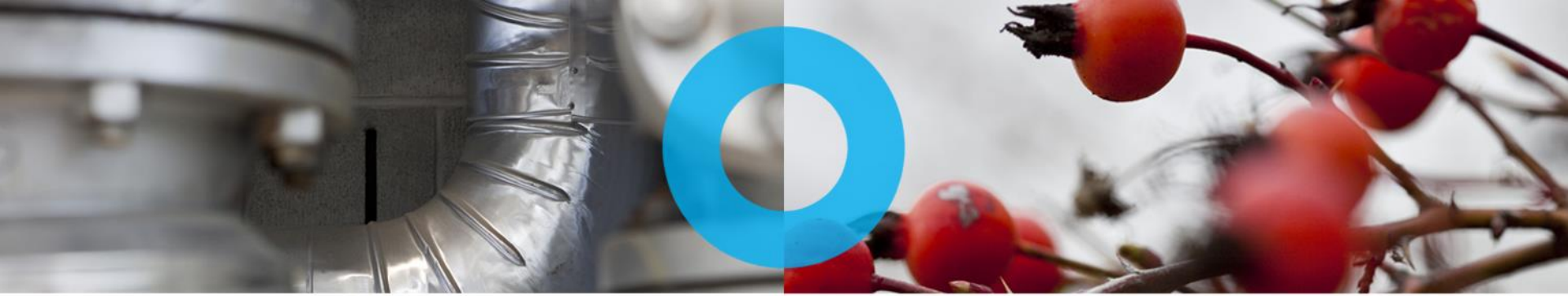
IDEA 2016

107th Annual Conference, St. Paul, MN

corix®



Getting Started
With District Energy

Overview

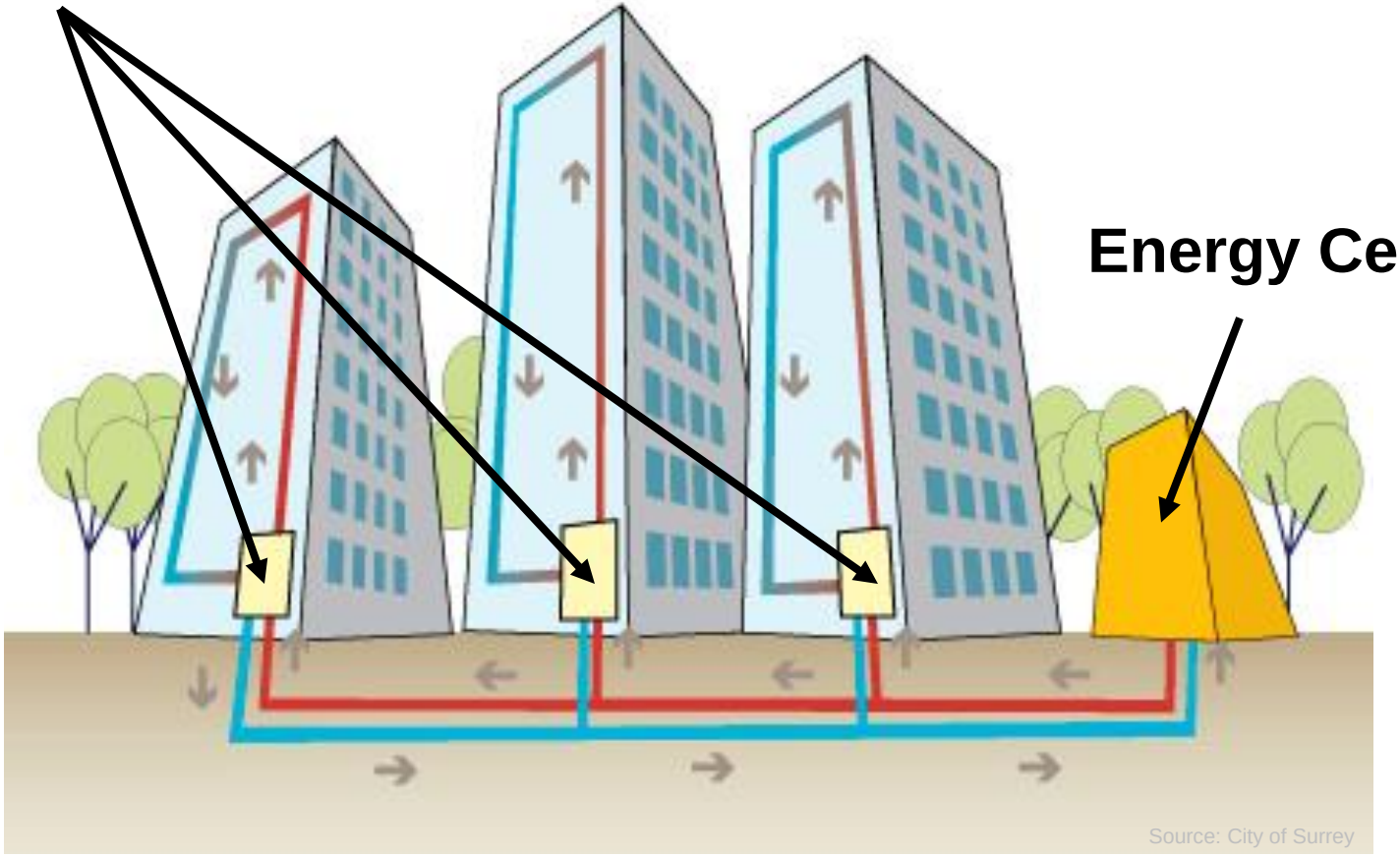
- Content applies to:
  - Expanding existing DE utility
  - Replacing existing DE utility
  - Creating a new DE utility

- Planning for DE in a growing community

- Strategies to defer capital investment
  - Temporary Energy Centers
  - Pre-packaged ETS

Terminology

Energy Transfer Stations (ETS)



District Piping System (DPS)

Planning Phase

- Propose area for DE
  - Define physical boundaries
  - Define targeted service area
- Development Timeline
  - Most critical document used to schedule and design
- List of key drivers
  - Environmental, financial, political, etc.
  - Used in business case and to maintain project focus

Development Timeline

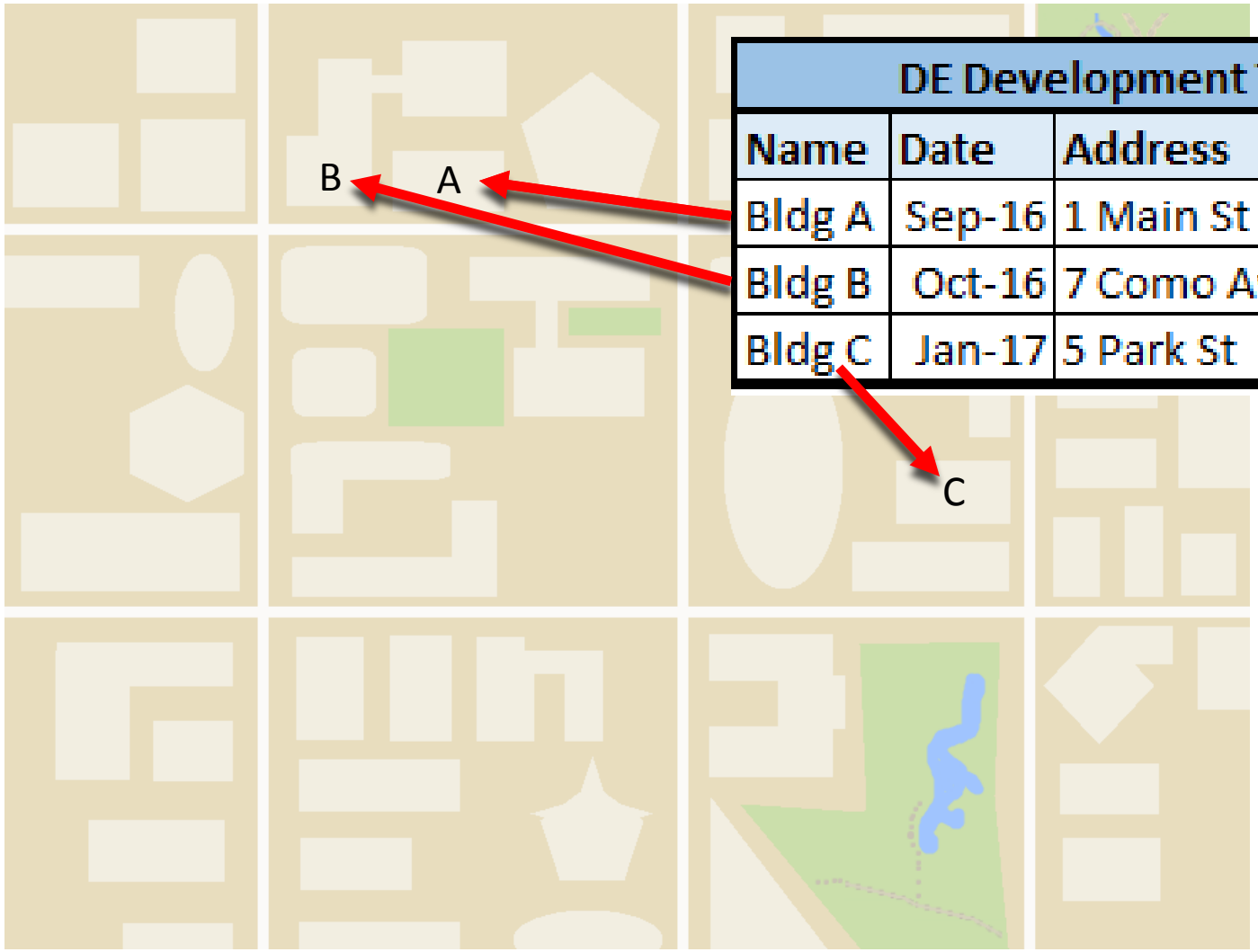
- List all buildings to connect
- Locations of buildings and energy sources
- Connection dates
- Building loads
  - Floor Area, # Units
- Fluid document
- Total demand at final buildout (winter vs summer)

DE Development Timeline			
Name	Date	Address	Heated Area
Bldg A	Sep-16	1 Main St	200,000 sqft
Bldg B	Oct-16	7 Como Ave	438,000 sqft
Bldg C	Jan-17	5 Park St	153,500 sqft

Changes to the Development Timeline

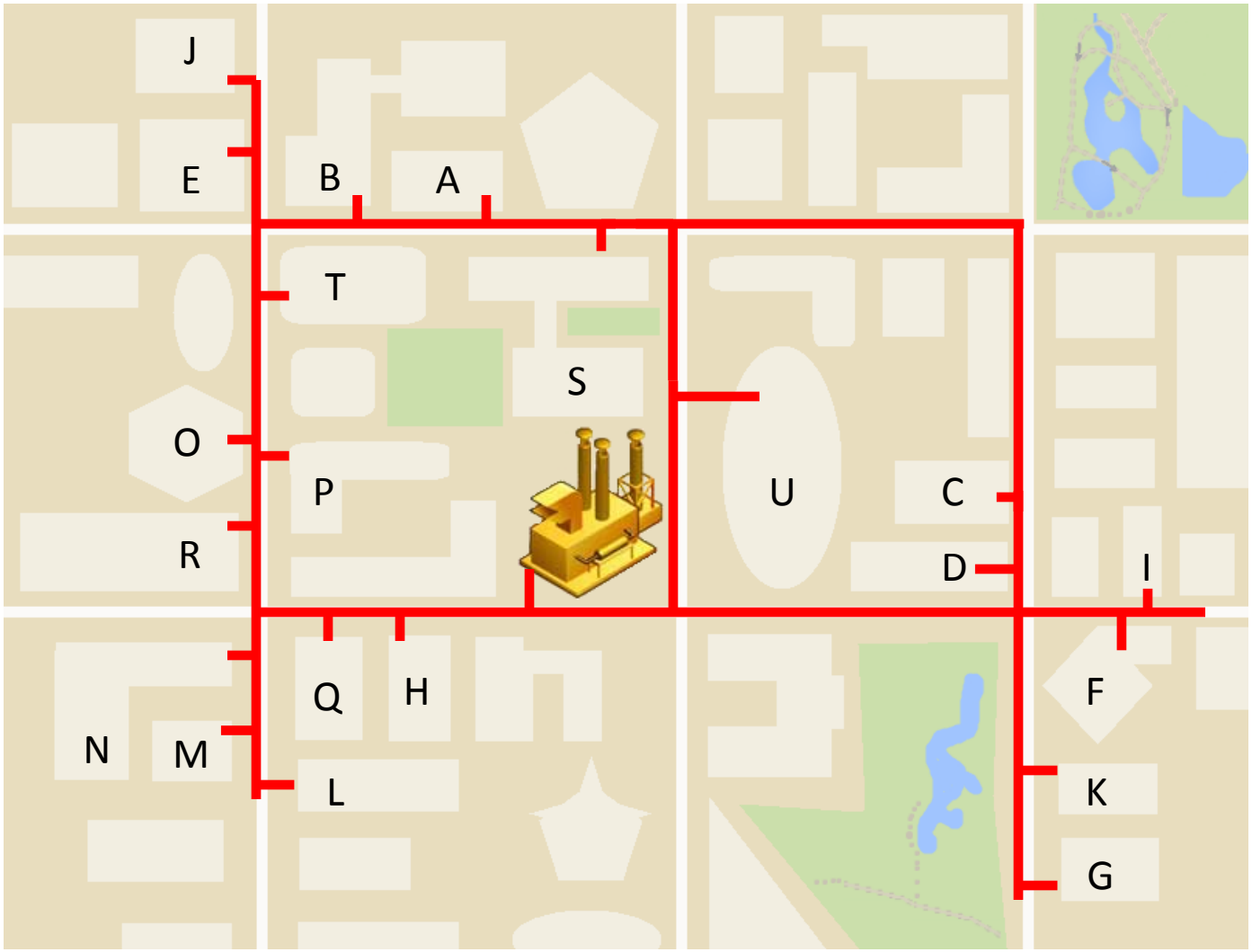
- Permits
- Developer's schedule
- Changes in housing market
- Funding availability for larger DE conversion projects (phased approach)

Development Timeline Map



DE Development Timeline			
Name	Date	Address	Heated Area
Bldg A	Sep-16	1 Main St	200,000 sqft
Bldg B	Oct-16	7 Como Ave	438,000 sqft
Bldg C	Jan-17	5 Park St	153,500 sqft

Development Timeline Map



- Identify all buildings to connect in order
- Locate permanent energy center
- Map optimal DPS routing at full build-out
- Identify looping opportunities for redundancy

Determine Ideal Routing

- Several iterations are required to find ideal routing
- Consider:
  - Congested utility corridors
  - Accessibility for O&M
  - Expensive hard/soft landscape to replace
  - Future development
  - Changes in roadways
  - Utility right of Ways
  - Proximity to energy source(s)
  - Valve plan
  - Minimize pipe length and size
  - Looping for redundancy in case of repair or expansion

Estimating Final Total District Load

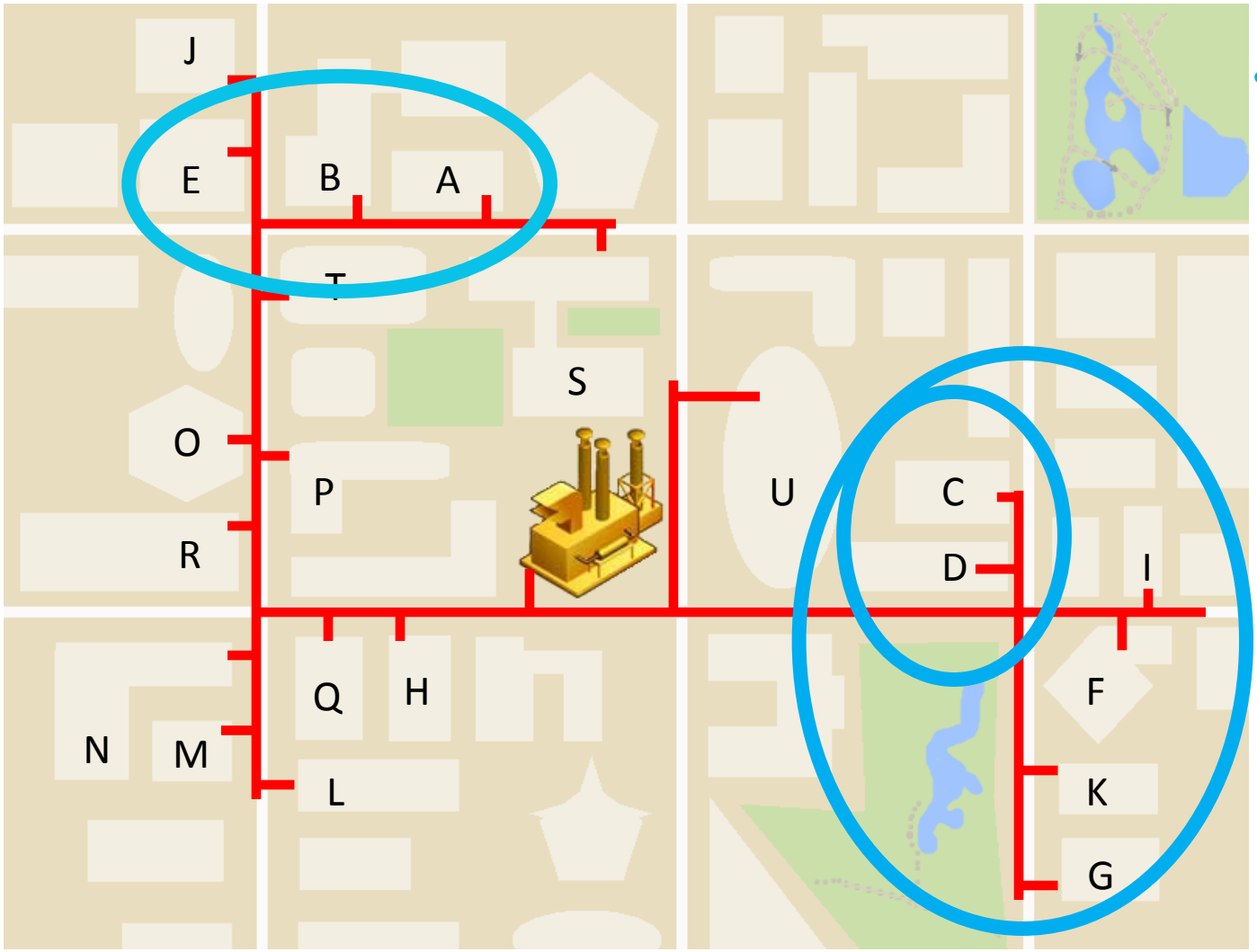
Too High

- Oversize DPS and Energy Centre
- Increase capital cost for larger pipe
- Increase O&M cost
  - Pumping larger volume, larger materials

Too Low

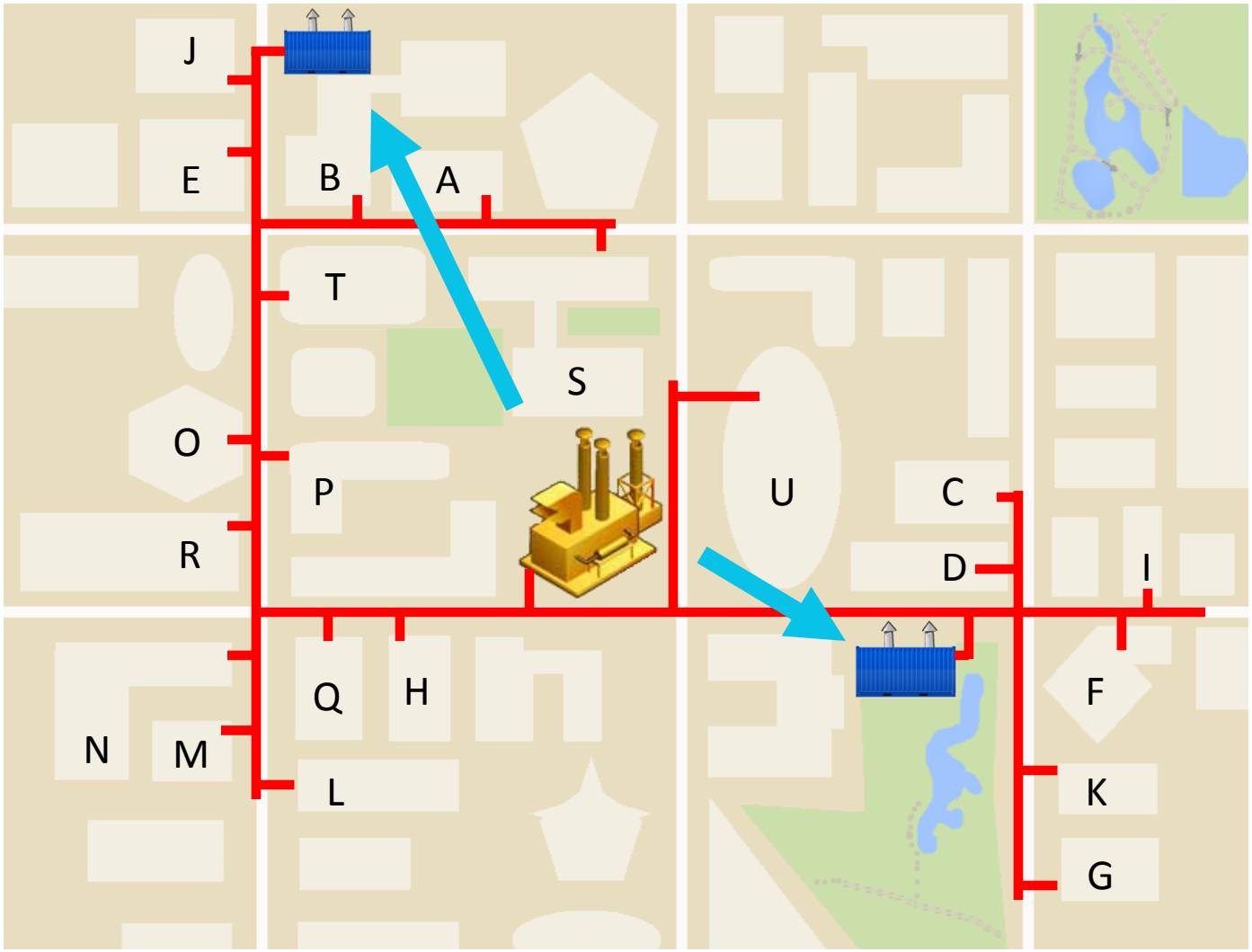
- Limits total connections
- Risk of under-sizing energy center
- Risk of reinstalling DPS or installing duplicate lines

Deferring Capital Investment



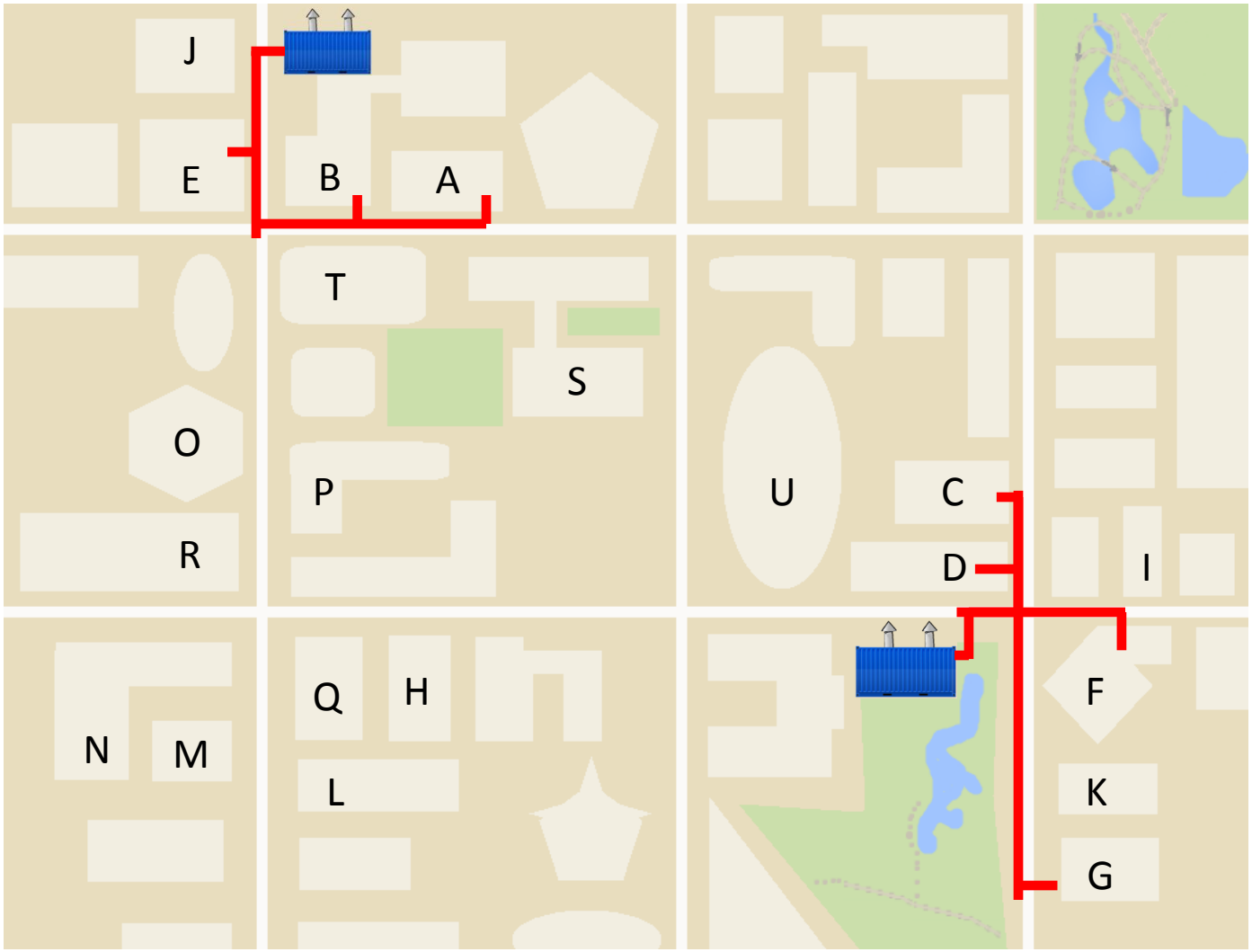
- Identify groups for early energization

Deferring Capital Investment



- Temporary Energy Centers (TECs) with micro-grids can defer large up front capital investment

Deferring Capital Investment

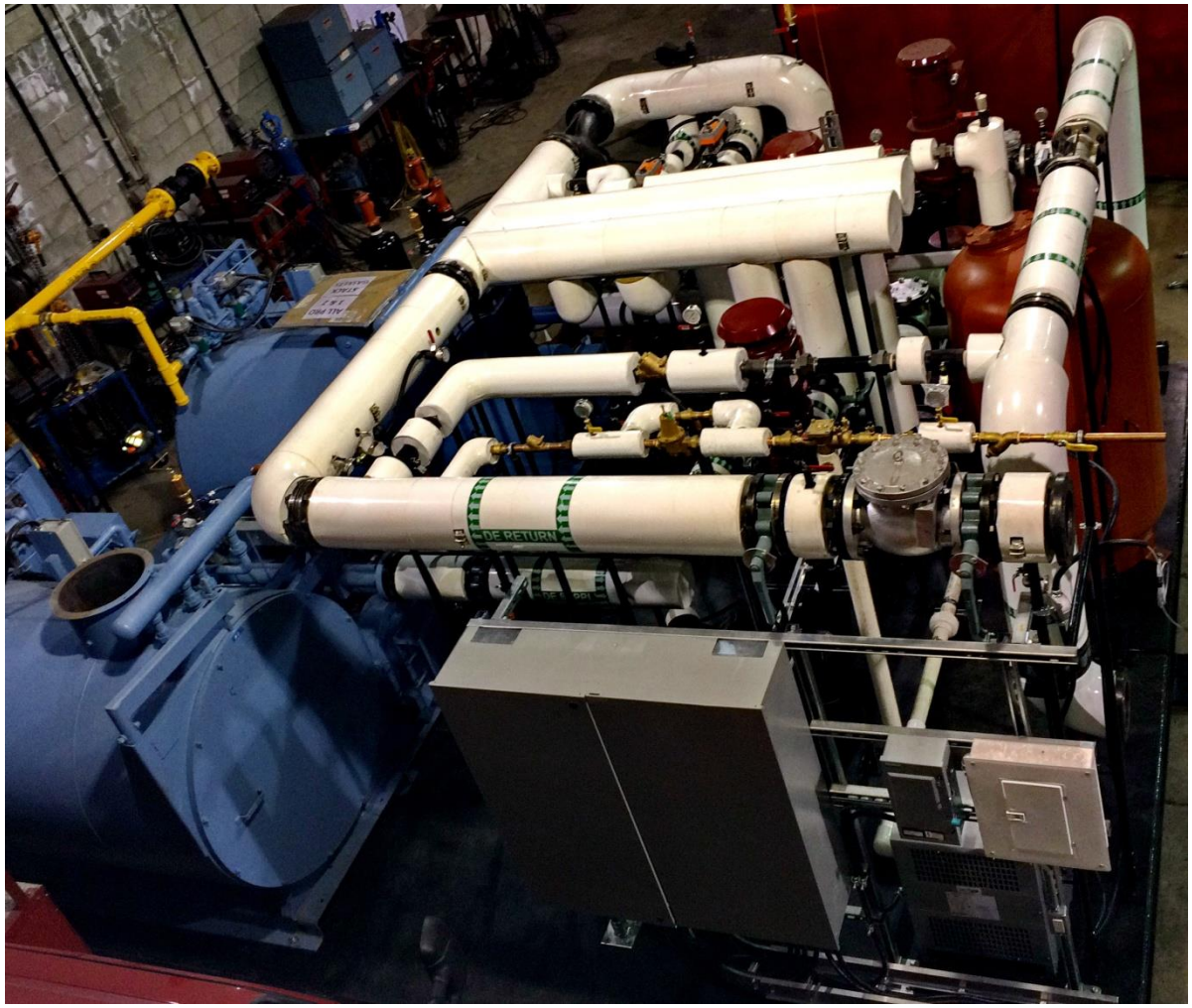


- Temporary Energy Centers (TECs) with micro-grids can defer large up front capital investment
- Reduce the DPS required to get started
- Quick start
- Defer construction of main plant

Temporary Energy Centers

- Pre-designed
- Pre-packaged, assembled off site
- Mobile: Containerized or Skid-mounted
- Inputs: Natural Gas, Propane, Diesel, Steam
- Outputs: Hot Water or Steam

Skid-mounted TECs / Custom Enclosures

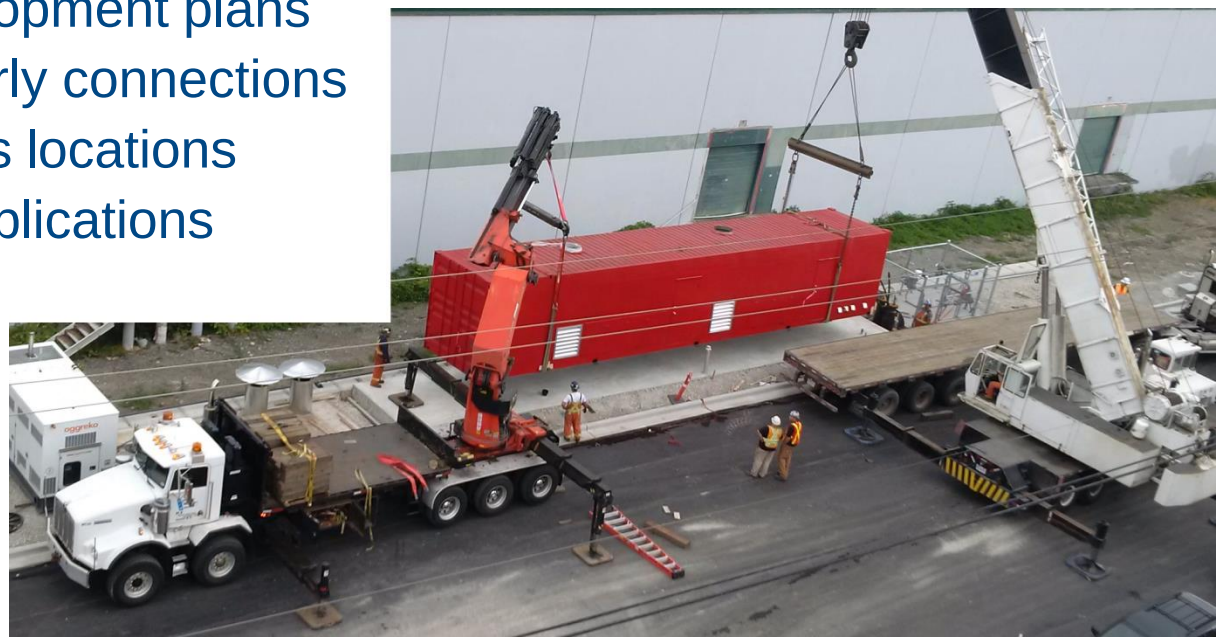


Containerized TECs

- Over 8.2 MW in a 54’ container
- Over 6 MW in a 40’ container
- Design-built in 8 months

Temporary Energy Centers

- TECs are ideal for:
  - Deferring capital investment on permanent energy center
  - Deferring capital investment on underground piping
  - Quick implementation / lean construction
  - Starting construction before completing full build-out plan
  - Variable development plans
  - Spread out early connections
  - Hard to access locations
  - Green field applications



TECs in Challenging Locations

- Forests and parks
- Tight spaces
- Temporary locations
- Barren lands

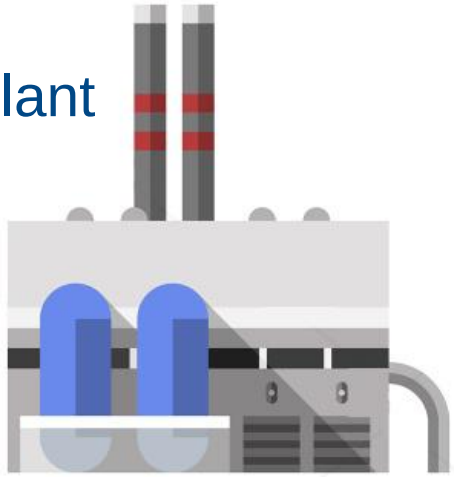
TECs in Challenging Locations

TECs in Challenging Locations

TECs in Challenging Locations

Permanent Plant vs. TEC

Without TECs



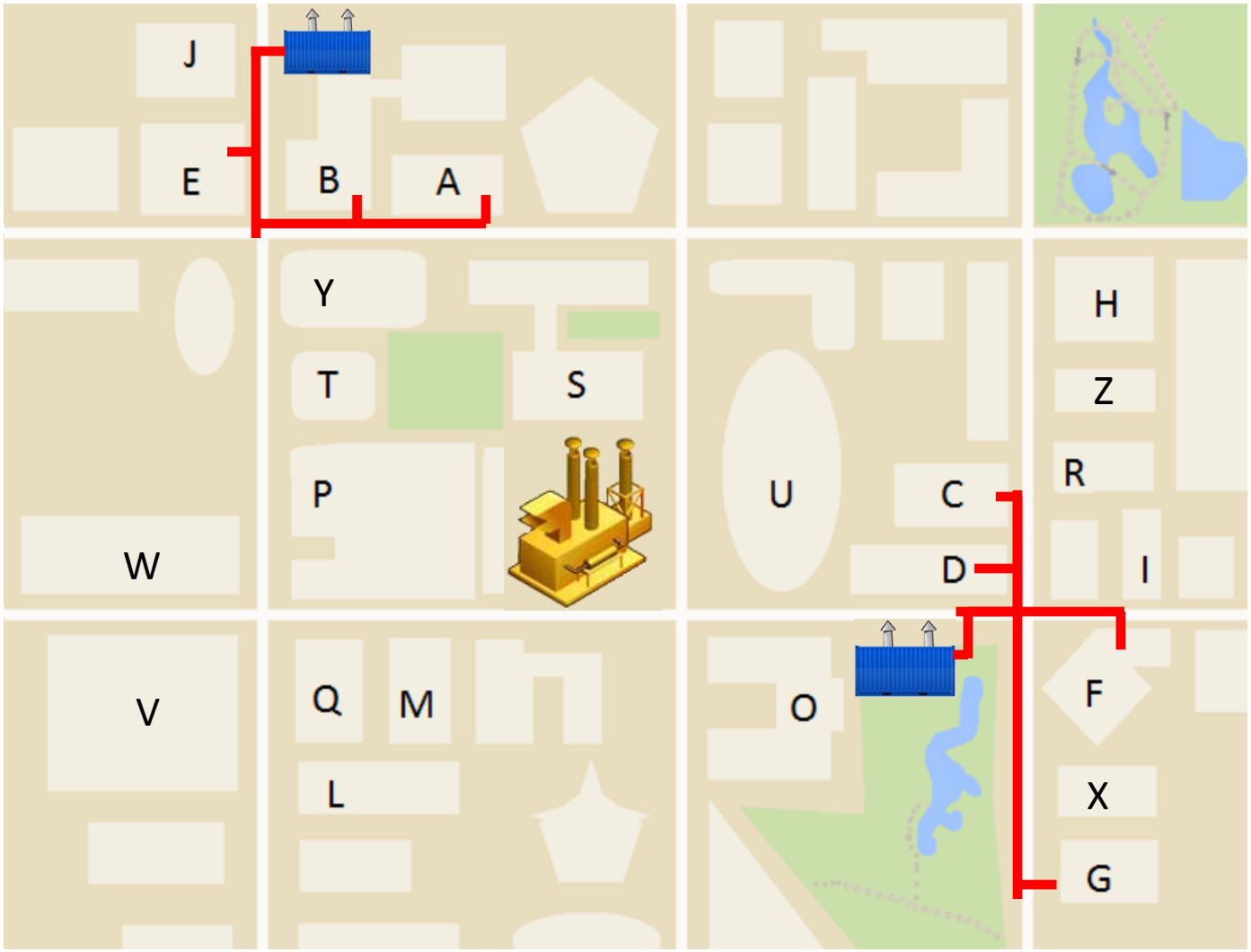
- Earlier detailed design costs for permanent plant
- Earlier construction start for permanent plant
- Higher startup project costs
- Delay on return on investment
- Risk front-end loaded
- Cannot energize any buildings until plant complete
- Miss some early connection opportunities
- Aged equipment and expired warranty before full build-out
- Commissioning challenges
- Large boilers cannot turn-down enough for small load

Permanent Plant vs. TEC

With TECs

- Minimize DPS at start
- Energy 6-8 months from approval
- Fixed cost: reduced risk of changes
- Construction off-site (tandem with permitting, etc.)
- Remain flexible with design of plant and DPS
- Smaller footprint
- Unmanned and controlled remotely
- Allows for project phasing
- Repurpose boilers into permanent plant
- Smoother commissioning of permanent plant

Changes to Development Timeline



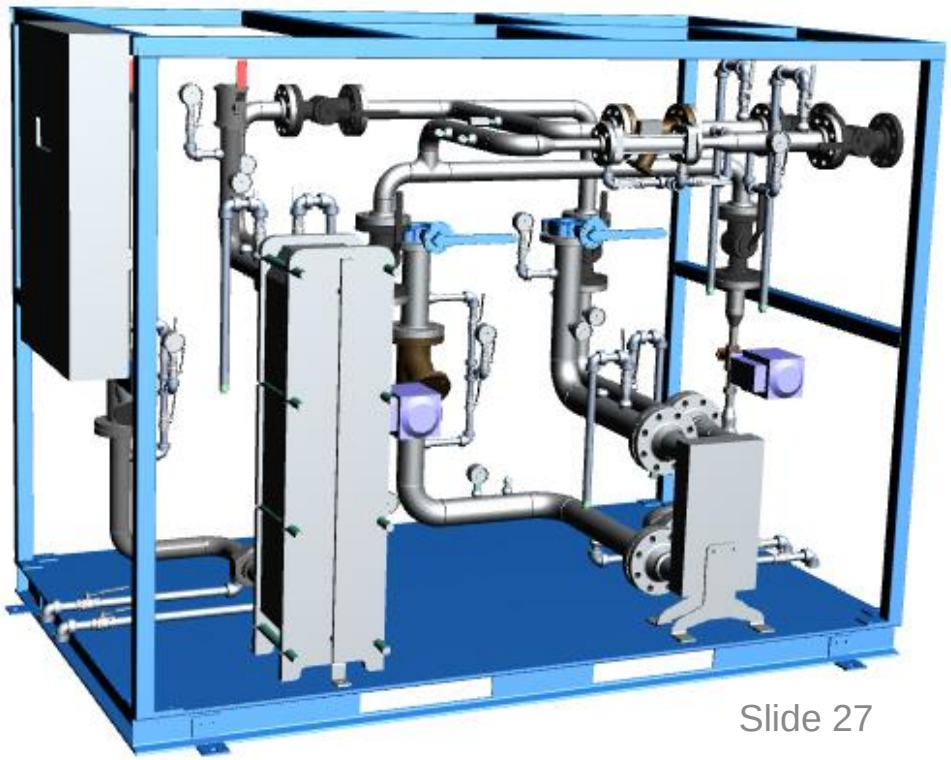
- Reduce initial commitments
- Plan for changes
  - Buildings relocate
  - Re-sequence
  - Different size/loads
  - Delay / cancel
  - Buildings added
  - Change energy center location

Gain Trust

- Community Members
  - Proven Technology
  - Utility gains presence in community
- Funding Authorities
  - Proven business case in phases
  - Proven schedules
  - Proven technology

Energy Transfer Stations (ETS)

- Pre-engineered / pre-packaged
- Known stats (size, weight, performance)
- Single warranty
- Customizable



Energy Transfer Stations

- Reduce construction management costs
- Reduces engineering costs
- Defer capital investment
- Reduce time on site
- Load-bearing frame

Summary

- Plan for the future. Build for the present.

- Make a Development Timeline Map for the long-term plan
- Prove project success with smaller phases (micro-grids)
- Plan for change

- Pre-packaged TECs and ETSs
  - Defer early large investments
  - Allow for variable development plans
  - Reduce engineering costs
  - Reduce construction on site
  - Smoother commissioning
  - Streamlined operations

Questions