Wireless

Question1: Calculate the savings due to Wireless Technology compared to 4-20 mA Wired solution

1. **As for the cost savings due to wireless Technology, we can get the result from this online tool.And here is the details of result in Table 1**

Focus contents	Wired Costs	Wireless Costs
Total cost	368864	278828
Cost per point	5269	3983

Table 1: Results summary of cost saving

The saving cost: $\Delta_{cost} = Cost_{wired} - Cost_{wireless} = 368864 - 278828 = 90036$

The saving cost per point: $\Delta_{cost(per)} = Cost_{wired(per)} - Cost_{wireless(per)} = 5269 - 3983 = 1286$

2. **As for the time savings due to wireless Technology, we can get the result from this online tool.And here is the details of result in Table 2**

Focus contents	Wired Time	Wireless Time
Total cost	1632	291
Cost per point	23	4

Table 2: Results summary of time saving

The saving time: $\Delta_{time} = Time_{wired} - Time_{wireless} = 1632 - 291 = 1341$

The saving time per point: $\Delta_{time(per)} = Time_{wired(per)} - Time_{wireless(per)} = 23 - 4 = 19$

Question2: The I/O details:

In this part, I use this setting of I/O details in Table 3 from online tool.

Table 3: I/O details of Selected Instruments

Type of Instruments	Instruments	No. of Instruments
Smart power	Power Module	70
Gateway	Smart Wireless Gateway	1
Inline Pressure	Rosemount 3051S Wireless Series Of Instrumentation	10
DP Pressure	Rosemount 3051S Scalable Pressure transmitters	10
High Density Temperature	Rosemount 848T Wireless Temperature Transmitter	10
Standard Temperature	Rosemount 248 Wireless Temperature Transmitter	10
Level	Rosemount 2160 Wireless Vibrating Fork Liquid Level Switch	5
Discrete	Rosemount 702 Wireless Discrete Transmitter	5
Analytical	Rosemount 6081 Analytical (pH/ORP Conductivity)	5
Position Monitoring	Fisher 4320 Wireless Position Monitor	2
Position Monitoring	TopWorx 4310 Wireless Position Monitor	2
Vibration Monitoring	CSI 9420 Wireless Vibration Transmitter	1
Rosemount 928	Rosemount 928 Wireless Gas Monitor	1

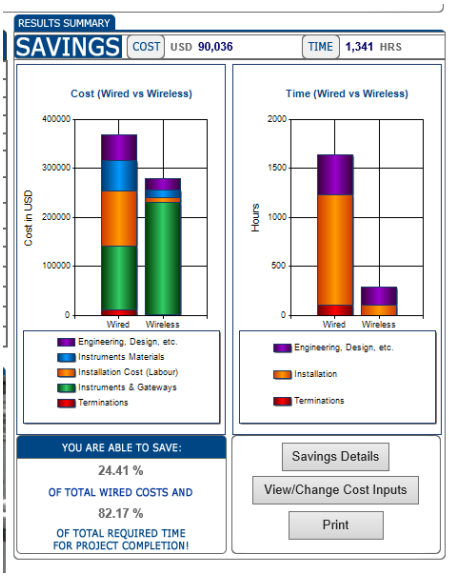

Figure 1: Summary result of savings

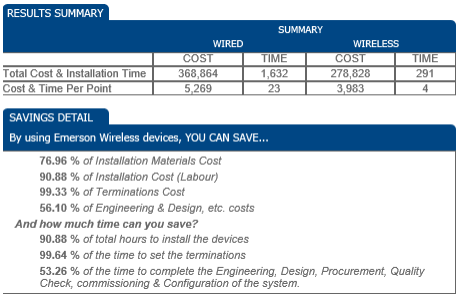

Figure 2: Details result of savings

Question 3: Calculate the Savings:

Through above analysis, we can get the cost savings(about 90036 USD), the cost savings per point(about 1286 USD),the time savings(1341 hours) and the time savings per point(19 hours)

Question 4: Print and submit the cost savings report:

As for the cost saving report, Figure 2 is the coresponding screenshot.

Question 5: Analysis for the overall savings:

By using the wireless devices, we can save a lot both in cost and time through the result from Figure 1. Here are the conclusions from summary direction.

- From the cost perspective, it is obvious to find that the greatest reduction is installation cost (about 50000 USD), and next largest reduction is in instrument cost (about 30000 USD)
- From the time perspective, it is very easy to find that the greatest savings is installation time (about 1100 hours), and next largest reduction is in design time(about 200 hours)

Here are the conclusions from details direction through the result from Figure 2.

- From the cost perspective, it is very easy to find that the greatest improvement is reducing Termination cost(97.33%), and next largest improvement is reducing in installation cost(90.88%)
- From the time perspective, it is very easy to find that the greatest improvement is reducing setting time in Termination (99.64%), and next largest improvement is in reducing installation time(90.88%)

To sum up

we can save a lot both in cost and time if we take wireless technology rather than traditional wired solution.

IIoT/Digital Transformation in power distribution system

Electricity systems around the world are undergoing fundamental changes. Driven by three key megatrends decarbonisation, decentralisation and digitalisation utilities are changing faster and more profoundly than they have in decades.The power system is no longer founded on unidirectional energy flows and traditional centralised generation, but rapidly evolving into a cohesive system that embraces both the prevailing and emerging technologies. This new and integrated system is being shaped by digital tools that enable data-driven decision making across the organisation and allow a range of technologies to coexist.

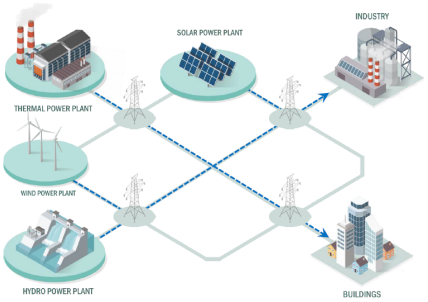

Figure 3: Traditional energy systems

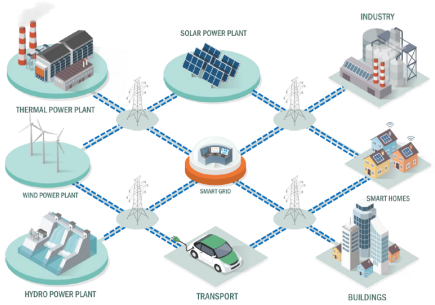

Figure 4: Smart energy distribution systems

Four major stages on process automation

To effectively modernise to meet regulatory challenges and become more resilient and automated, power distribution system must progress through four stages: Sensing, Communication,Operation,Community.

Sensing: Smart devices (IEDs, sensors, etc.) are deployed in the field, the data can be quickly captured and transformed via device level sensing and data acquisition. And then converting analog data into digital formats that can be gathered, stored and processed by data center.

Communication: This stage happens in the control room, once data is digitalised, it accelerate business velocity because systems are more efficient and responsive.

Operation: In this level, the service provider business business velocity to customers and enables utilities to make faster decisions, allows for dynamic, real-time grid management and provides cross-functional visibility.

Community: This is the end-level, which means customers in boardroom can proceed any real-time activity.

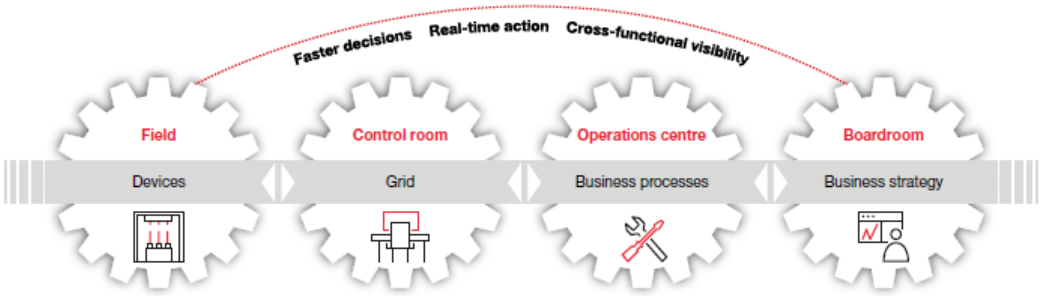

Figure 5: The total process

Smart pannels in Low-voltage intelligent power distribution system

Traditional power distribution cabinet only displays the most basic measurement information and has no remote transmission function. Today, energy efficiency optimization requires more advanced dashboards, so traditional solutions can no longer meet the ever-increasing demand for measurement.

Application Procedure

Nowadays, when transmitting large amounts of data between the power distribution system and the local display screen or remote server, the Ethernet network has been recognized as the most suitable transmission medium. The following are the steps for its efficient management.

- Built-in measuring circuit breaker and multi-function instrument, which can provide measurement and control functions
- Realize safe transmission through efficient network: Modbus communication protocol is adopted between the components in the power distribution cabinet.The building uses Ethernet (through network cable or WIFI) to connect to the power distribution cabinet.Through broadband Ethernet or GPRS connection, Schneider Electric online services can be obtained at any time.
- The dashboard is generated by Schneider Electric's online service based on a web server. To this end, it is necessary to collect energy consumption, circuit breaker protection status, and electrical equipment information from all power distribution cabinets in the building.

Improvement Details

Smart Panels is an overall solution integrating smart hardware, customized software, and sustainable services. It achieves a perfect combination of online and offline, and can be mastered anytime, anywhere.

- Analyze the load types and trends of energy consumption, automatically generate professional reports to find energy consumption problems and provide continuous energy saving services
- Real-time monitoring of equipment status and timely access to fault alarm information. Refined management of equipment assets for easy operation and maintenance.System safety assessment, providing preventive maintenance guidance and planning.
- Timely and professional fault recovery guidance to reduce the technical requirements for operation and maintenance personnel.Provide sustainable services to ensure the continuity and safety of power supply

Hardware

In this part, I used some resources from product documents of Schneider Electric.

Module	Name	Product number
Gateway+Server	Com'X 200 Ethernet Energy Data Server	EBX200
Interface	Acti 9 Smartlink Ethernet	A9XMEA08
I/O module	I/O	LV434063
Monitor	FDM128 multi-loop touch screen	LV434128
Modbus	USB cable link	A9XCATM1

Software

Ecoreach is an electrical asset management software that helps users manage electrical assets at various stages in the project life cycle, including design, testing, debugging, and effective assistance during operation and other stages. Here is the link about Ecoreach: Ecoreach tutorials in YouTube.