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Business & Technology Panel: Valuing DER and Unbundled Services

Information as a Service

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- Mr. Bernstein is CEO of RBCG, an engineering and business consulting company. He has over 30 years' experience with control automation design, specification development, educational program development, and facility master planning. His is a co-author of the latest ASHRAE BMS Guidespec, training developer/instructor, co-author of texts on Control Networking and Building Automation, author/advisor of control standards for the US DOD, healthcare, retail giants, and the oil/gas industry. He is an elected member of the US DOE Gridwise Architecture Council and a partner of the Grid Modernization Laboratory Consortium. He is the Executive Director of LonMark International a non-profit standards development association. He holds a BS in Mechanical Engineering from CMU, a Masters in Psychology, and a Masters in Philosophy.

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Information as a Service

- Difference between data and information
- Does Metcalf's "law" apply?
- Data+context+time+location+…= Information
- Who values information?
- Data profiling – complex but doable
- Use case example
- Value of interoperable information

Data versus Information

Data (static)

- Temperature is 32
- Energy demand is 100kw
- Solar DER current production is 10.5 kw
- Equipment current draw is 25 amps

Information (actionable)

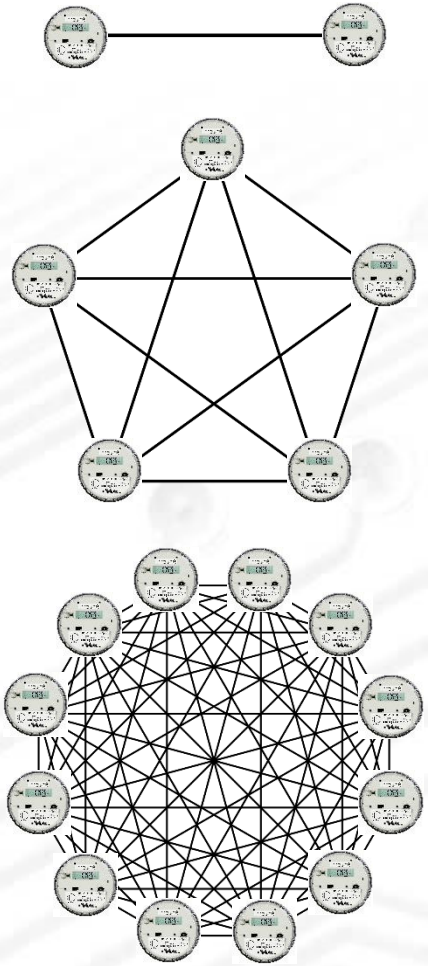
- I'm too hot, cool off the room
- Air handler 2 coming online now
- Will be a sunny day today, full power from solar array expected
- MRI Machine scheduled for 3pm today, pre-cool the zone
- Power of the dilithium crystal drive is 4000 gigajoules, I need more power Scotty!

Metcalf's law applied to TE for buildings and cities?

- The value of the system is equal to the square of the number of connections

- $V=N^2$

Does this apply to TE?



Value of Information: Applying Metcalf's Law

- Stakeholder value
  - To owner
  - To utility
  - To grid operator
  - To third party

The Connections

- Example Applications
  - Building as an energy source
  - Building as an energy sync
  - Building-to-building connections
  - Campus to Campus connections
  - Storage and time value of available

- Objectives:
  - Improve operations
  - Make better decisions
  - Timeliness of information
  - Alarms and alerts
  - Realtime value
- More value with more data point connections
- Non-traditional connections

CONNECT THE DOTS

Key Objectives

- Energy reliability and associated "value"
  - Example of internet speed - pay for quality at differing value tiers
- Resilience
  - how quickly can system recover, value for speed of recovery
- Economic importance of:
  - Minimizing downtime
  - Operational performance
  - Production
  - Comfort

Energy Criticality Valuation

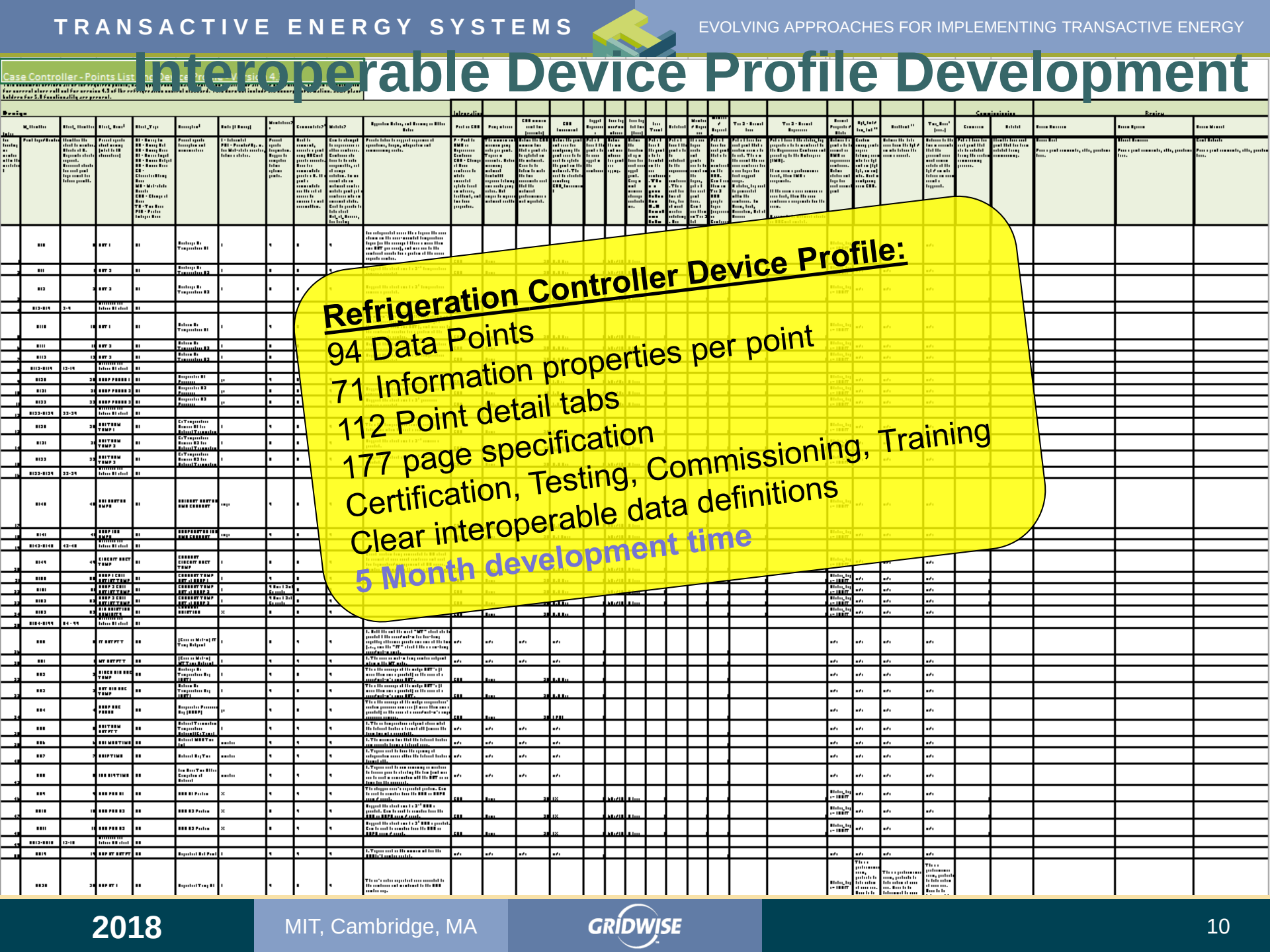
- **Severe**
  - Injury or loss of life ex: hospital
- **High**
  - Unhealthy conditions requiring shut down of facility, safety hazard
- **Moderate**
  - Loss of productivity, significant inconveniency, high loss of revenue
- **Low**
  - Inconvenience, some loss of productivity, some loss of revenue
- **Other**
  - Good will impacts, social program impacts, etc.

Information from Data

- Data+context+time+ location+…= Information
- Equipment and device profiles
- Complex structures, but necessary
- Requires interoperability

Case Point Details	Discharge Air Temperature #1		
Design		Object Configuration	
Object_ Name1	DAT 1	Mandatory Properties	Required
Description1	Discharge Air Temperature #1	Object_Identifier	Y
Index	1	Object_Name	Y
W_Identifier	AI0	Object_Type	Y
Object_ Identifier	0	Present_Value	Y
Units (if Analog)	F	Status_Flags	Y
Mandatory?2	Y	Event_State	Y
Commandable?3	N	Out_Of_Service	Y
Writable?	Y	Units	Y
Object_Name Truncated		Property_List	Y
Integration		Optional Properties	
Polled or COV	COV	Description	Y
Polling interval	None	Device_Type	Y
COV minimum send time (seconds)	30	Reliability	N
COV Increment	0.5 Deg	Update_Interval	Y
Logged Supervisor	1	Min_Pres_Value	Y
Local Log max/min interval	60s/10s	Max_Pres_Value	Y
Local Log hold time (days)	5 days	Resolution	Y
Local Trend	0	Reliability_Evaluation_Inhibit	N
Scheduled	0	Profile_Name	N
Monitor/ Display local	1	Required if Object Supports COV	
Monitor / Displayed Supervisor	1	COV_Increment	
Tier 3 - Alarmed Local	1	Time_Delay	
Tier 2 - Alarmed Supervisor	1	Notification_Class	
Tier 1 - Alarmed Enterprise (IMS)	1	High_Limit	
Alarmed Property / State	Status_Flags = FAULT	Low_Limit	
High_Limit/ Low_Limit 4, 5	n/a	Deadband	
Deadband 4, 6	n/a	Limit_Enable	
Time_Delay7 (sec.)	n/a	Event_Enable	
		Acked_Transitions	
		Notify_Type	
Commissioning		Event_Time_Stamps	

Interoperable Device Profile Development



Refrigeration Controller Device Profile:

- 94 Data Points
- 71 Information properties per point
- 112 Point detail tabs
- 177 page specification
- Certification, Testing, Commissioning, Training
- Clear interoperable data definitions
- **5 Month development time**

ANSI/CTA 709.6 - 153 Device Profiles

SFPTactuateDrive
SFPTactuateDriveFan
SFPTactuateLight
SFPTactuateSunshade
SFPTactuateTemperatureSetpoint
SFPTairQualityControl
SFPTairQualityMeasurement
SFPTairTemperatureSensor
SFPTairVelocitySensor
SFPTanalogInput
SFPTanalogOutput
SFPTaudibleFireIndicator
SFPTautomaticLightController
SFPTautomaticSolarControl
SFPTautomaticThermalControl
SFPTautomaticTransferSwitch
SFPTautomaticTwilightControl
SFPTboilerController
SFPTcalendar
SFPTchannelContinuityMonitor
SFPTchannelMonitor
SFPTchilledCeilingController
SFPTchiller
SFPTclosedLoopActuator
SFPTclosedLoopSensor
SFPTclothesWasherDomestic
SFPTco2Sensor
SFPTconstantLightControl
SFPTconstantLightController
SFPTcontrolDriveActuator
SFPTcontrolDriveActuatorFan
SFPTcontroller
SFPTcontrolRoomUtilisationTypes
SFPTdamperActuator
SFPTdataLogger
SFPTdaylightDependentLighting
SFPTdeviceMonitor
SFPTdewpointMonitoring
SFPTdischargeAirController
SFPTelevatorArrivalGong
SFPTelevatorDirectionLantern
SFPTelevatorFireSystemsPort
SFPTelevatorHallLantern
SFPTelevatorPositionIndicator
SFPTelevatorVoiceAnnouncer
SFPTenergyModeSelection
SFPTenergyModeSelectionWithStartOpt
SFPTentryExit
SFPTfanCoilUnit
SFPTfanControl
SFPTfireSmokeDamperActuator
SFPTfrostSensor
SFPTfunctionSelection
SFPTgeneratorSet
SFPTglobalSolarRadiation
SFPThardwiredFireAlarmShutdown
SFPThardwiredFullVentilation
SFPThardwiredGasDetectionShutdown
SFPThardwiredRecirculation
SFPThardwiredSafetyInstrumentedSystemSIS
SFPTheatPump
SFPThvacRelativeHumiditySensor
SFPThvacTempSensor
SFPThvacValvePositioner
SFPTidentifierSensor
SFPTisiKeypad
SFPTisiLampActuator
SFPTisiMonitorPoint
SFPTisiOccupancySensor
SFPTisiSunblindActuator
SFPTlampActuator
SFPTlightActuator
SFPTlightControl
SFPTlightingPanelController
SFPTlightSensor
SFPTmanipulatedValueLimiting
SFPTmodemController
SFPTnightTimeCooling
SFPTnodeObject
SFPToccupancyController
SFPToccupancyEvaluator
SFPToccupancySensor
SFPTopenLoopActuator
SFPTopenLoopSensor
SFPToutdoorBrightnessMeasurement
SFPToutdoorLuminairController
SFPTpartitionWallControl
SFPTpartitionWallController
SFPTprecipitationDetection
SFPTpresenceDetection
SFPTpressureSensor
SFPTpriorityControl
SFPTpullStationFireInitiator
SFPTpumpController
SFPTrailcarAudioController
SFPTrailcarAudioSensor
SFPTrainSensor
SFPTrealTimeBasedScheduler
SFPTrealTimeKeeper
SFPTrefrigDisplayCaseControllerDefrost
SFPTrefrigDisplayCaseControllerEvaporator
SFPTrefrigDisplayCaseControllerThermostat
SFPTroofTopUnit
SFPTroomBrightnessMeasurement
SFPTroomSupplyAirTemperatureMC
SFPTroomSupplyAirTemperatureSC
SFPTsccAHU
SFPTsccChilledCeiling
SFPTsccCommandModule
SFPTsccFanCoil
SFPTsccHeatPump
SFPTsccRadiator
SFPTsccRooftop
SFPTsccSelfContained
SFPTsccUnitVentilator
SFPTsccVAV
SFPTsceneController
SFPTscenePanel
SFPTscheduler
SFPTschedulerSimple
SFPTselectRoomUtilisationType
SFPTsequenceControl
SFPTsetpointCalculation
SFPTshadowCorrection
SFPTsignalPresence
SFPTsinglePhaseSubMeter
SFPTslatTracking
SFPTsmartLuminaireController
SFPTsmokeFireInitiatorConvent
SFPTsmokeFireInitiatorIntelli
SFPTspaceComfortController
SFPTstairwellLightControl
SFPTstaticProgrammable
SFPTsunblindActuator
SFPTsunblindController
SFPTsunshadeActuator
SFPTswitch
SFPTtelephoneDirectory
SFPTtemperatureControl
SFPTthermalFireInitiator
SFPTthermostat
SFPTtimeProgram
SFPTtwilightControl
SFPTunitHeater
SFPTunitVentilatorController
SFPTuniversalFireIndicator
SFPTuniversalFireInitiator
SFPTutilityDataLoggerRegister
SFPTutilityMeter
SFPTvariableAirVolume
SFPTvariableSpeedMotorDrive
SFPTvisibleFireIndicator

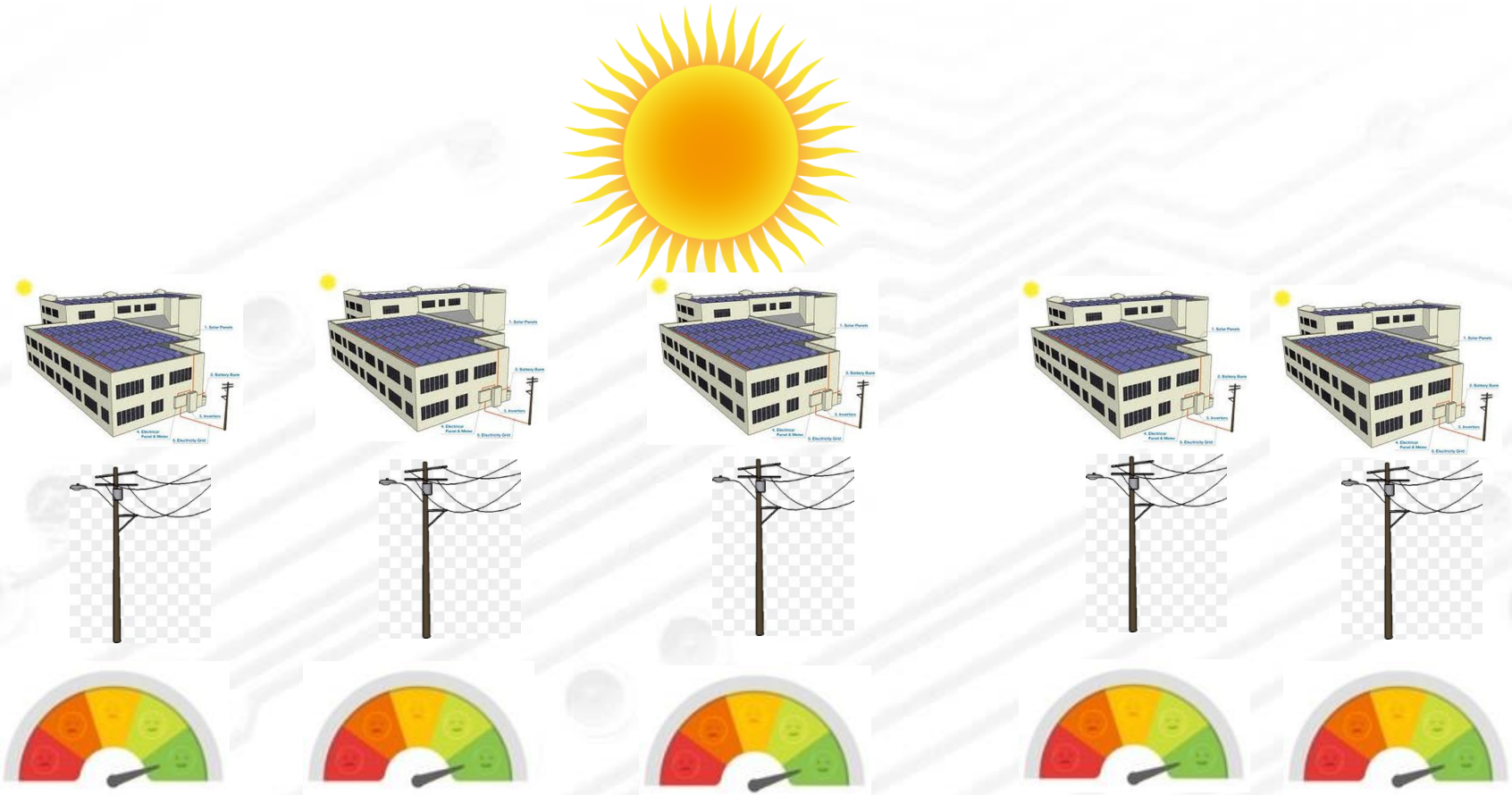
Source: www.lonmark.org

Example multi-participant model: DERs by building owners

- End user
  - Producer and consumer of energy
- Transmission
  - Deliver energy from one location to another
  - Value proposition for end user
- Distribution
  - Manage and maintain infrastructure
  - Value for “managed DER”/managed load
- Regulation
  - Incentive for greater energy efficiency
  - Program participation

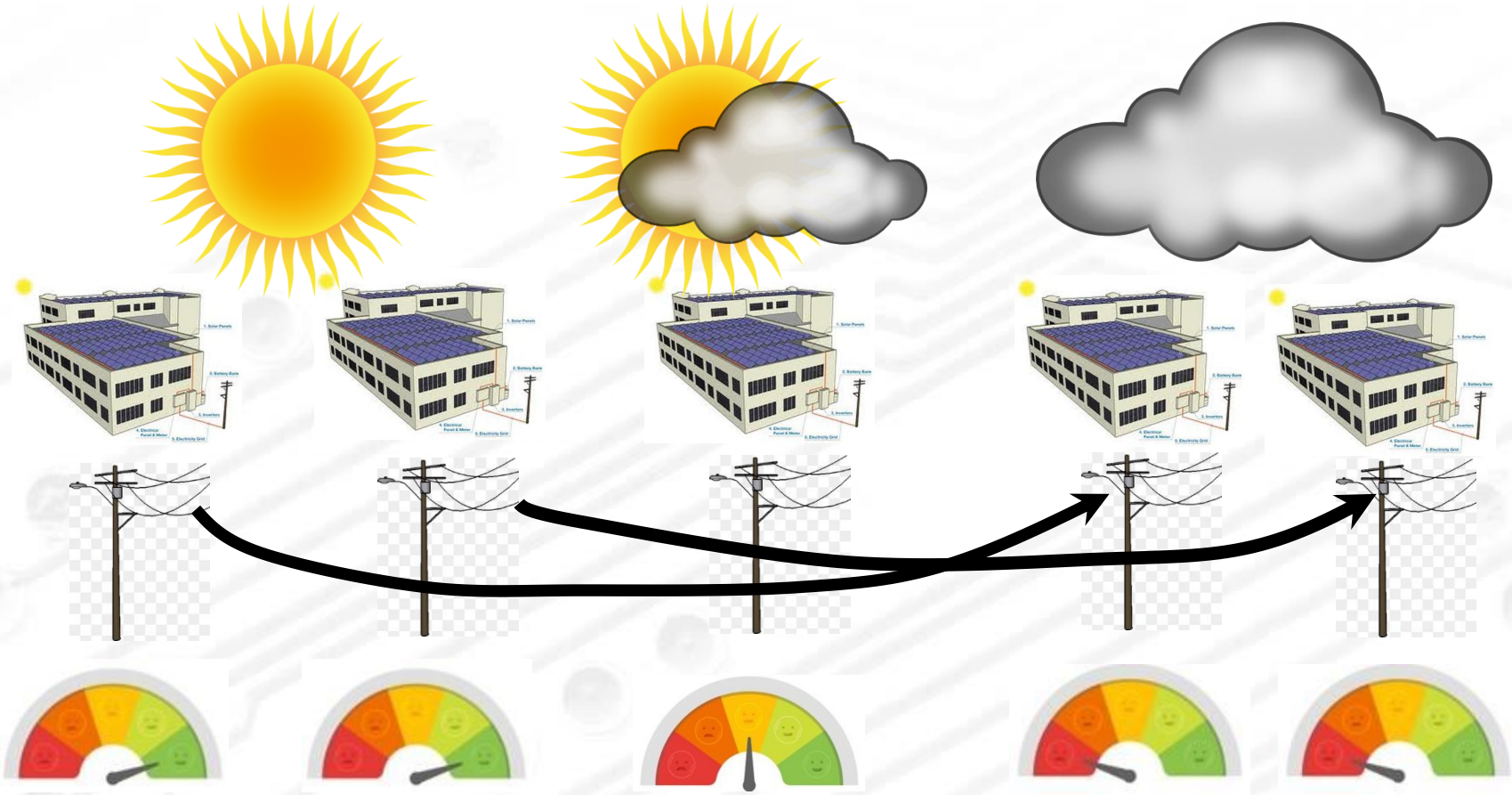
Building/City to Grid Interactions

- Production and consumption same facility
- Siloed systems – simple, self contained



TE for 3 or More Participants

- Transfer power from one site to another
- Complexity and value increase



Energy Information as a Service

- Building/City energy load as an information service
- Point-to-point versus point-to-multipoint model
- Opportunity for better load management
- Owner “sells” power to itself
  - Fee for use of transmission
  - Fee for use of distribution
  - Incentives for “good citizen” of grid
  - Encourage microgrid interactions
- Opportunity for multi-party TE model
- Higher level of detailed “information” required
- Higher degree of interoperability required

Thank you!

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