
NIAGARA
SUMMIT
2026
SEAMLESS CONNECTIVITY,
POWERFUL INTELLIGENCE
NS26
TECH TRENDS
TRIDIUM

3:30PM – 4:20PM | THURSDAY

RAISING THE BAR: EXCELLENCE WITH NIAGARA INTEGRATION

TRIDIUM

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SPEAKERS

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3:30 PM - 4:20 PM| THURSDAY

Quality Through Standardization Templates, A Practical Example

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Quality

- Multiple interpretations vs ISO9001
- General
  - Customer expectations
  - Requirements
  - Systems fit for purpose
- Cost of poor quality

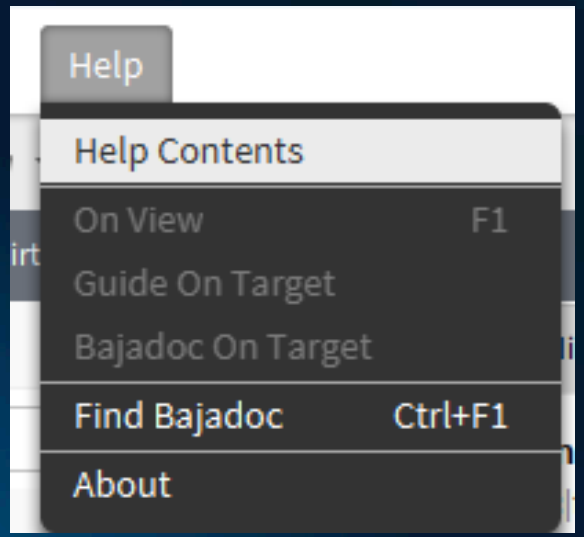
Why quality matters

- **Prevent losses**
  - Dangerous system behaviors
  - Reduced downtime
- **Ensure performance**
  - Improvements scale
  - Consistent results
- **Lower your costs**
  - Fewer repairs/errors
  - Lower maintenance

Automation as quality enabler

- Humans → errors
- Excel for processing
  - Input data can be processed automatically
  - Intermediate data can be derived / composed
  - Final values can be calculated
- Let’s bring it in!

How? – Templates



- Niagara Help:
  - Deployable package of Niagara objects
  - Set of configured objects encapsulated and deployed **as a unit**
  - Eliminate repetitious configuration steps

Templates

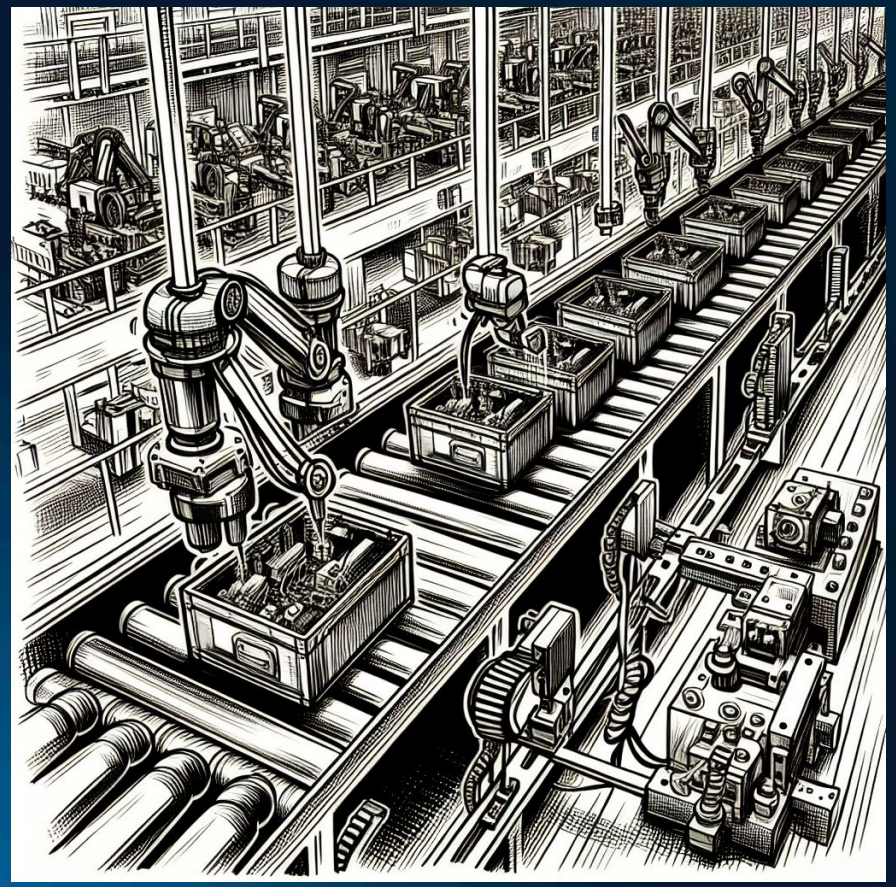
- I can create a “master unit”
- Each copy can be “configured”
- Will do a repeatable, exact deploy for me!

But please read the docs

Versioning

- Traceability
  - What has been used where
  - What has bugs and what is safe
  - What has been tested
  - …
- Templates already handle version for you
  - But still follow a process…

Template Service



- Bulk upgrades
- Bulk deploy
- **Configurable** bulk deploy

- Quality by design
  - If design phase done properly
- Easy to spot failures
  - Orange visual clues
  - Textual error logs
- Detects illegal changes

Architecting the solution

CAPTURE: document specifications, features needs… the solution.

DEFINE: configurations, links, logic, graphics

IMPLEMENT: PoC element

TEST: validate upfront design, document results

RELEASE: requirements, functional design, test evidence, user manual

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Test upfront design

- You have a great design but...
  - Is it a great implementation?
  - Can you prove it?
- Fixing is more expensive than doing right
- Many tripping points
- Ensure to trip on each bug... at least once

Practical example

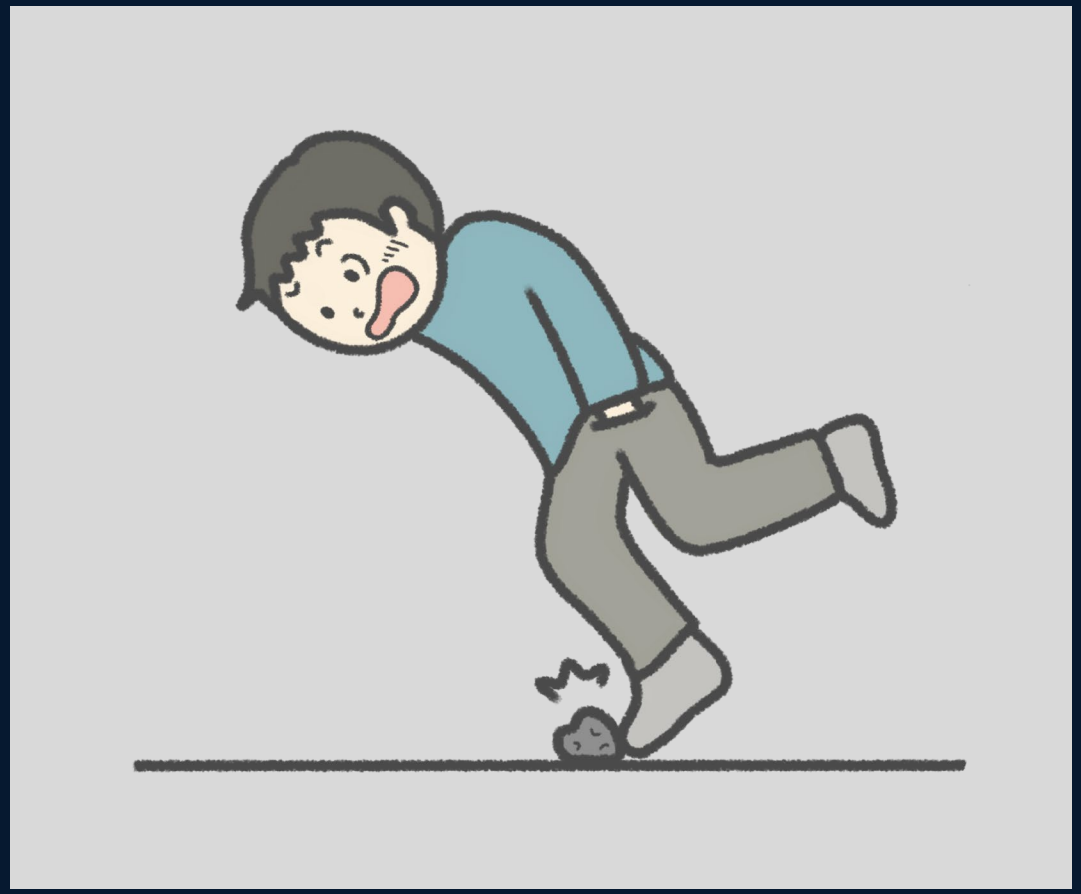
- Fire system: **8K+ elements**
- Modbus integration
- System details in text file
- Several Modbus/IP panels
- Different types of elements
- Niagara as gateway to BACnet/IP

Should we go manual?

PREMATH

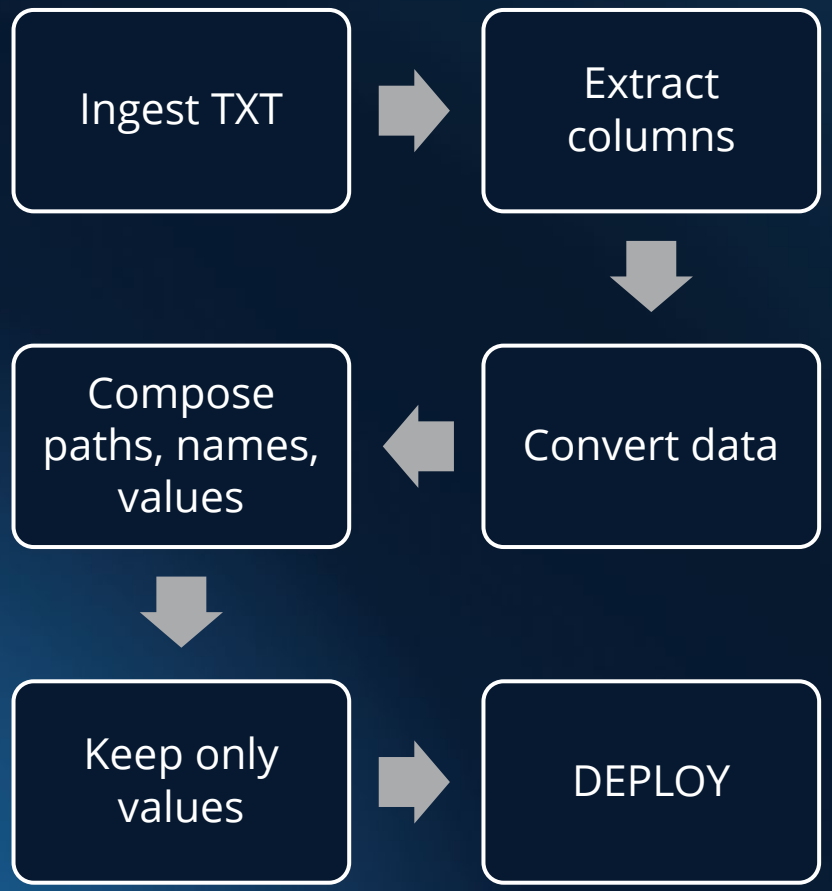
- Each element
  - Contained in one folder
  - Modbus register for read
  - Modbus register for write
  - Logic to prevent forbidden write values
  - Registers bit encoded, logic for evaluation and priority
  - BACnet exposed name
  - BACnet exposed instance

Hidden surprises in the horizon



- New elements caused Modbus register map shift
- Fire system changes after receiving the information
- Rework mandatory
- Multiple occurrences

Automate data processing



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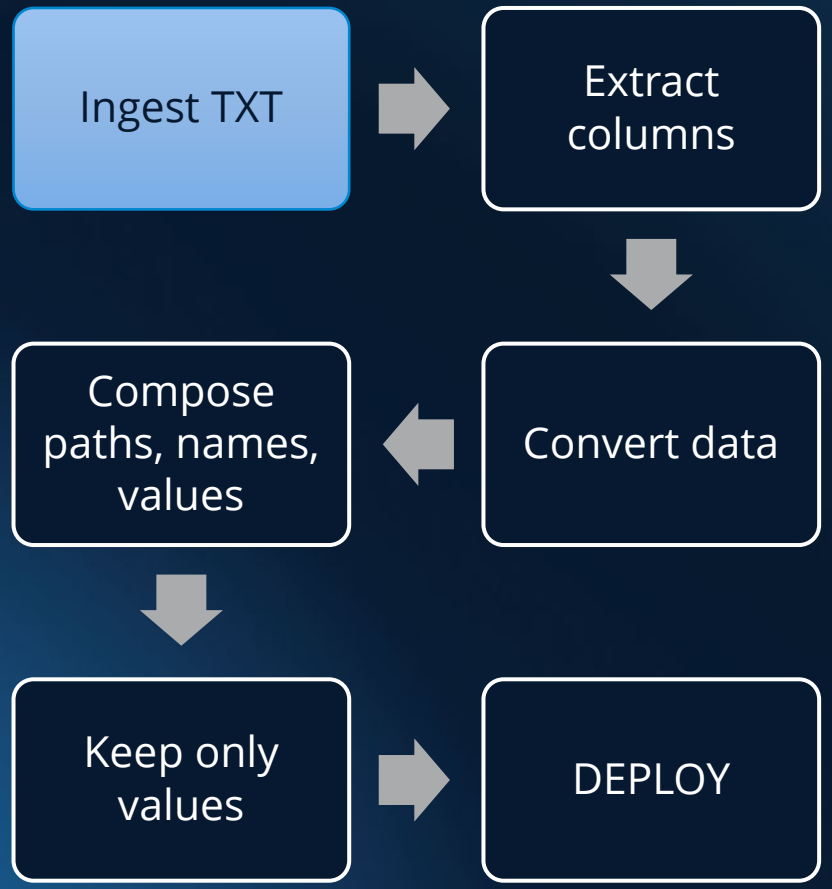
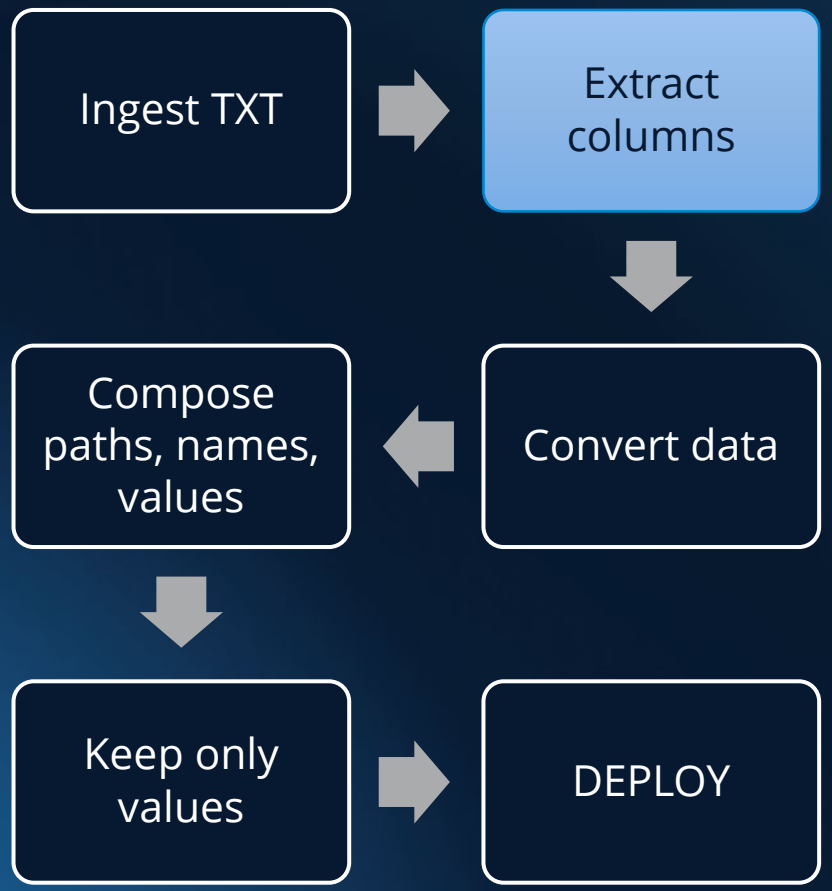
Automate data processing



Automate data processing



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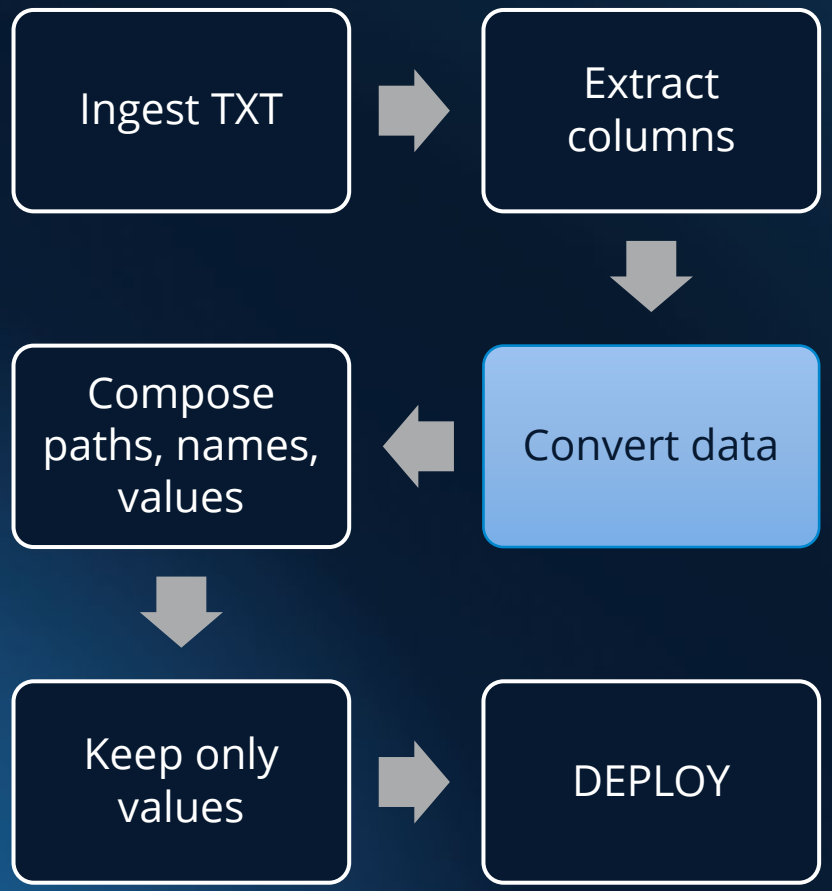
Automate data processing



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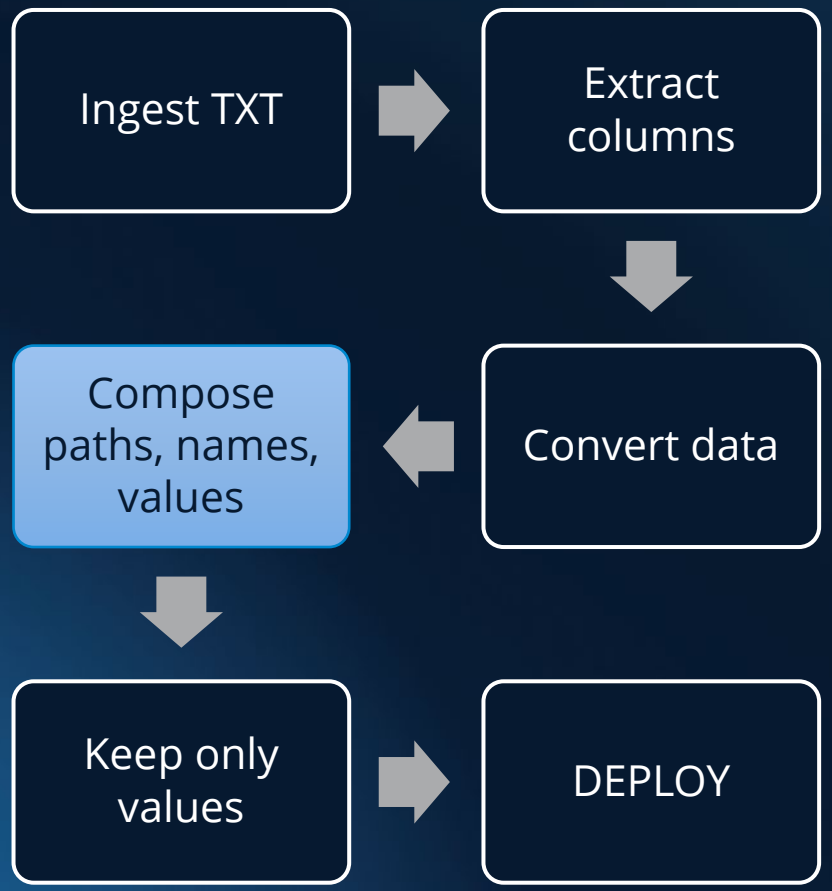
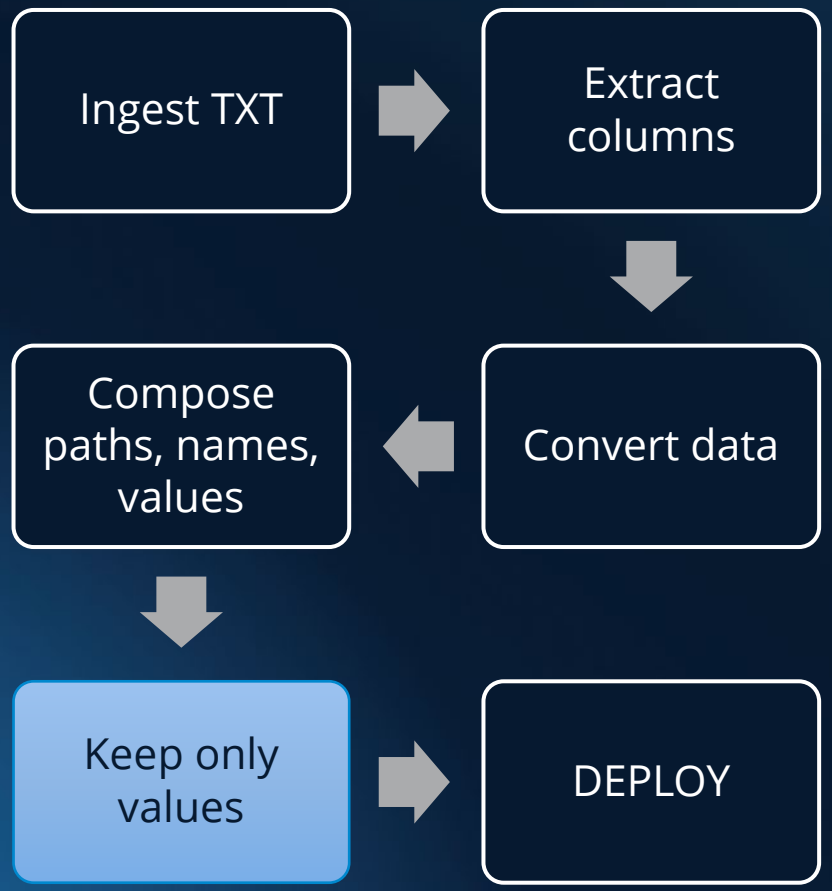
Automate data processing



Automate data processing



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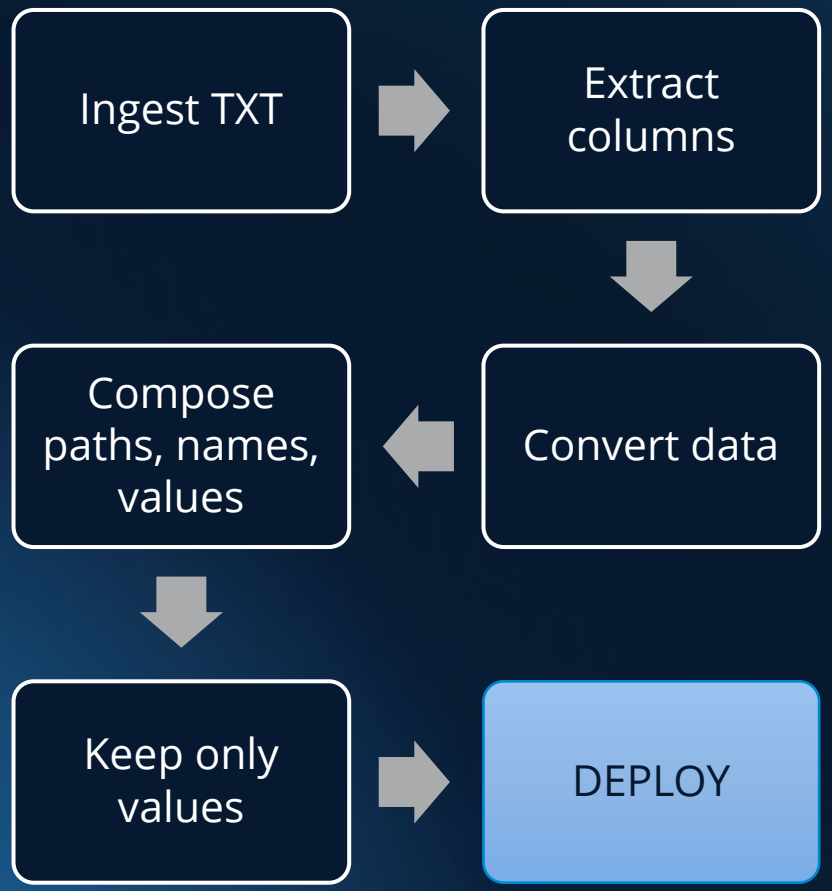
Automate data processing



Excel in action

```
=IF(NOT(ISERROR(FIND(" F.T.";[@[Zone name]])));"FT"; IF(NOT(ISERROR(FIND(" FT ";[@[Zone name]])));"FT";
IF(NOT(ISERROR(FIND(" F.S.";[@[Zone name]])));"FS"; IF(NOT(ISERROR(FIND(" FS ";[@[Zone name]])));"FS";
IF(NOT(ISERROR(FIND("SIRENA ";[@[Zone name]])));"S"; VLOOKUP([@RiesgoTrim];TablaAsignacion;2;FALSE))))))
```

Zone	PtZ	PtPn	Point	Risk	Zone name
1	1	1	01/1/001/01 -	Entradas	N1 E-N FLUJO BIES L1 M01.1
2	1	2	01/1/001/02 -	Entradas	N1 E-N VALV.OUT BIES L1 M01.2
3	1	3	01/1/001/03 -	Entradas	N1 E-N VALVLVULA IN L1 M01.3
4	1	4	01/1/001/04 -	Entradas	N1 E-N BYPASS L1 M01.4
5	1	5	01/1/002/01 -	Optico	N1 E-N CIRCULACION GEN. L1 D02
6	1	6	01/1/003/01 -	Optico	N1 E-N CIRCULACION GEN. L1 D03
7	1	7	01/1/004/01 -	Pulsador	N1 E-N CIRCULACION GEN. L1 PUL04
8	1	8	01/1/005/01 -	Sirenas	N1 E-N CIRCULACION GEN. L1 SIR05
9	1	9	01/1/006/01 -	Optico	N1 E-N CIRCULACION GEN. L1 D06
10	1	10	01/1/007/01 -	Optico	N1 E-N CIRCULACION GEN. L1 D07
11	1	11	01/1/008/01 -	Optico	N1 E-N CIRCULACION GEN. L1 D08
12	1	12	01/1/009/01 -	Optico	N1 E-N CIRCULACION GEN. L1 D09

```
=[@CENTRAL2]&" "&[@NOMBRE]&" - "&[@[Zone name]]
```

```
=MID([@[Point      ]];6;3)
```

```
=[@CENTRAL2]&"_L"&[@LAZO]&[@TIPO]&[@ELEM]&IF(OR([@TIPO]="ME";[@TIPO]="MS");"_"&[@SUBDIRECCION];"")
```

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Automated data processing E2E

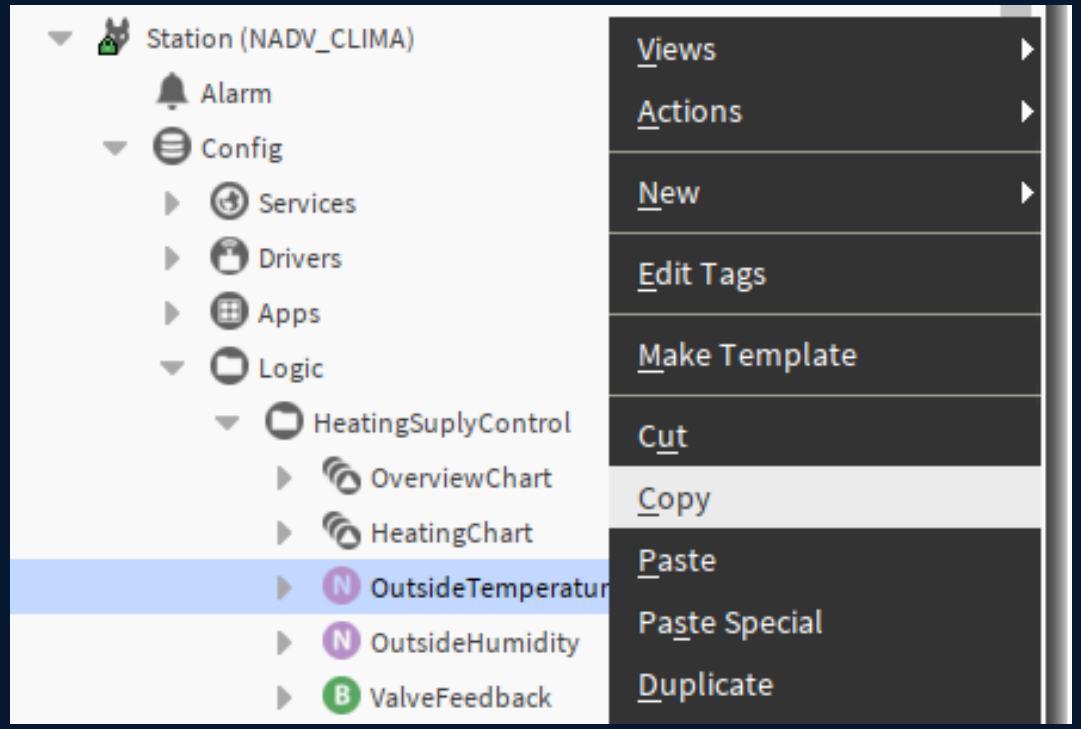
Zone	PtZ	PtPn	Point	Risk	Zone name
1	1	1	01/1/001/01 -	Entradas	N1 E-N FLUJO BIES L1 M01.1
2	1	2	01/1/001/02 -	Entradas	N1 E-N VALV.OUT BIES L1 M01.2
3	1	3	01/1/001/03 -	Entradas	N1 E-N VALVLVULA IN L1 M01.3
4	1	4	01/1/001/04 -	Entradas	N1 E-N BYPASS L1 M01.4
5	1	5	01/1/002/01 -	Optico	N1 E-N CIRCULACION GEN. L1 D02
6	1	6	01/1/003/01 -	Optico	N1 E-N CIRCULACION GEN. L1 D03
7	1	7	01/1/004/01 -	Pulsador	N1 E-N CIRCULACION GEN. L1 PUL04
8	1	8	01/1/005/01 -	Sirenas	N1 E-N CIRCULACION GEN. L1 SIR05
9	1	9	01/1/006/01 -	Optico	N1 E-N CIRCULACION GEN. L1 D06
10	1	10	01/1/007/01 -	Optico	N1 E-N CIRCULACION GEN. L1 D07
11	1	11	01/1/008/01 -	Optico	N1 E-N CIRCULACION GEN. L1 D08
12	1	12	01/1/009/01 -	Optico	N1 E-N CIRCULACION GEN. L1 D09

	Zone	PtZ	PtPn	Point		Risk	Zone name	CENTRAL	OFFSET BACNET	RiesgoTrim	CENTRAL2	NOMBRE	LAZO	TIPO
6	14	1	15	07/1/013/03	-	Entradas	N1 O V.BYPASS BIES L1 M13.3	N06O P-CH-06011	3007000	Entradas	N06OPCH06011	N06 OESTE	1	ME
7	15	1	16	07/1/013/04	-	Entradas	N1 O VALV.IN BIES L1 M13.4	N06O P-CH-06011	3007000	Entradas	N06OPCH06011	N06 OESTE	1	ME
8	16	1	17	07/1/014/01	-	Contr. CCF	N1 O CCF SALA IDF L1 M14	N06O P-CH-06011	3007000	Contr. CCF	N06OPCH06011	N06 OESTE	1	ME
9	17	1	18	07/1/015/01	-	Puertas CF	N1 O RETENEDOR ESCAL.SUR13 L1M15	N06O P-CH-06011	3007000	Puertas CF	N06OPCH06011	N06 OESTE	1	MS
0	17	2	19	07/1/015/02	-	Puertas CF	N1 O RETENEDOR ESCAL.SUR13 L1M15	N06O P-CH-06011	3007000	Puertas CF	N06OPCH06011	N06 OESTE	1	MS
1	18	1	20	07/1/016/01	-	Optico	N1 O CIRCULACION GEN. AMB L1 D16	N06O P-CH-06011	3007000	Optico	N06OPCH06011	N06 OESTE	1	D
2	19	1	21	07/1/017/01	-	Optico	N1 O CIRCULACION GEN. AMB L1 D17	N06O P-CH-06011	3007000	Optico	N06OPCH06011	N06 OESTE	1	D
3	20	1	22	07/1/018/01	-	Puertas CF	N1 O P. ESTERIORES TORRE B L1M18	N06O P-CH-06011	3007000	Puertas CF	N06OPCH06011	N06 OESTE	1	MS
4	20	2	23	07/1/018/02	-	Puertas CF	N1 O P. ESTERIORES TORRE B L1M18	N06O P-CH-06011	3007000	Puertas CF	N06OPCH06011	N06 OESTE	1	MS
5	21	1	24	07/1/019/01	-	Optico	N1 O C.ELECTRICO AMB L1 D19	N06O P-CH-06011	3007000	Optico	N06OPCH06011	N06 OESTE	1	D
6	22	1	25	07/1/020/01	-	ALARMA PMR	N1 O ALARMA PMR TORRE B L1 M20	N06O P-CH-06011	3007000	ALARMA PMR	N06OPCH06011	N06 OESTE	1	ME
7	23	1	26	07/1/021/01	-	Optico	N1 O ASEO MASCULINO FT L1 D21	N06O P-CH-06011	3007000	Optico	N06OPCH06011	N06 OESTE	1	FT
8	24	1	27	07/1/022/01	-	Optico	N1 O ASEO MASCULINO AMB L1 D22	N06O P-CH-06011	3007000	Optico	N06OPCH06011	N06 OESTE	1	D
9	25	1	28	07/1/023/01	-	Optico	N1 O ASEO MASCULINO FT L1 D23	N06O P-CH-06011	3007000	Optico	N06OPCH06011	N06 OESTE	1	FT
0	26	1	29	07/1/024/01	-	Optico	N1 O ASEO MASCULINO AMB L1 D24	N06O P-CH-06011	3007000	Optico	N06OPCH06011	N06 OESTE	1	D
1	27	1	30	07/1/025/01	-	Optico	N1 O ASEO MASCULINO FT L1 D25	N06O P-CH-06011	3007000	Optico	N06OPCH06011	N06 OESTE	1	FT

	Q	R	S	T	U	V	W	X	Y	Z	
1	Deployed Name	Display Name	Position	Unique Device	INPUTS	alarmInhibit	slot	CONFIG	Descripcion	alarmClass	NumEle
2	NS2EPCHS2009_L1P001	NS2E P-CH-S2009 L1P001				Drivers/ModbusTcpGatewaysAGUILERA4/NS2EPCHS2009/LogicaInhibicion/InhibirAlarmas	out		NS2EPCHS2009 - S02 E VESTIBULO ASEOS L1 PUL01	HighAlarmClass	
3	NS2EPCHS2009_L1D002	NS2E P-CH-S2009 L1D002				Drivers/ModbusTcpGatewaysAGUILERA4/NS2EPCHS2009/LogicaInhibicion/InhibirAlarmas	out		NS2EPCHS2009 - S02 E VESTIBULO ASEOS AMB L1 D02	HighAlarmClass	
4	NS2EPCHS2009_L1FT003	NS2E P-CH-S2009 L1FT003				Drivers/ModbusTcpGatewaysAGUILERA4/NS2EPCHS2009/LogicaInhibicion/InhibirAlarmas	out		NS2EPCHS2009 - S02 E VESTIBULO ASEOS FT L1 D03	HighAlarmClass	
5	NS2EPCHS2009_L1P004	NS2E P-CH-S2009 L1P004				Drivers/ModbusTcpGatewaysAGUILERA4/NS2EPCHS2009/LogicaInhibicion/InhibirAlarmas	out		NS2EPCHS2009 - S02 E PASILLO SALA VIP L1 PUL04	HighAlarmClass	

	A	B	C	D	E	F	G	H	
1	**Template Description**	Fire Zone					**Configs**		
2						**Slot Name**	description	Disablement_Num_uaNodeId	Wa
3	**Template Title**	WINMAG Fire Zone				**User Tip**	Description of the Device		
4	**Template Version**	1.8.0				**Slot Type**	baja:String	baja:String	baj
5						**Default Value**	FILL WITH DESCRIPTION FROM WINMAG		
6	**Parent Component Slot Path**	**Deployed Name**	**Display Name**	**Position**	**Unique Device**	**Description**			
7	Drivers/OpcUaNetwork/WinmagServerB/points/D21P7_7/Loop1	Zone1	Zone1		Liv1_Sup		Building 7 Zone-1	ns=2;g=0758adae-0070-0065-0000-010000000000	ns=
8	Drivers/OpcUaNetwork/WinmagServerB/points/D21P7_7/Loop1	Zone2	Zone2		Liv1_Sup		Building 7 Zone-2	ns=2;g=0758adae-0070-0066-0000-010000000000	ns=

Prepare your formulas



- Create one line manually
  - Copy paste from WB
  - Work over that first PoC
  - Remove prefixes per cell notes

station:|slot:/Logic/HeatingSuplyControl/OutsideTemperature

1	Template Description	Elemento de Aguilera			
2					
3	Template Title	AE Aguilera Elemento			Slot Name
4	Template Version	2.3			User Tip
5					Bind Hints
6	Parent Component Slot Path				
7					
8					
9					
10					

Parent Component Slot Path is required. It is the slot path to the Component that will contain the template instance. There should be no starting or ending slashes in the entered value.
Example: Folder1/Folder2/Folder3

- Recreate with formulas
- Inspect

Deploy aftermath

- 16K+ proxy points bit-encoded
- 8K+ logic folders
- 24K+ protocol details configurations

- Templates + Excel Formulas
- Deployment benchmark:
  - 2.5K+ in 40 minutes
  - 8k+ ramped to 8h → overnight

Benefits

- Repeatability
- Avoid cost of poor quality
  - Fixing human errors / bad quality
- Improved reliability
  - 12 reworks due to externalities
  - Process was tested and trusted
- Reduced commissioning time
  - Try to estimate manual time

Going beyond deploy

- “Stickers”: small PX graphics in template
- Used as symbols on floorplan
- Drag and drop folder, select “sticker” PX
- Human manual
  - Folder to drag and drop
  - Type of element*

LAST WORD

- Care your templates
  - Template design time pays off
  - Test, test and test
  - How to reuse my template?
    - Be general
    - Distribute
    - Document

THANK YOU!

Questions?

Pacific Northwest
NATIONAL LABORATORY

Real-World Deployment of Model-Free Extremum-Seeking Control

Timothy I. Salsbury
Controls Engineer and Chief Research Scientist

U.S. DEPARTMENT OF ENERGY BATTELLE

PNNL is operated by Battelle for the U.S. Department of Energy

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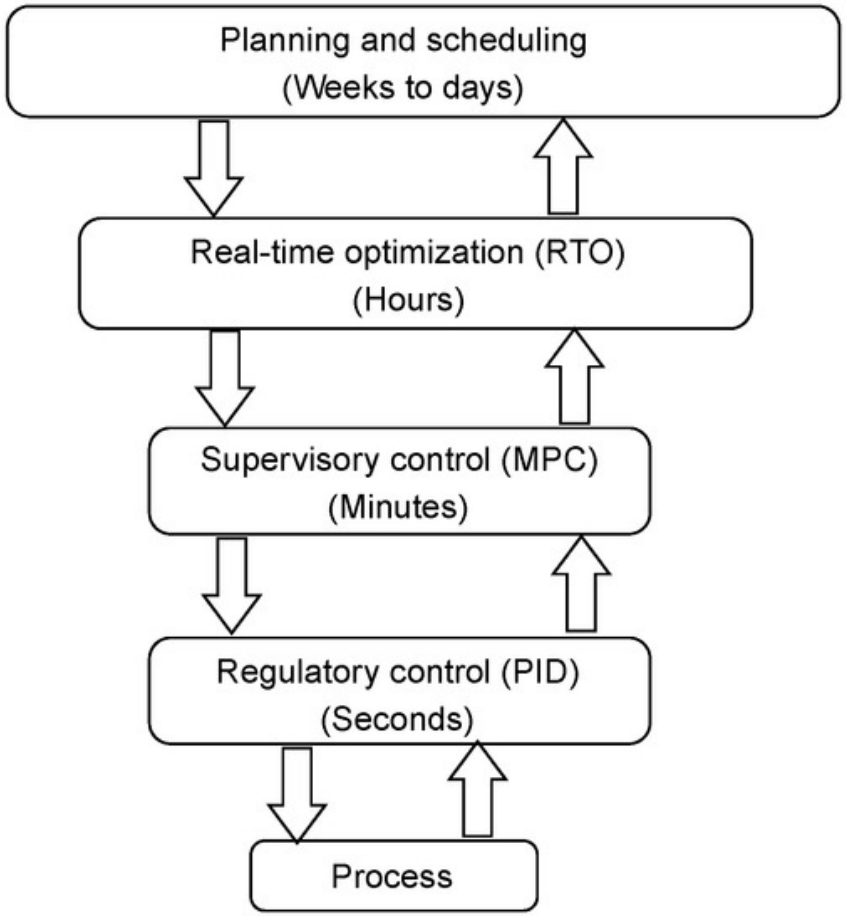
Bottom line upfront

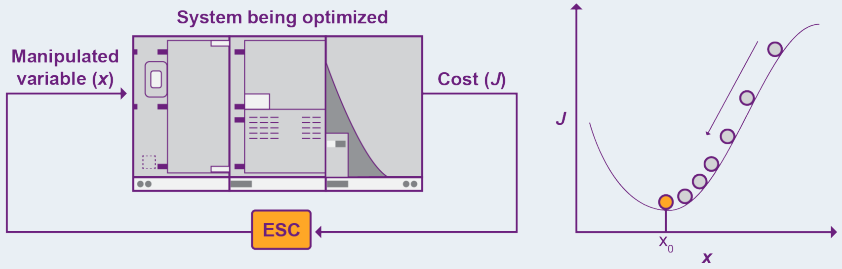
- PNNL developed and deployed a new *extremum-seeking* control (ESC) block in Niagara, programmed in Java
- PNNL obtained funding from the U.S. DoW via the *Environmental Security Technology Certification Program* (ESTCP) to demonstrate the ESC on air-handling units in U.S. Army Reserve buildings
- We demonstrated on > 30 buildings for two different applications and across various climates and building types
- We demonstrated large energy cost savings, peaking at up to 50% savings on certain cooling days

A quick primer on “control layers”



- Temporal hierarchy with time scale separation between different control functionality
- Interactions and dependencies require functionality from lower layers to ensure performance
- RTO and supervisory control can be merged for certain applications

Extremum-seeking control (ESC) = Feedback-based Optimization

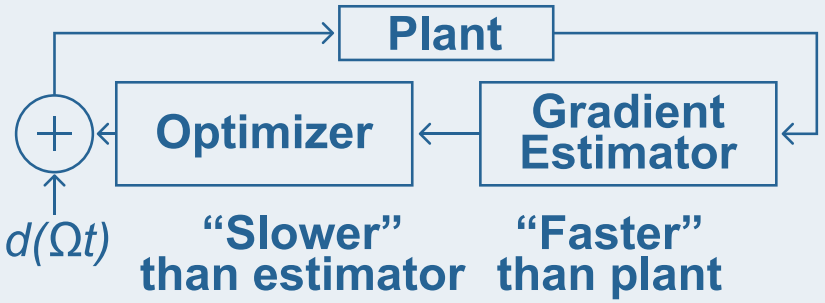


"Perturb and Observe"

Input excitation is needed

Gradient descent algorithm

Single Input Single Output



General-purpose optimizer

ESC

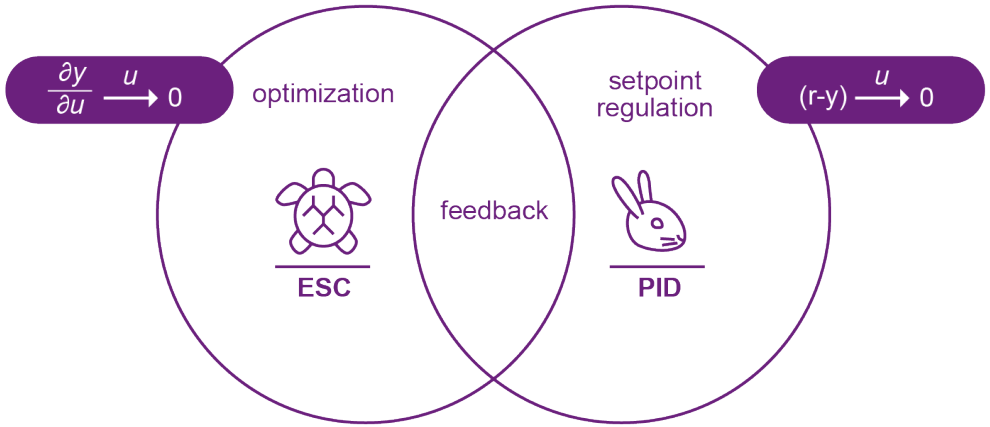
No models

No Training

Real-time Optimization

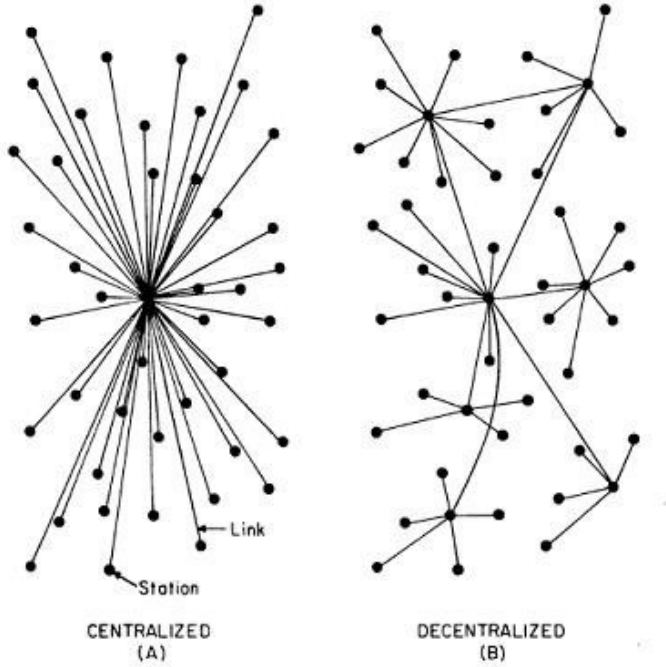
System/hardware agnostic

ESC is for optimization what PID is for control



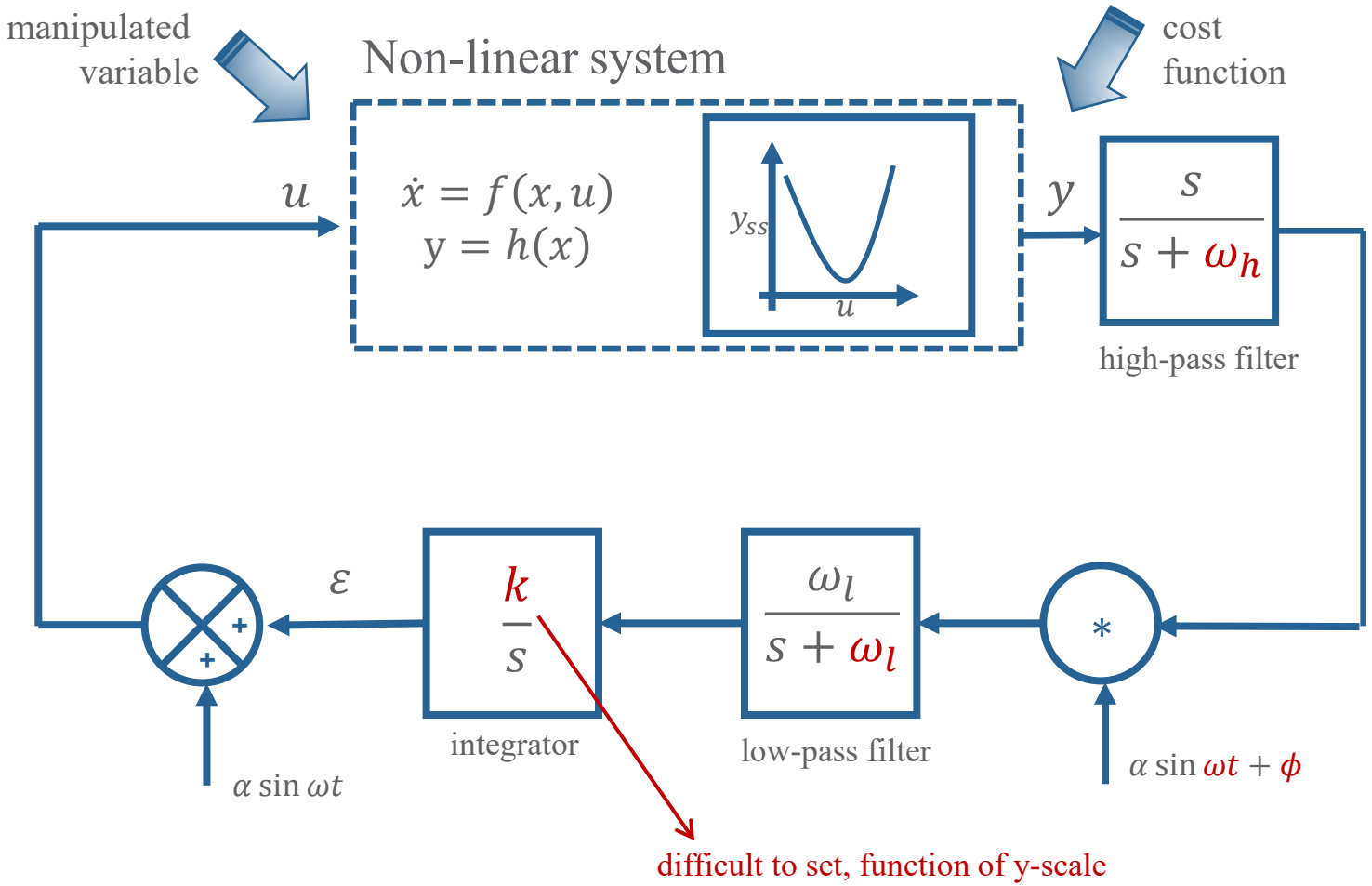
Simple, general-purpose, and decentralized

PID controllers are ubiquitous in building control



Traditional "text-book" ESC

- Gradient obtained via demodulation
- Many tuning parameters – difficult to set-up

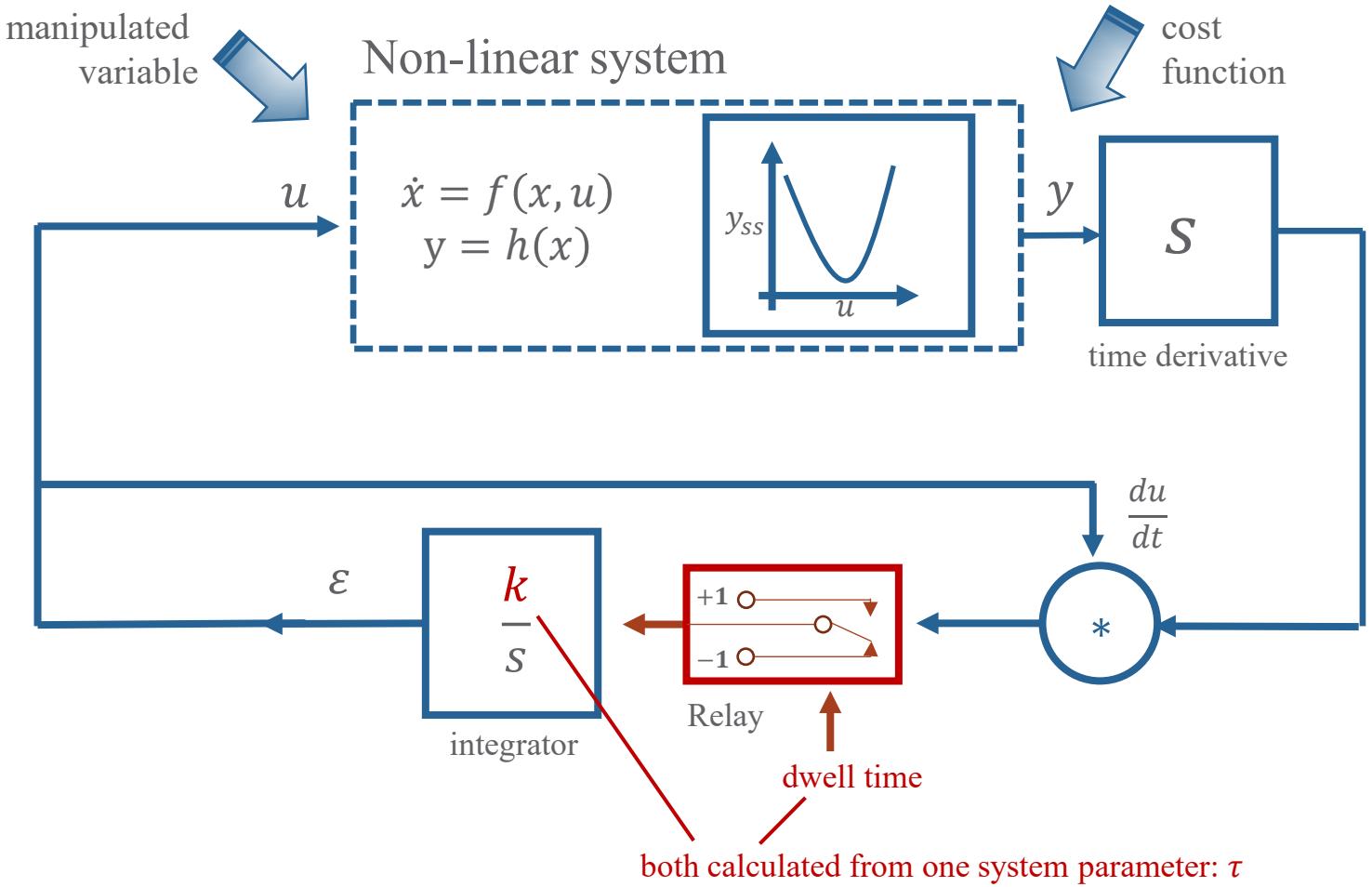


Easy-to-deploy ESC

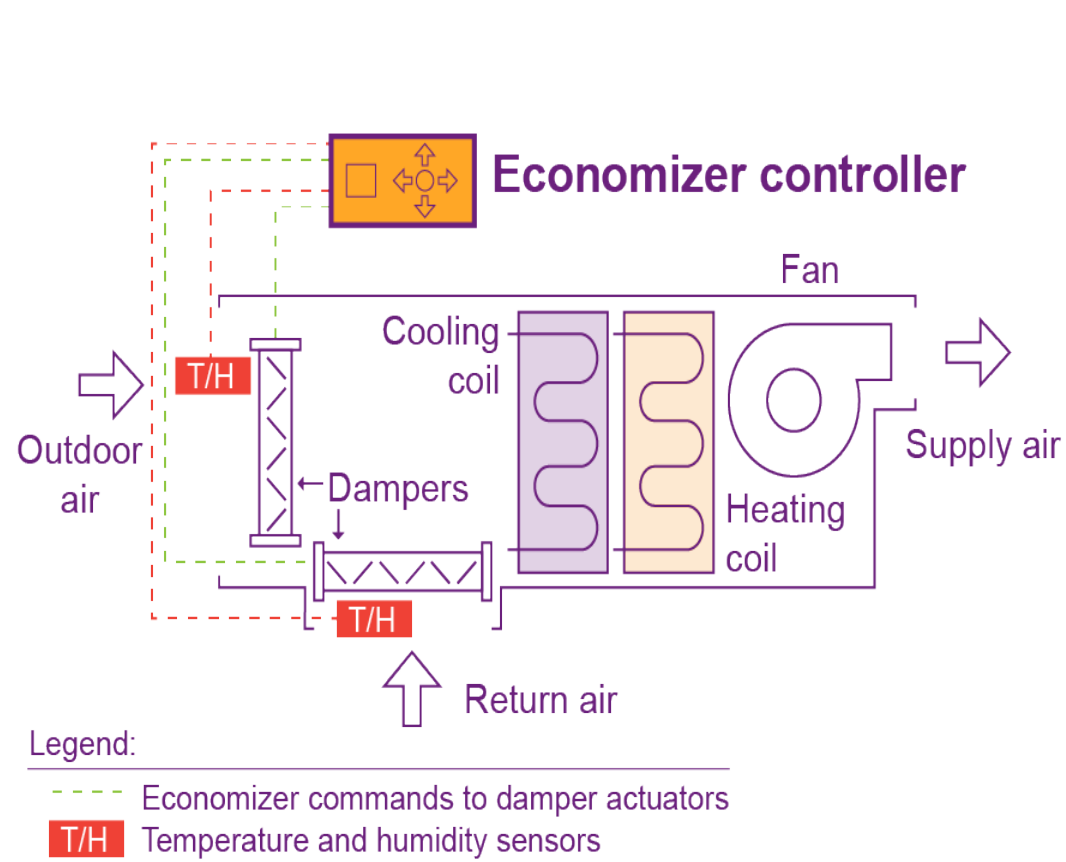
- Time scale separation via relay ***dwell time*** → $\frac{dy}{dt} \propto \frac{dy_{ss}}{dt}$
- Sign of gradient of cost function

$$\operatorname{sgn}\left(\frac{dy_{ss}}{du}\right) = \operatorname{sgn}\left(\frac{dy}{dt} \cdot \frac{du}{dt}\right)$$

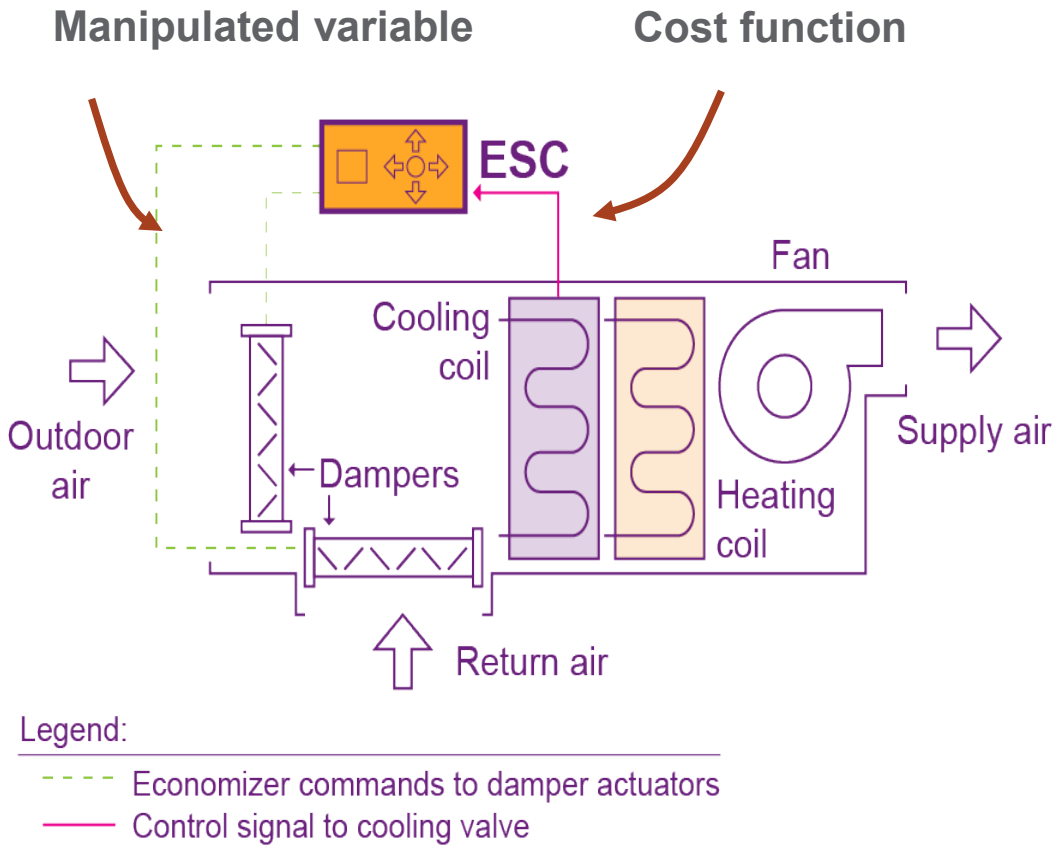
- Scale is eliminated and parameters are based on system dynamics
- ***Single* parameter, time constant**
- Ease of deployment



Economizer

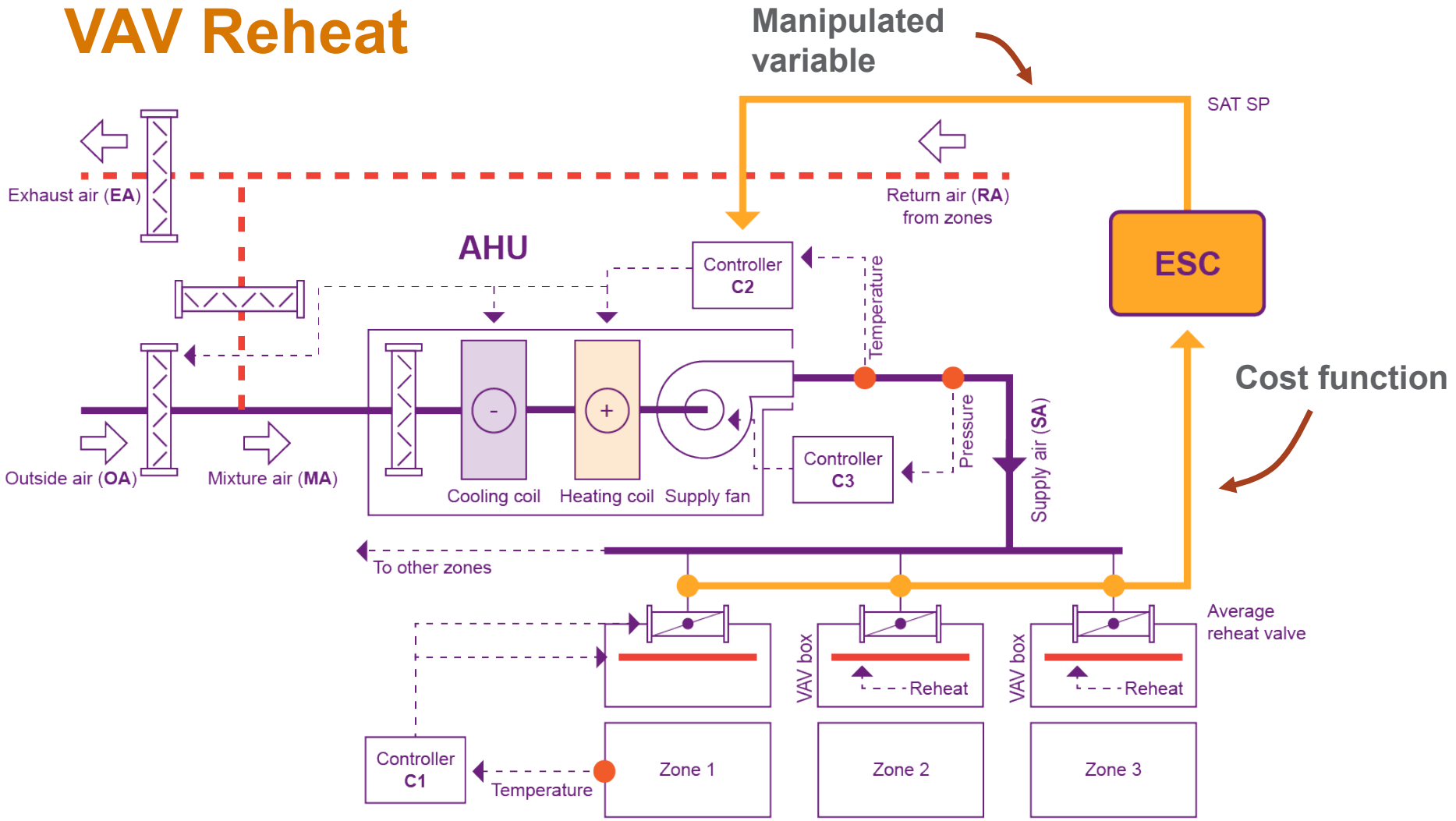


Existing: with up to 4 sensors



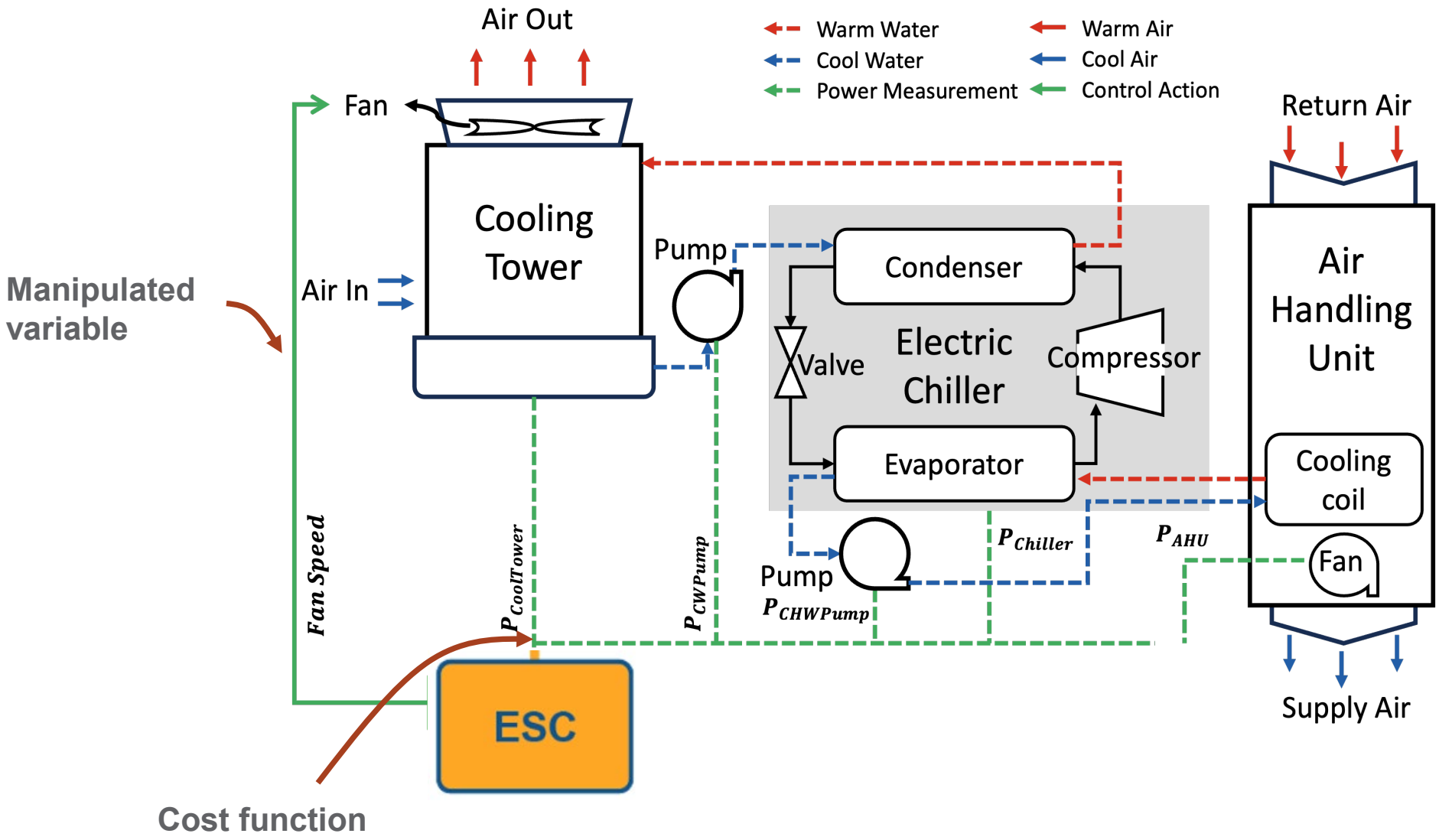
New: without sensors

VAV Reheat

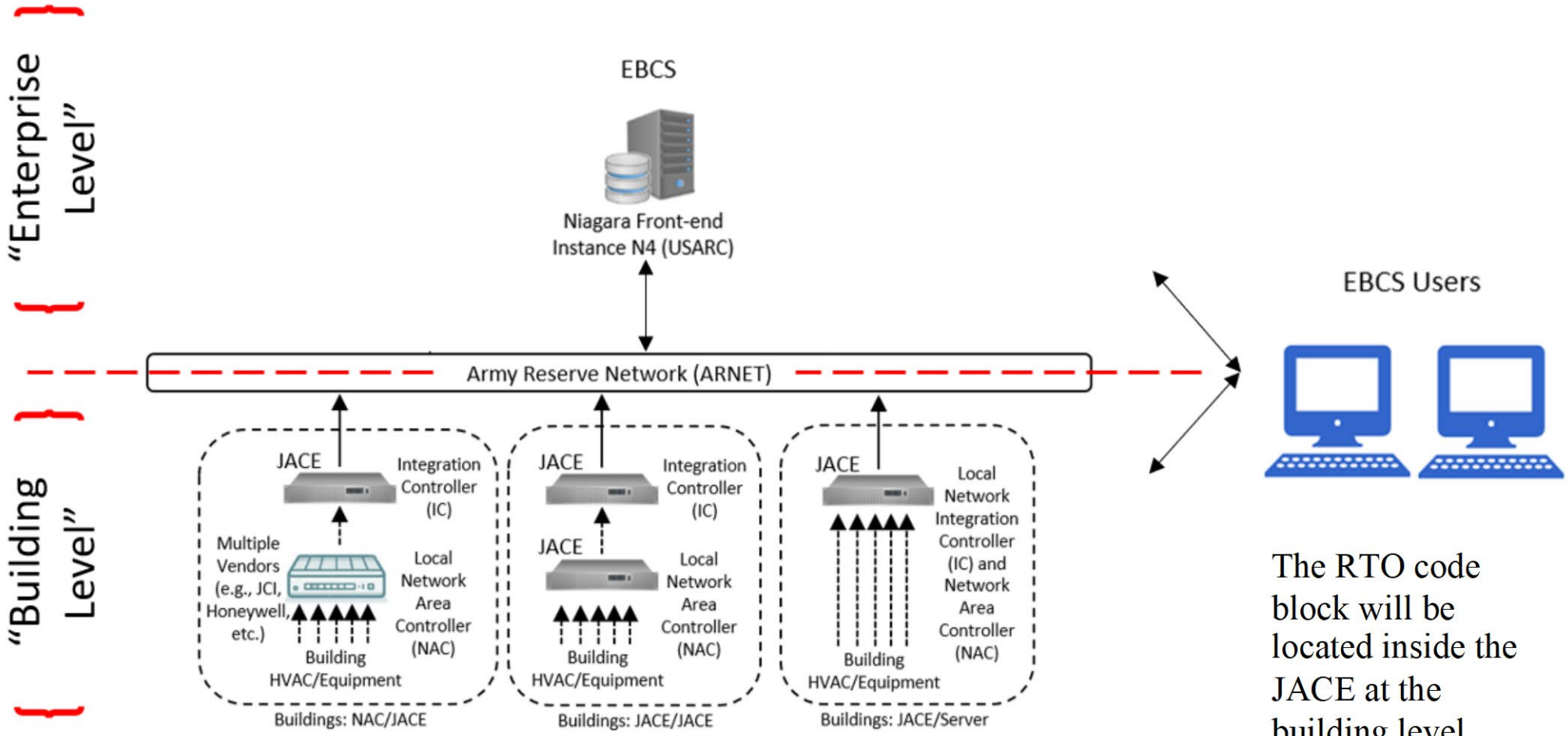


cost function = average reheat + (average damper > 50%)

Cooling tower



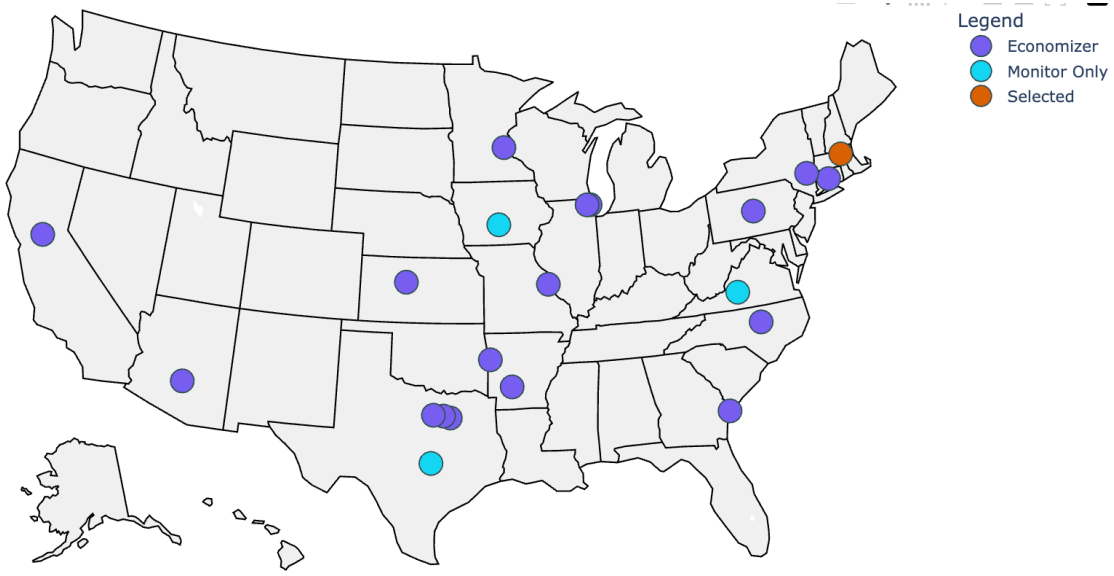
Niagara deployment for USAR



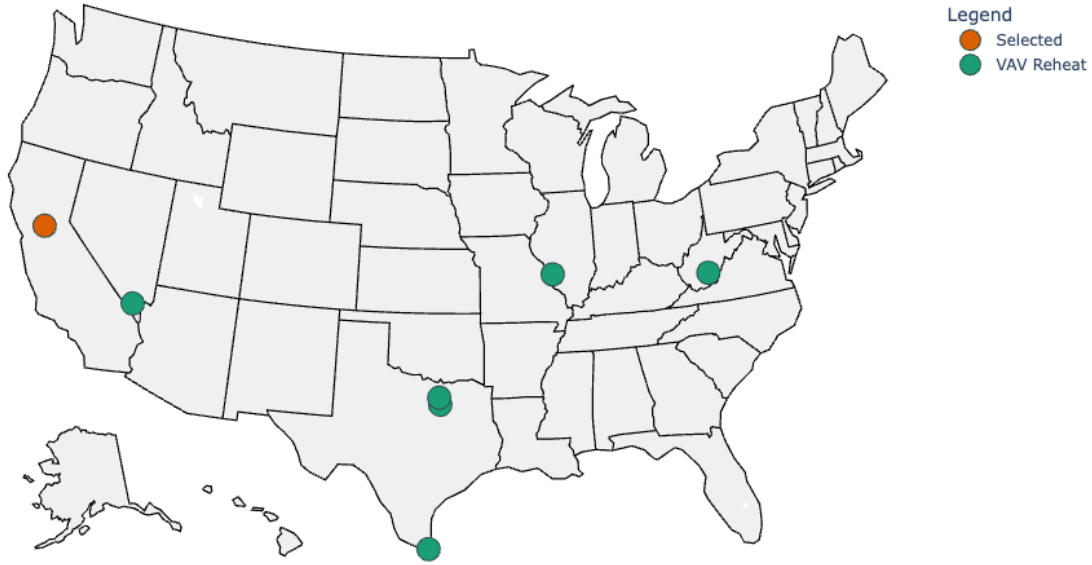
The RTO code block will be located inside the JACE at the building level.

Deployed on 30 USAR EBCS Buildings

Economizer deployments



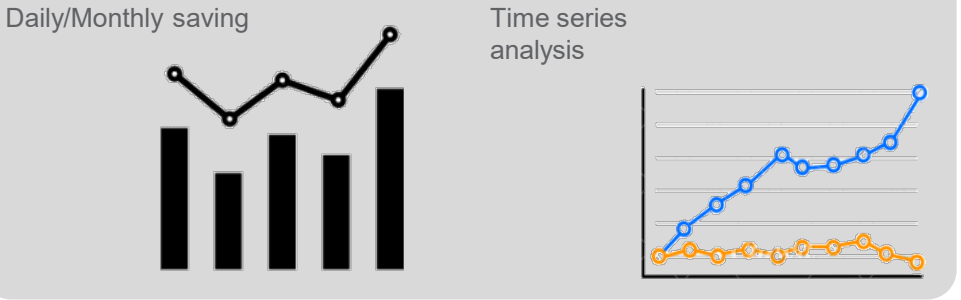
VAV deployments



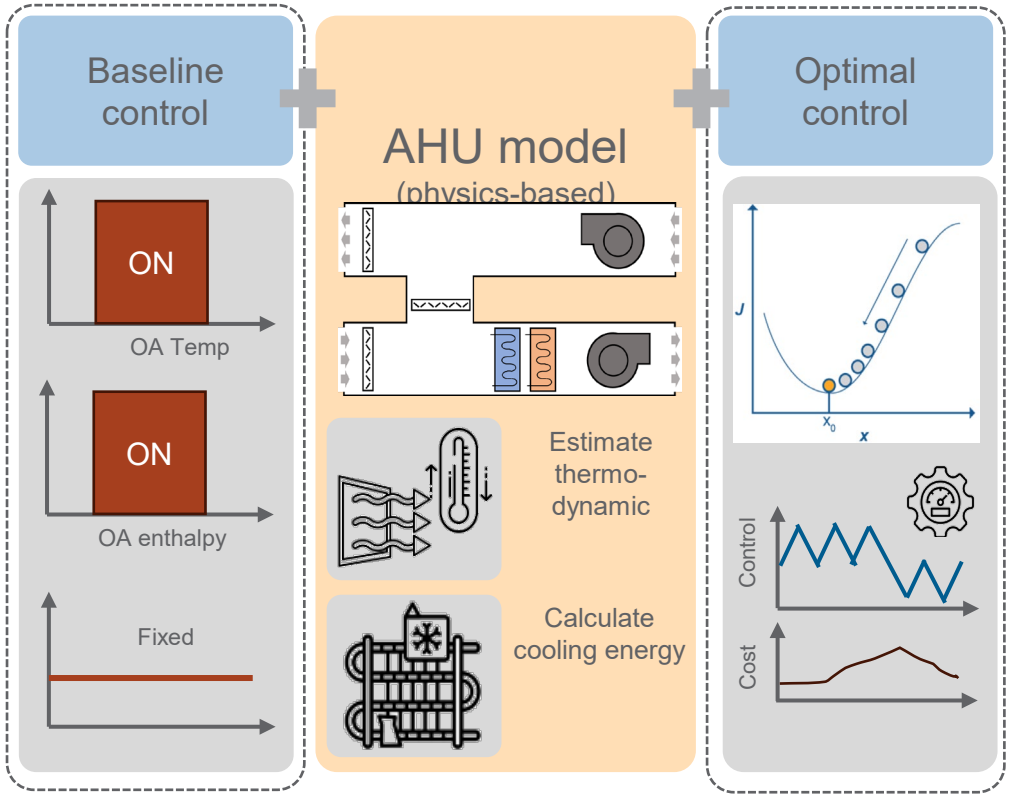
M&V to demonstrate energy savings

Collect information/measurements

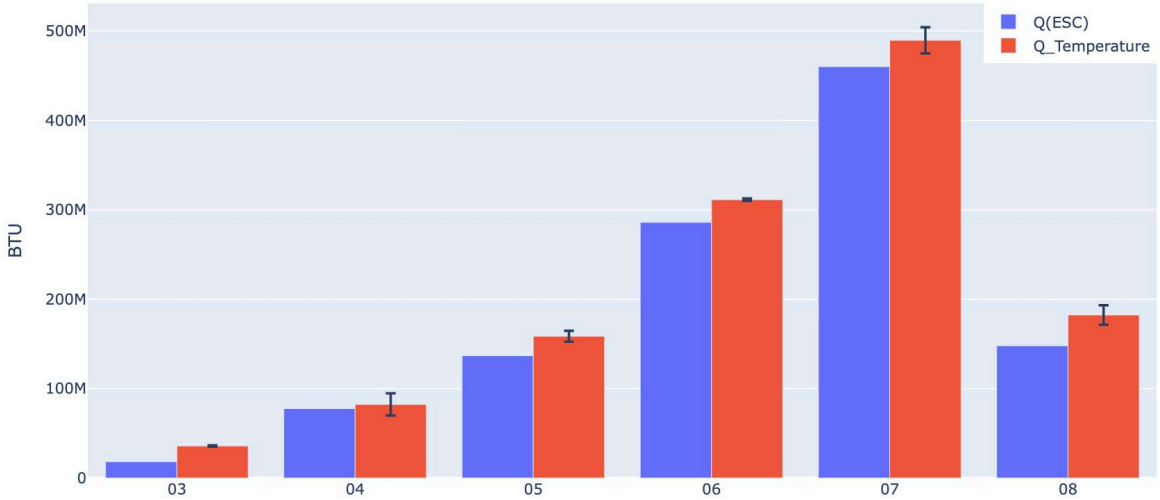
Energy saving potential

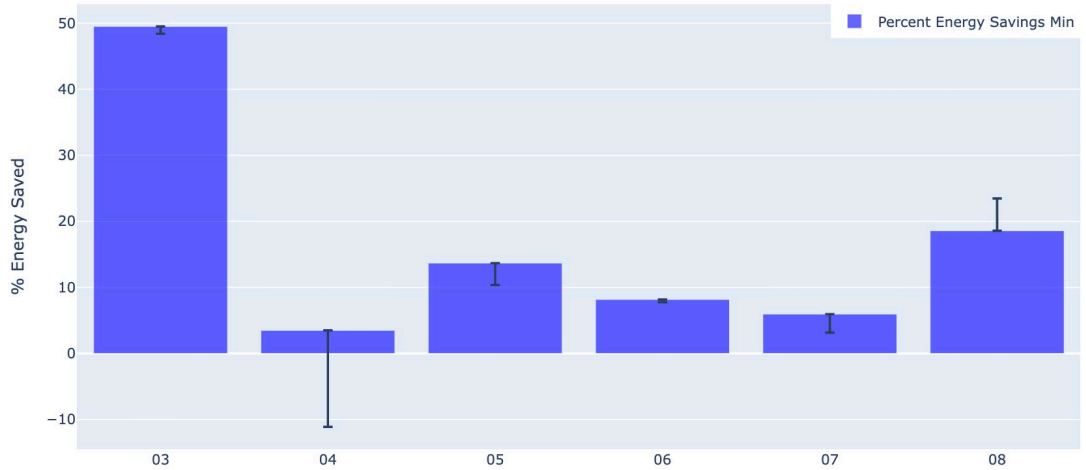


Model-based energy analysis



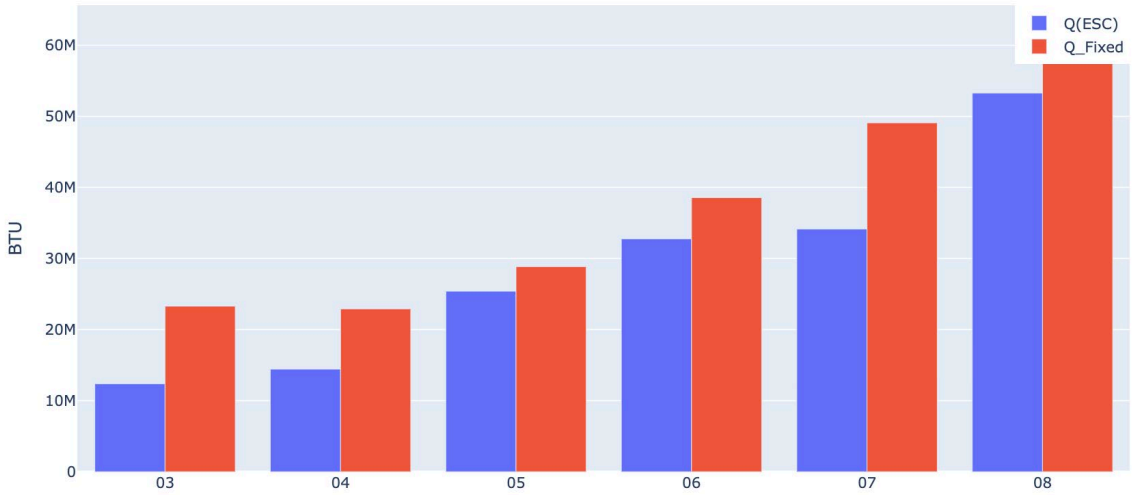
Economizer example - Massachusetts

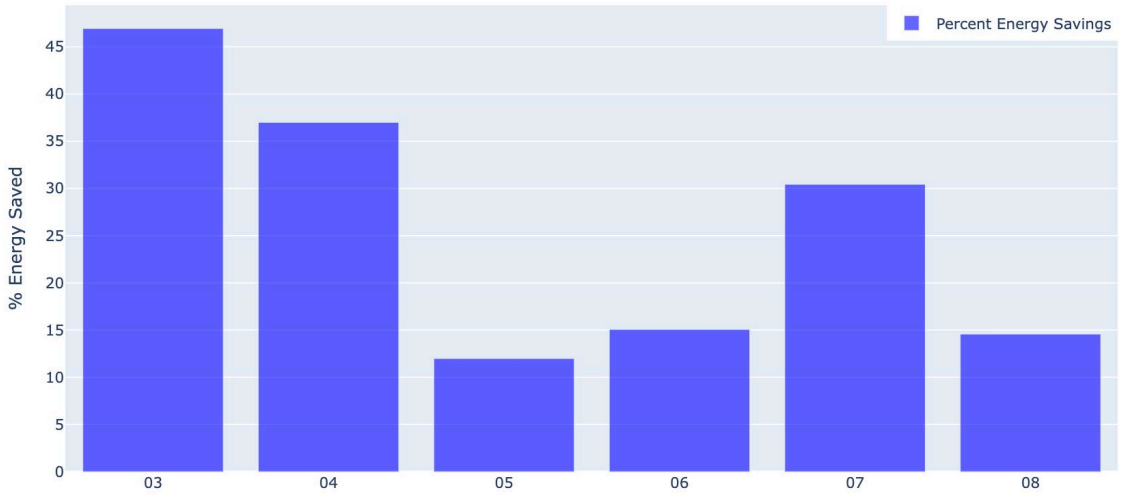




- Seasonal energy savings of up to 50%

VAV reheat example - Texas





- Seasonal energy savings of up to 45%

PNNL’s M&V dashboard

Conclusion

- **Easy implementation**
  - No new hardware
  - Simple connection of new control block

- **Robust and fault tolerant**
  - Performs control functions with fewer sensors than traditional strategies

- **Reduces energy costs**
  - Saves cooling energy, as high as 50% in certain scenarios

Thank you!

Questions?

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Grid Connectivity & Optimization

Michael Westerfield

NS26

TRIDIUM

THE OPPORTUNITY

200+

companies have pledged to be Net Zero*

*Source: Pledge to Net Zero

10,000+

companies have validated science based targets**

**Source: Science Based Targets.org

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TRIDIUM

GHG

PFC_S CO_2 N_2O HFCS CH_4 SF_6

Scope 3 INDIRECT

- Employee commuting
- Leased assets
- Waste generated in operations
- Capital goods
- Business travel
- Transportation & distribution
- Fuel and energy related activities
- Purchased goods & services

Scope 2 INDIRECT

- Purchased electricity, steam, heating & cooling for own use

Scope 1 DIRECT

- Company facilities
- Company vehicles

Scope 3 INDIRECT

- Use of sold products
- Investments
- Processing of sold products
- Leased assets
- Transportation & distribution
- End-of-life treatment of sold products
- Franchises

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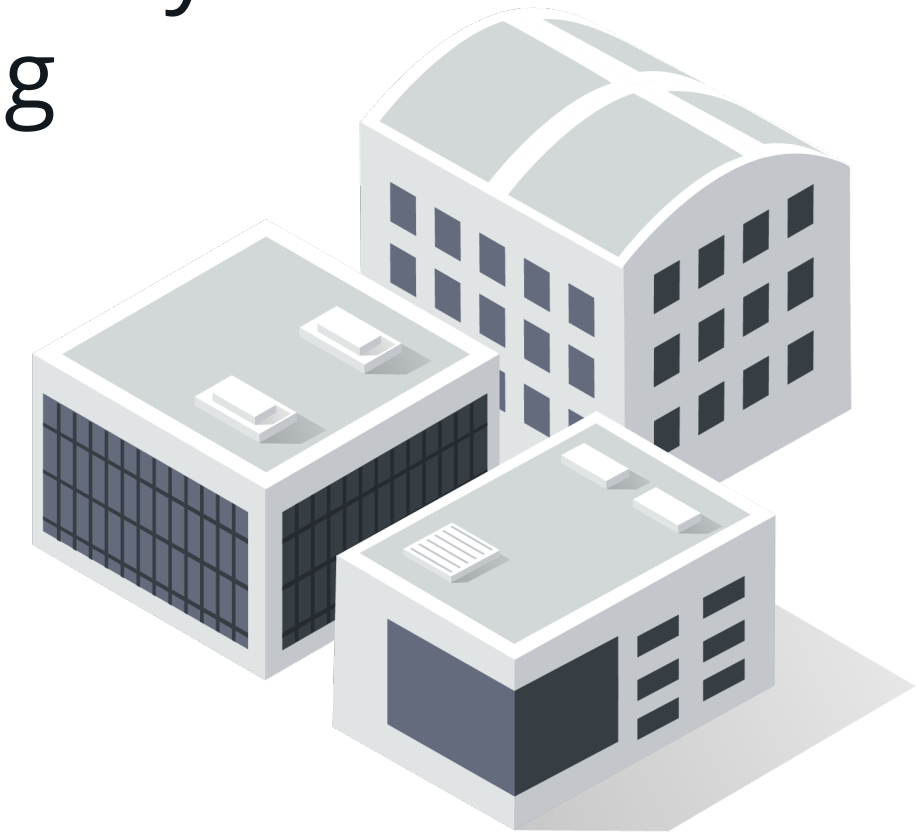
THE CHALLENGE

55% of companies are housing ESG data in spreadsheets*

*Source: Ernst & Young

The **Complexities** of Energy & Sustainability Reporting



- **Various reporting frameworks**
- **Evolving mandates**
- **Too many data points!**
- **Lack of internal resources**

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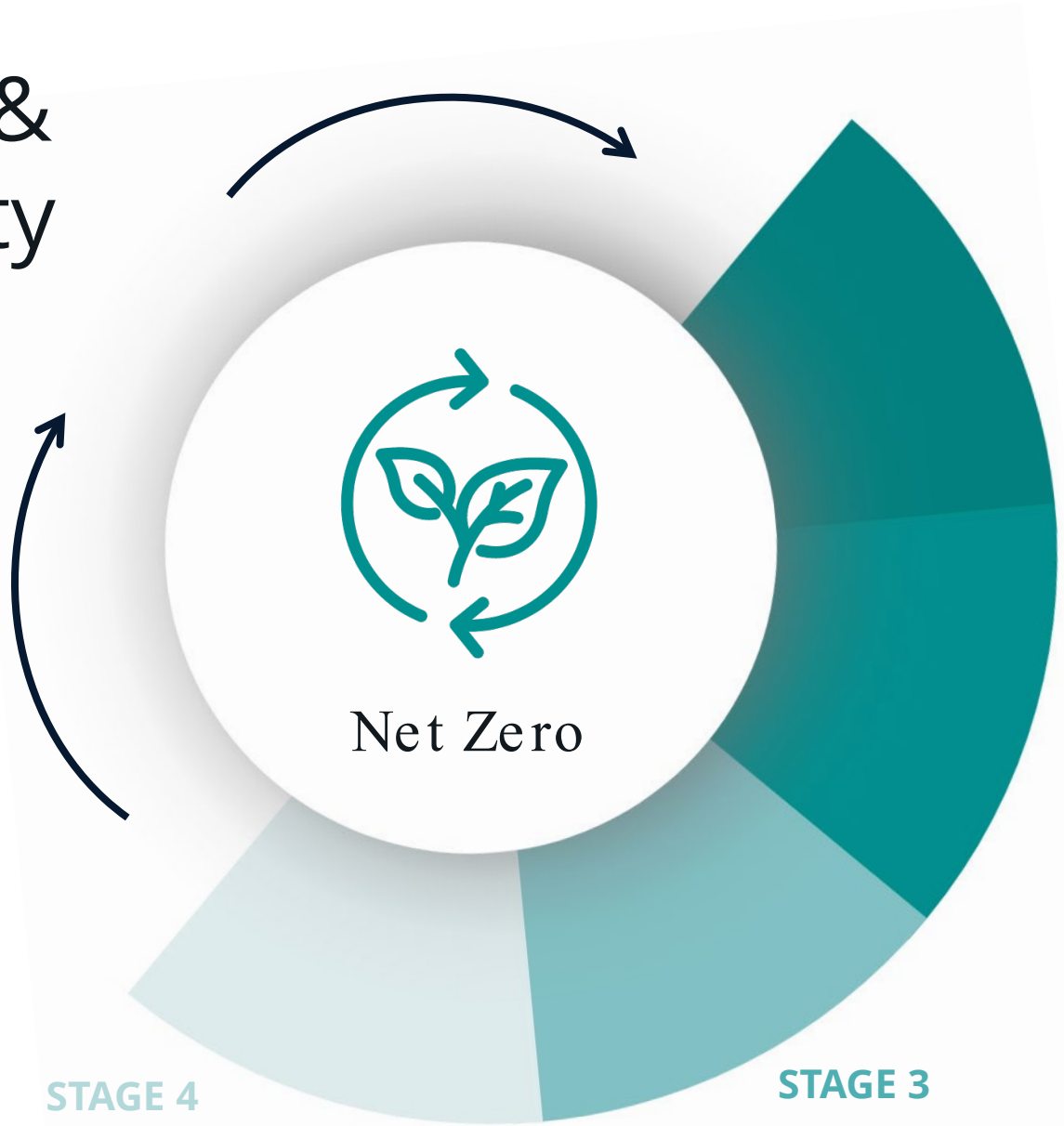
The Energy & Sustainability **Journey**



STAGE 1
Collecting, **measuring**, reporting data

STAGE 2
Goal tracking

STAGE 3
Internal awareness

STAGE 4
Project ROI

TRIDIUM
powered by
niagara framework®

Atrius Energy

Optimize energy and resource consumption across your portfolio

20+ Cards to visualize data

12+ Data integrations

Atrius Sustainability

Accelerate your journey to **net zero carbon** emissions

110,000+
Emission Factors

5,400+
Scope 1, 2, & 3 Emission Data Types

20+
Disclosure frameworks (CDP, TCFD, SASB)

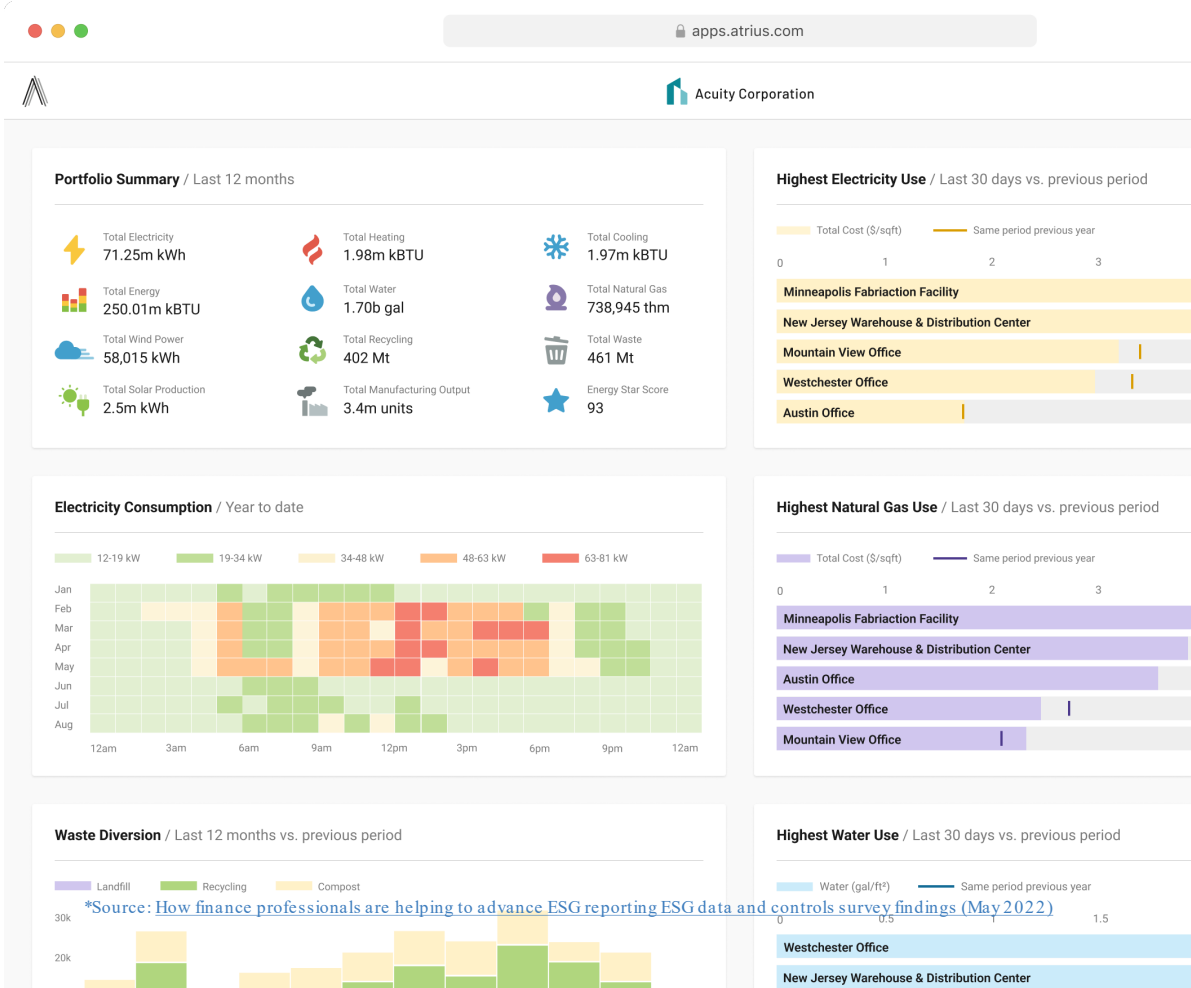
14,900+
Automated Utility Integrations

9
Localized Languages

152
Supported Country Emissions

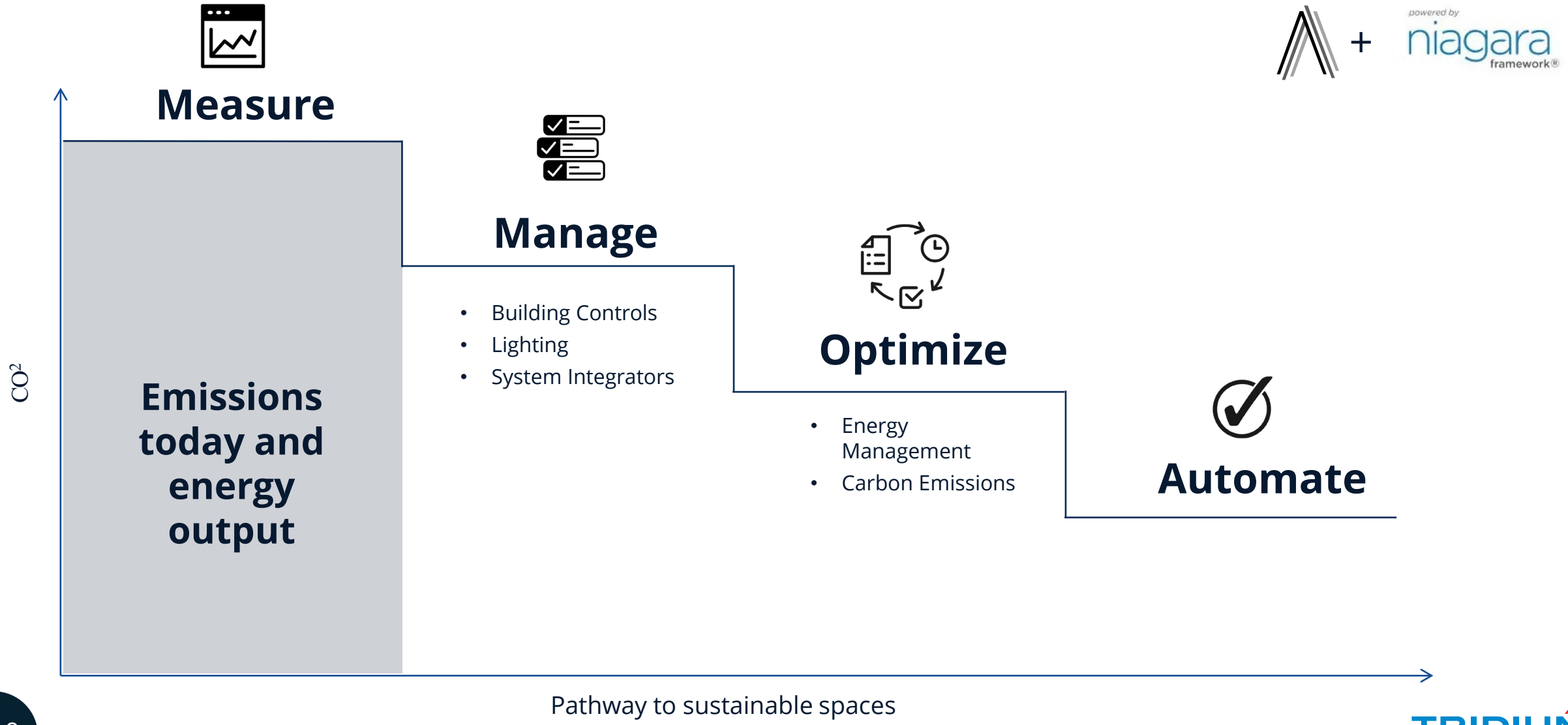
Key features:

- Real time and historical data integrations
- Data quality and automation workflows
- Storyboards to increase engagement
- Dedicated customer success manager



*Source: How finance professionals are helping to advance ESG reporting ESG data and controls survey findings (May 2022)

The pathway to **sustainable spaces**



DEMO

Thank you!

Questions?

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