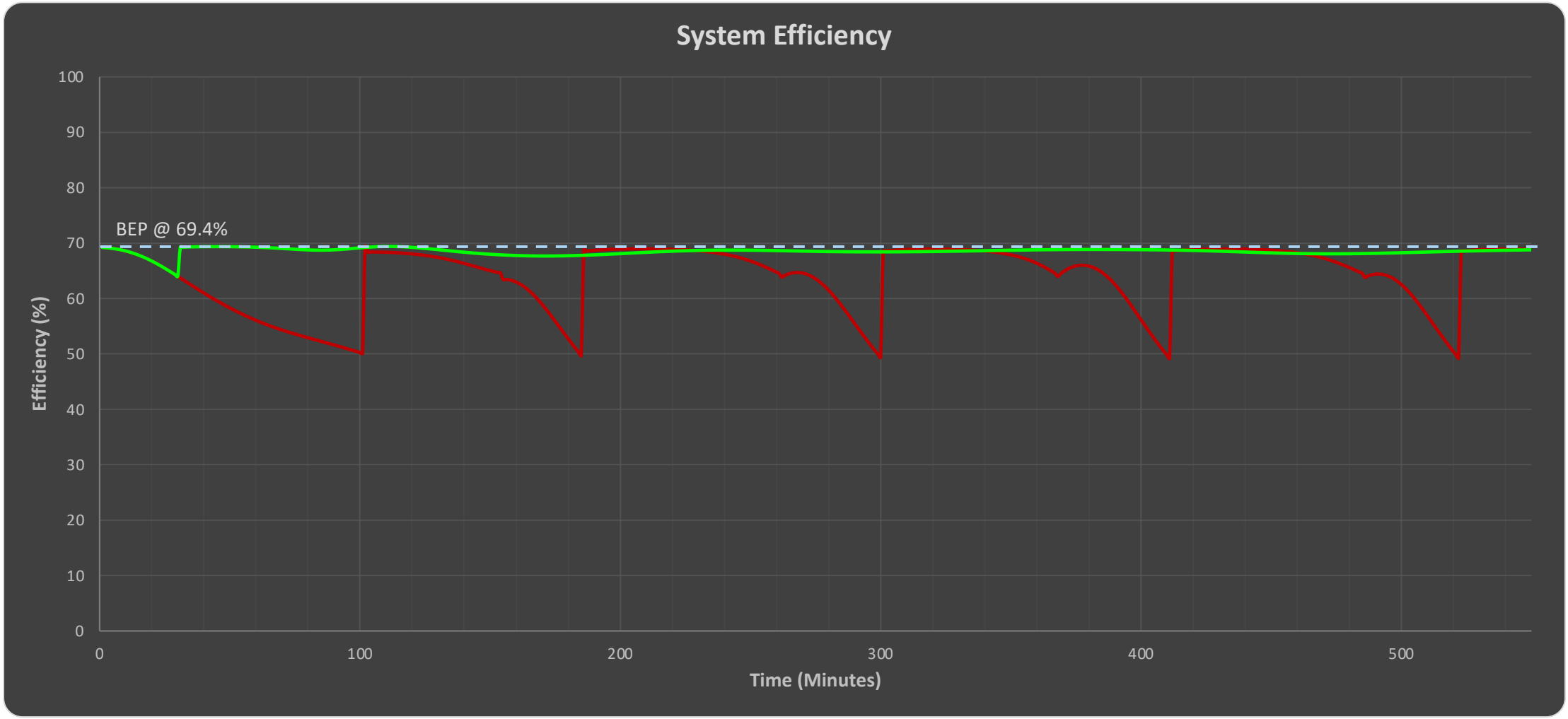
Simulation…

Result and analysis

Standard Programming

Optimized Programming

System Efficiency – Standard vs Optimized

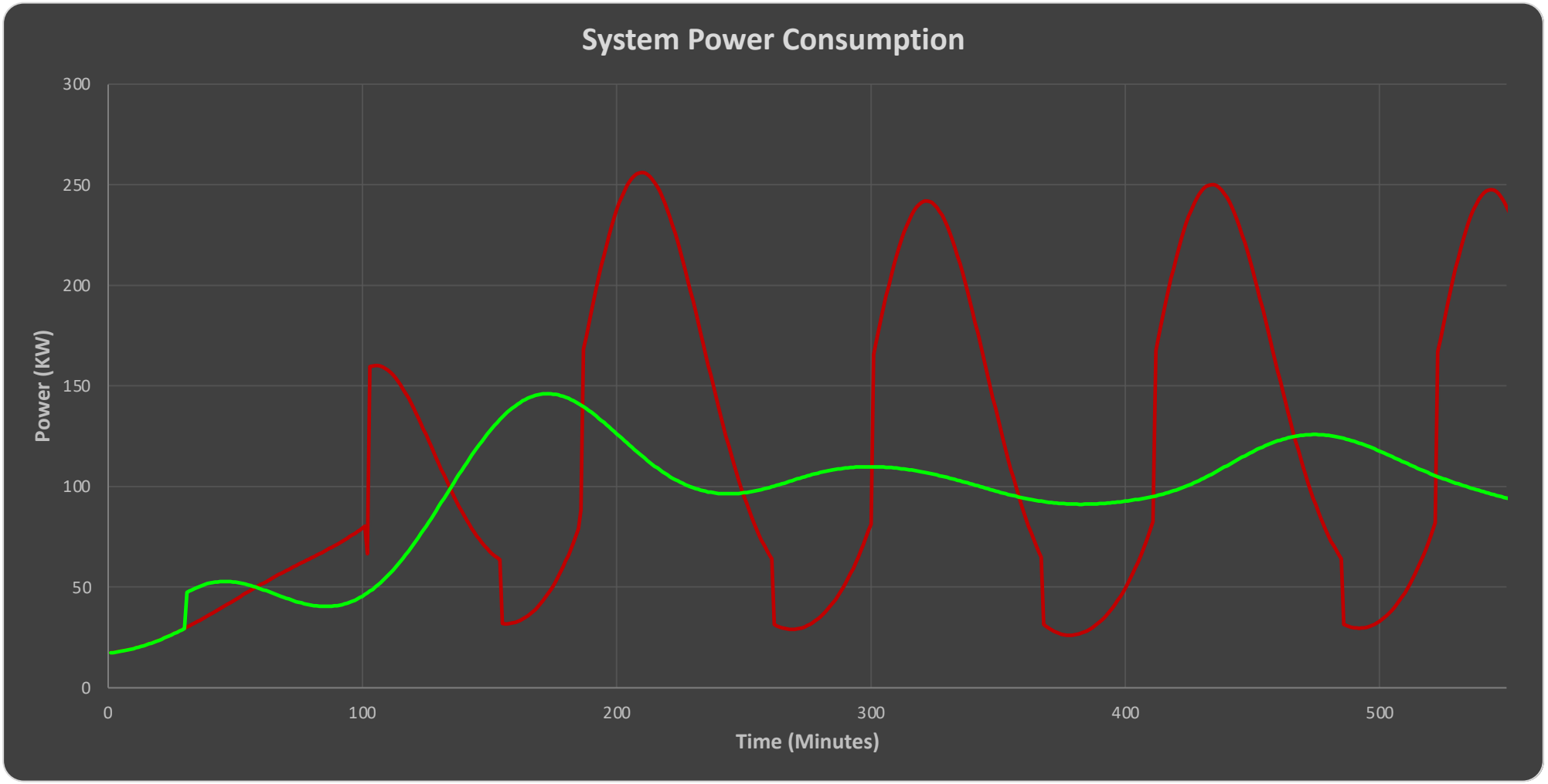


Result and analysis (cont.)

Standard Programming

Optimized Programming

System Power Consumption– Standard vs Optimized



Simulation…

Key Findings

Parameters	Standard Programming	Optimized Programming
No. of Pumps utilized	3 pumps	2 pumps
High Efficiency operation ***(< 5% deviation** of BEP)*	64.06% of total time	99.60% of total time
Lowest** operating* ***efficiency	49.20% efficiency (20.19% deviation from BEP)	64.01% efficiency (5.39% deviation from BEP)
Peak ***specific energy*** *consumption*	0.06 KW/GPM	0.044 KW/GPM
Peak ***Load***	256.11 KW	146.15 KW

Project Benefits

Improvements in efficiency of pumping system results in

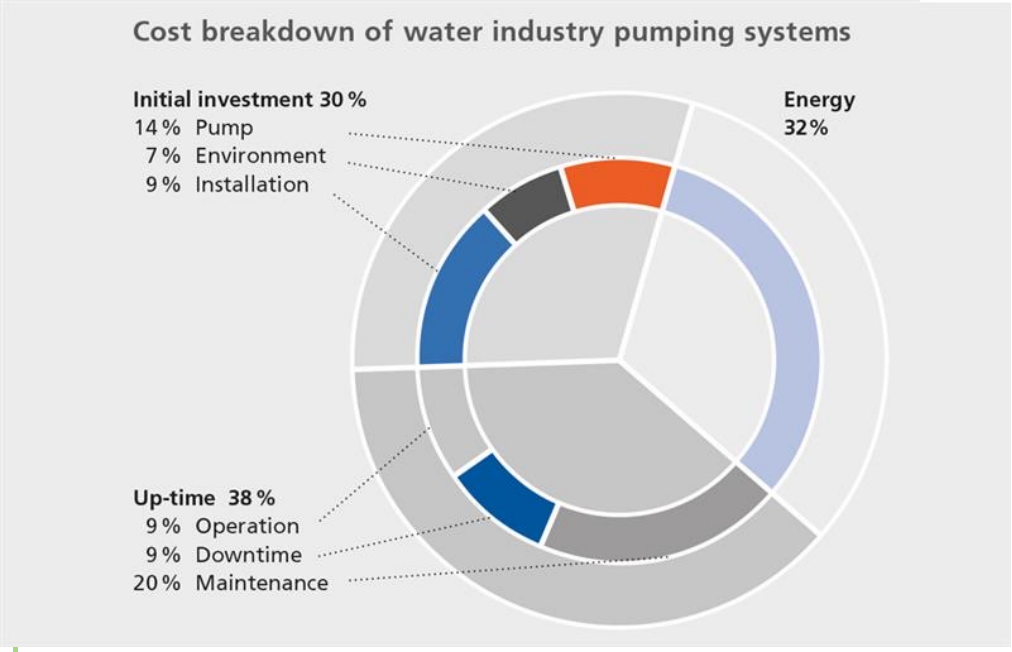
- reduced energy costs
- reduced maintenance requirements
- closer match between pumping system capacity and process requirements

At or near BEP, operating efficiency is highest and its radial bearing loads are lowest; hence a pump operating near its BEP results in significant operating **cost savings in terms of both energy efficiency and maintenance**.

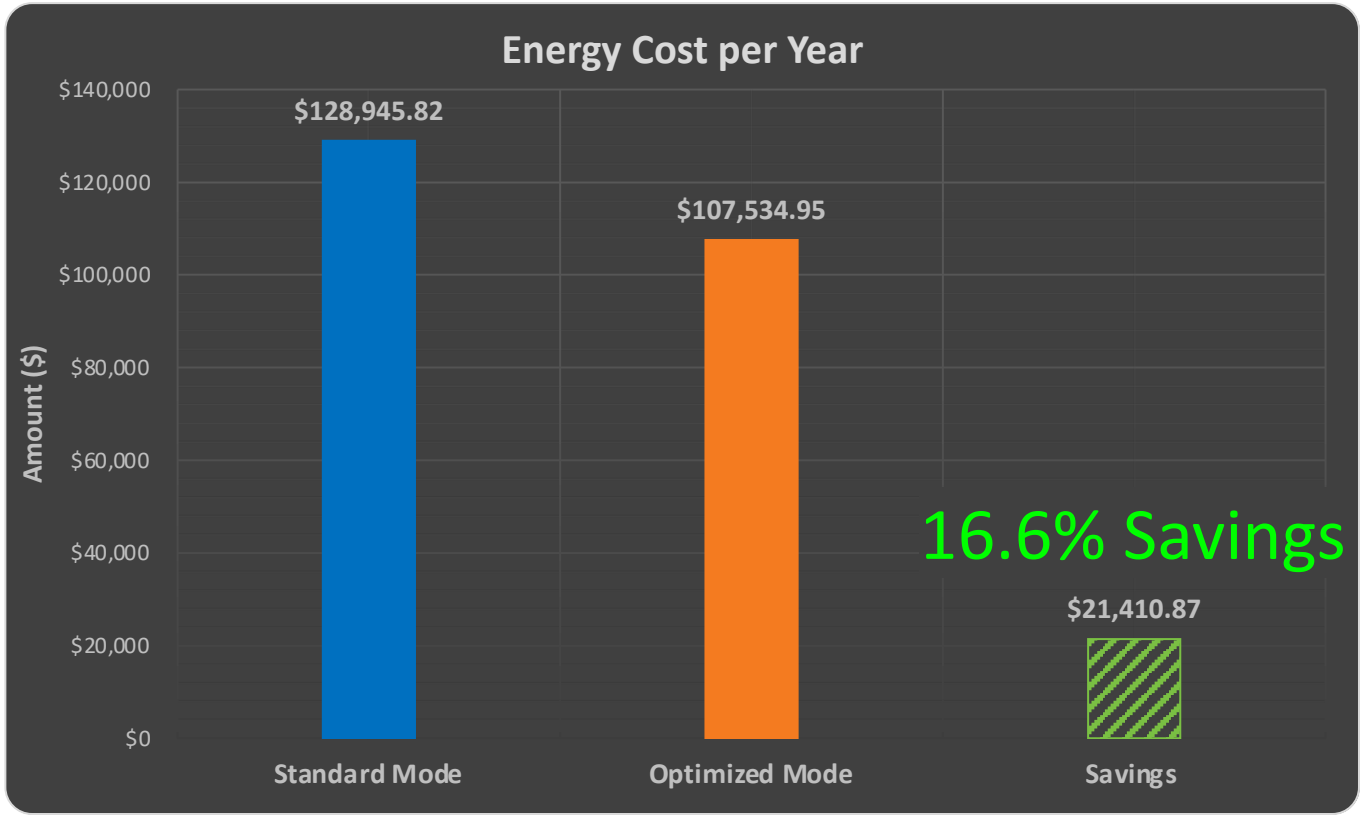
Project Benefits

Life cycle cost analysis

- With average energy and up-time cost accounting for 52-70% of pump ownership costs; pumping system efficiency improvements provide simple payback periods of several weeks to a few years by reducing energy cost and maintenance requirements.



Courtesy: KSB SE & Co. Magazine



** Electricity cost assumed @ 13 cents/KWh*


THANK
YOU

Contact me to find out more!

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