

Microgrids in Your Community: Opportunities and the Role of Municipalities

Assessing Microgrid Feasibility: Getting to Yes (or No)

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Laxmi Rao, International District Energy Association



ABOUT IDEA

Non-profit industry association formed in 1909

2000 + members – 26 nations

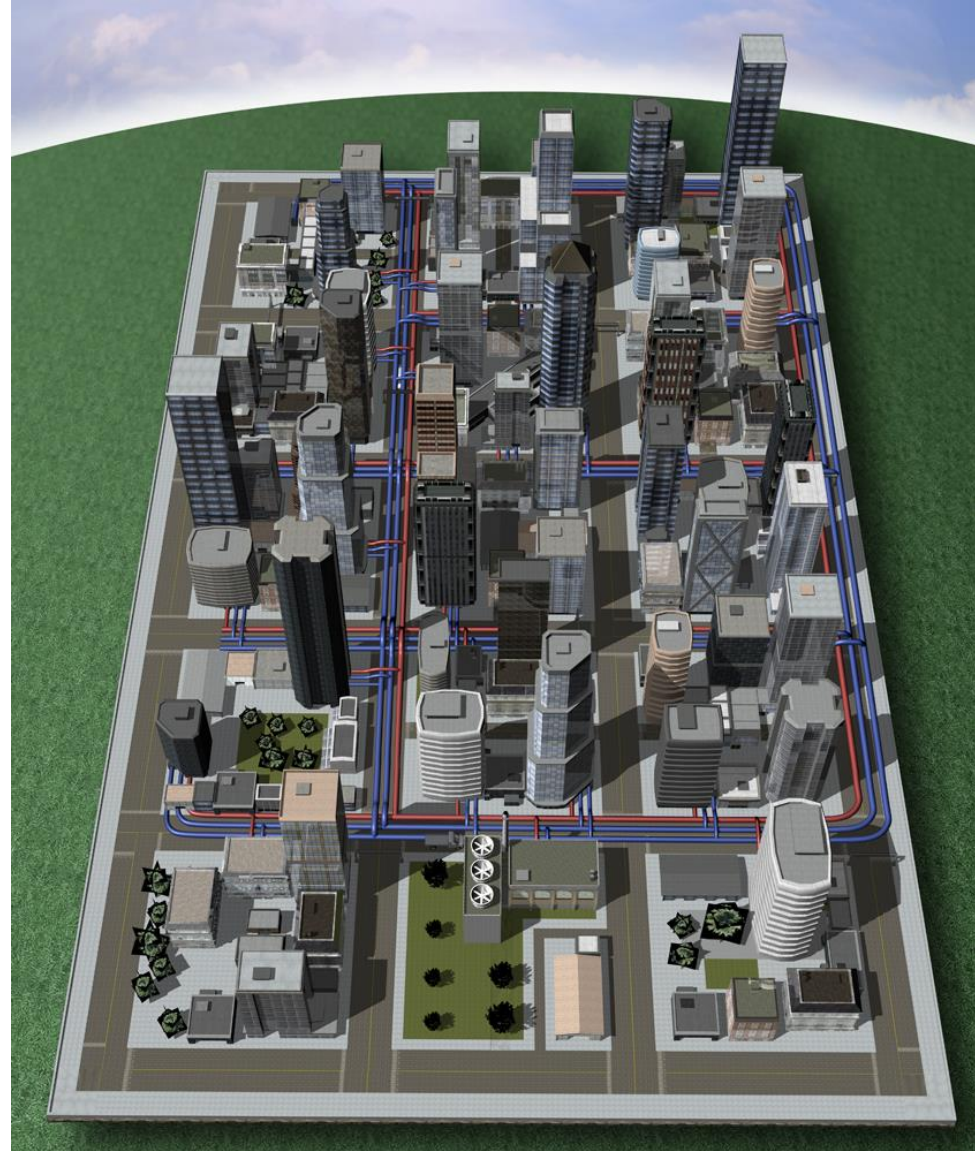
Major urban utilities, public and private universities & colleges, healthcare, pharma, airports, industry

Education, Outreach & Industry support

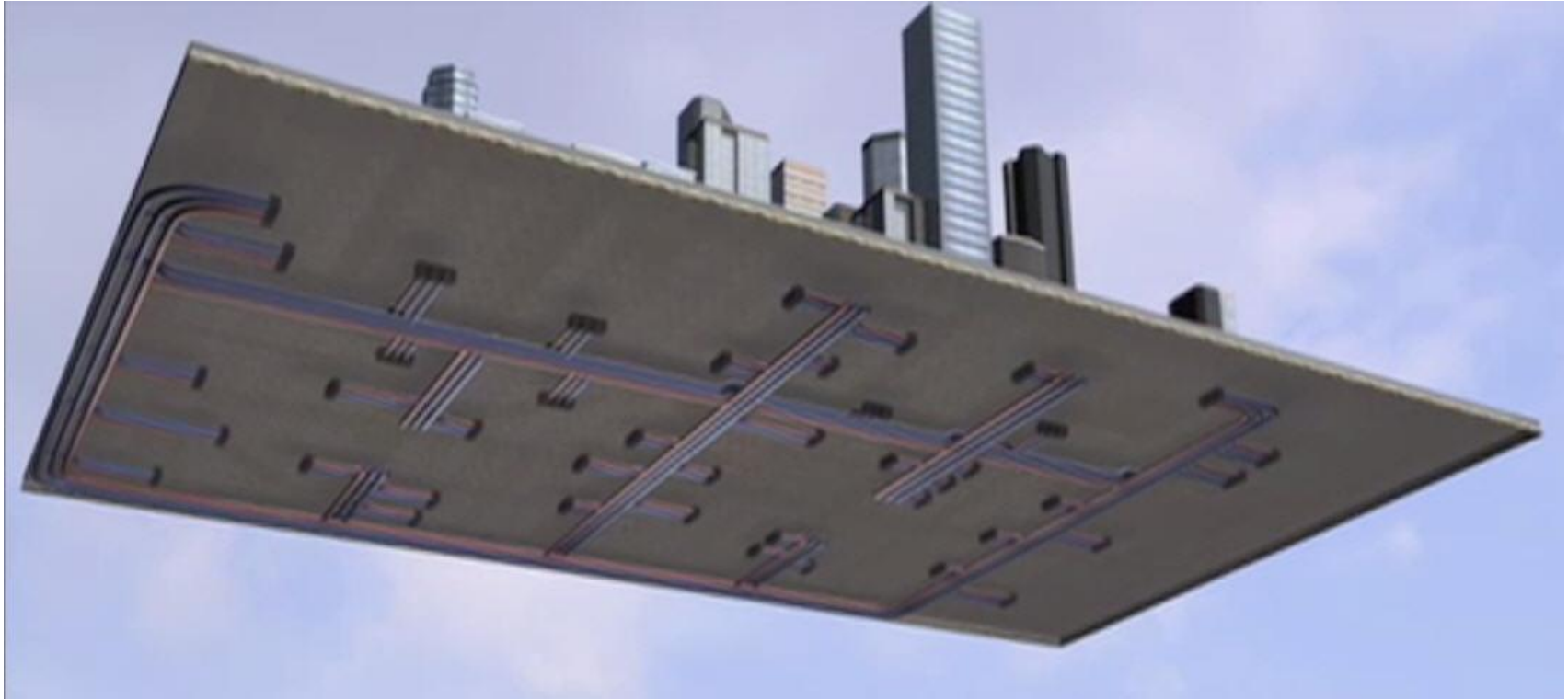


District Energy – Community Scale Heating and Cooling

- Underground pipe network enable “**combining**” heating and cooling requirements of multiple buildings
- Creates a “**market**” for valuable **thermal energy**
- Aggregated thermal loads creates **scale** to apply fuels, technologies not feasible on single-building basis
- **Fuel flexibility** improves energy security, local economy



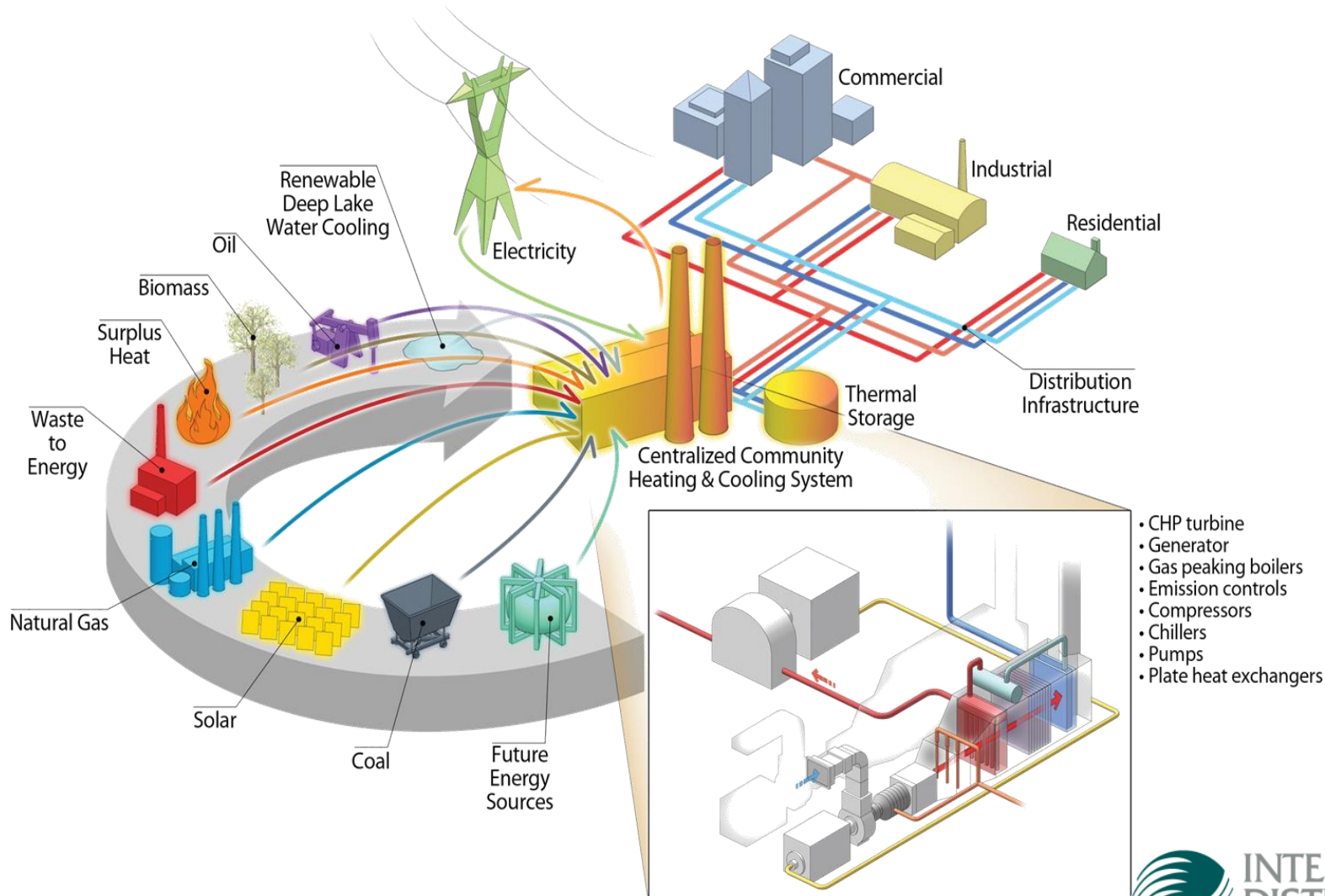
Infrastructure for Local Clean Energy Economy



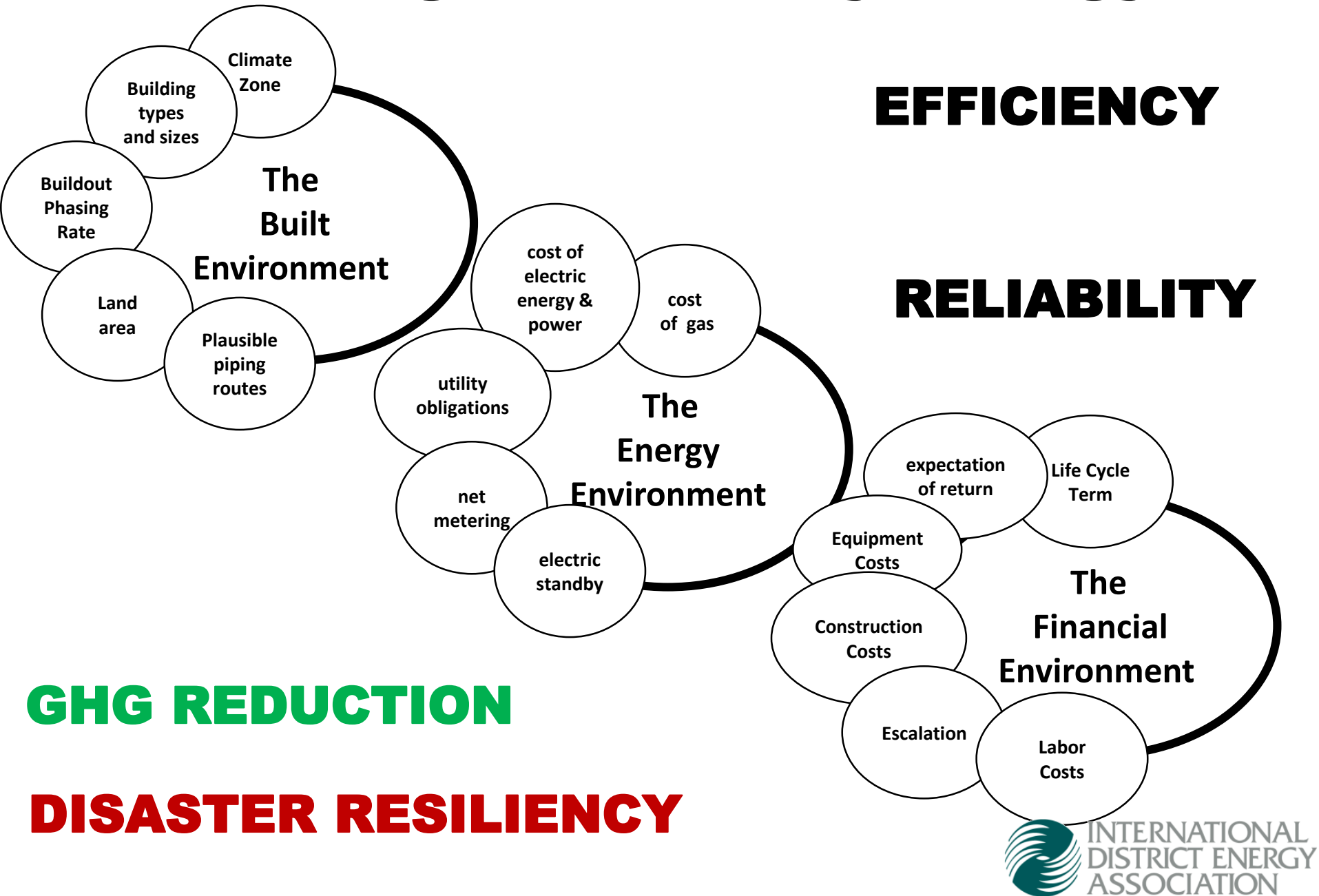
- Connects thermal energy sources with users
- **Enables CHP and Resiliency**
- Urban infrastructure – hidden community asset
- Energy dollars re-circulate in local economy,
- Improves livability

Districts, Municipalities, Towns, Cities

Future-Proofing an **Energy Efficient** Infrastructure



Planning Community Energy



Questions

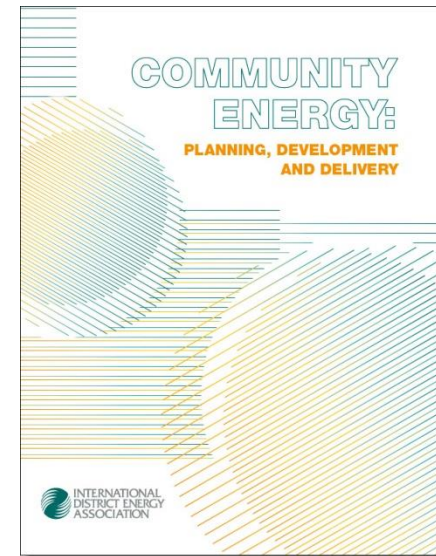
- Urban Planners
- Developers
- Architect/Engineers
- Facility Managers
- DE enterprises
- Financiers

- What Type?
- How Big?
- How Soon?
- How Much?
- Environmental Impact
- Economic Return
- Resiliency

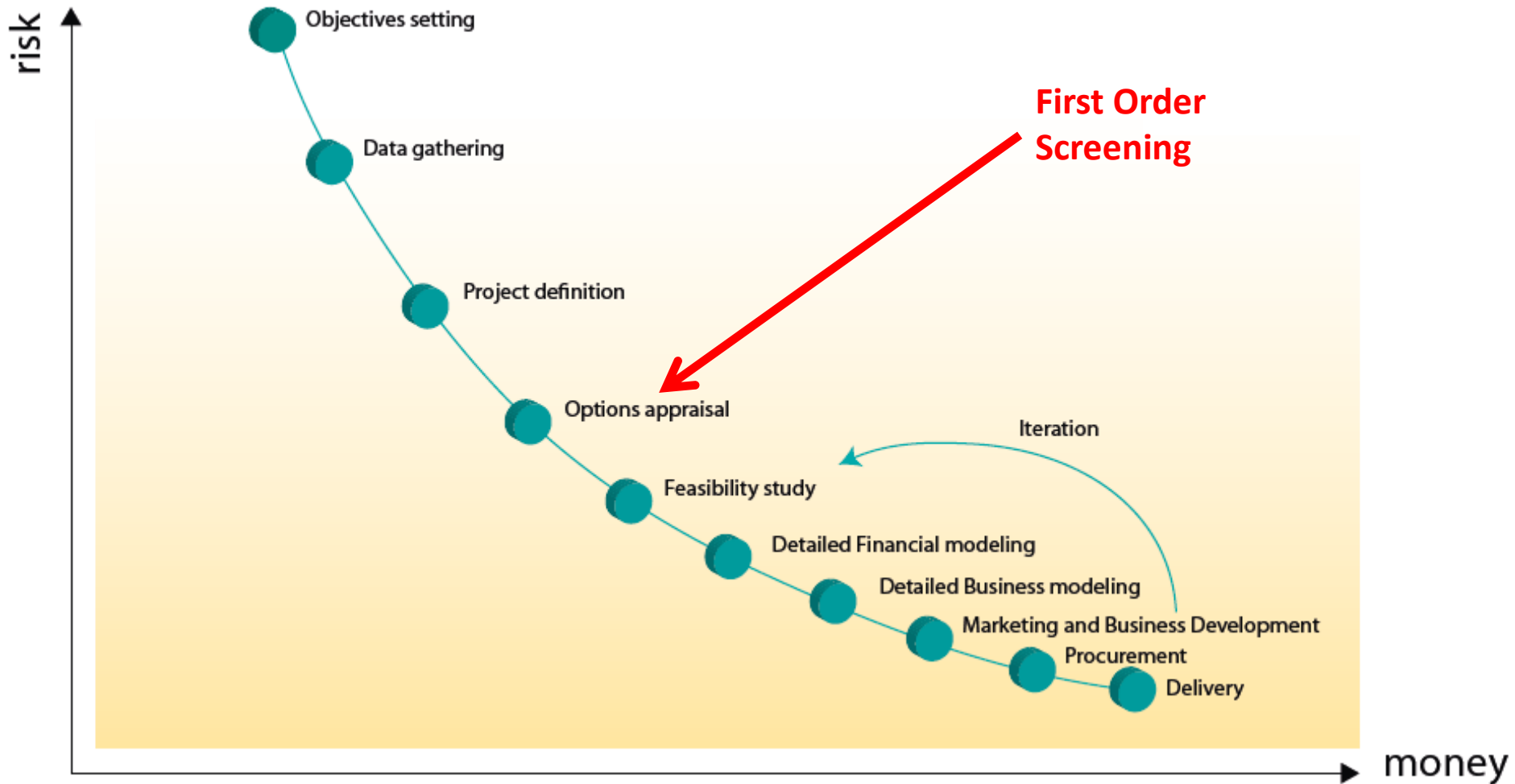


Planning Guide for Community Energy

- **Project champions:** Mayors, community energy, economic development and sustainability staff, elected officials, planners
- Consider energy in comprehensive planning, brownfield/revitalization projects, Climate Action Plans
- Variety of project developers: opportunities for **collaboration and public/private partnerships**
 - Local governments
 - Communities
 - Other public sector developers
 - Institutions
 - Corporations and industrial parks
 - Private property developers
 - Landowners and building operators



Project Flight Path & Risk Reduction



COMMUNITY ENERGY: PLANNING, DEVELOPMENT AND DELIVERY

Stages of Development

1: Objectives Setting

2: Data gathering

3: Project definition

4: Options appraisal



5: Feasibility study

6: Financial modeling

7: Business modeling

8: Marketing and business development;

9: Project procurement

10: Delivery

Objectives Setting

Economic

- **Strengthen local economy, retain energy dollars, stable high-quality jobs**
- **Develop infrastructure to exploit locally sustainable energy supplies**
- **Keep energy rates down**

Energy security

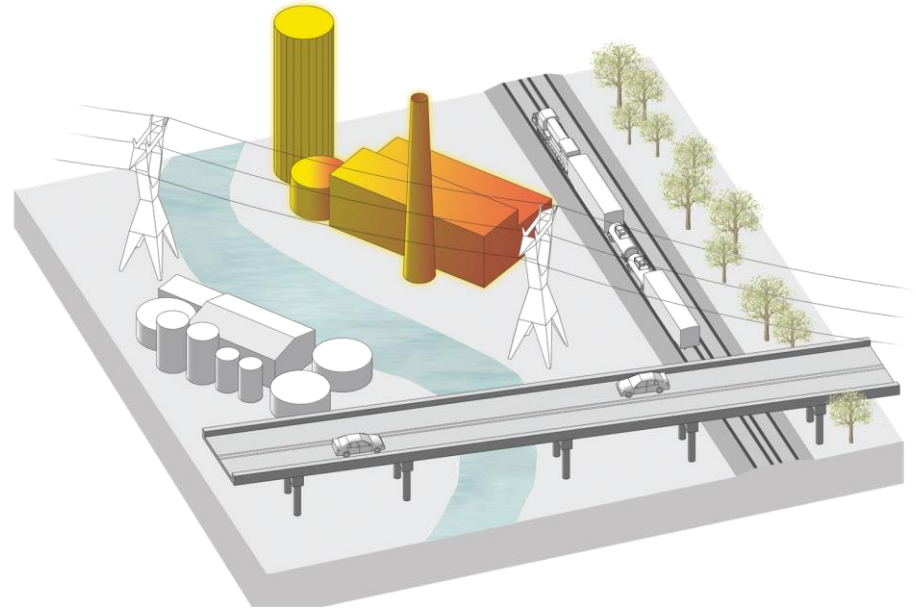
- **Reduce reliance on imported energy and lessen impact of volatile market**
- **Enable fuel flexibility**
- **Enhance reliability and resilience**

Emission reductions

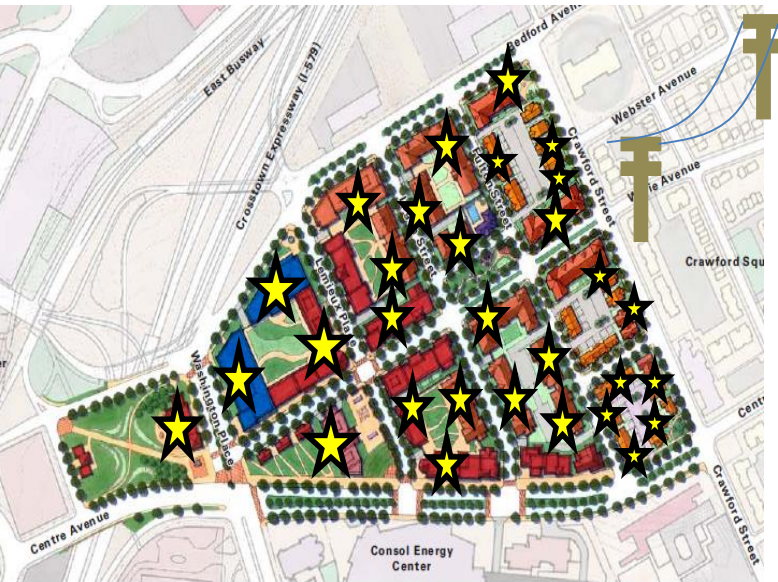
- **Energy Efficiency**
- **Lower carbon solutions**

Data Gathering

- Development building mix
- Build-out and phasing
- Anchor loads
- Heating/cooling loads
- Physical barriers
- **Other existing infrastructure:** gas and heat networks and electricity sub-stations; waste-to-energy plants, industrial processes that dump heat; transport infrastructure for bulky fuels such as biomass
- **Financial Factors :** escalation rate, hurdle rate, energy prices.....



Project Definition



DEVELOPMENT PLAN: PITTSBURGH, PENNSYLVANIA | 2 FEBRUARY 2011



DEVELOPMENT PLAN: PITTSBURGH, PENNSYLVANIA | 2 FEBRUARY 2011

Occupancy Type	<i>input values here</i>	
	SF	# Bldg
Large Office	1,000,000	3
Medium Office	1,500,000	10
Small Office	300,000	20
Warehouse	-	-
Stand Alone Retail	500,000	4
Strip Mall	-	-
Primary School	-	-
Secondary School	-	-
Supermarket	-	-
Quick Service Restaurant	30,000	4
Full Service Restaurant	30,000	4
Hospital	1,200,000	1
Outpatient Health Clinic	-	-
Small Hotel	250,000	2
Large Hotel	500,000	1
Midrise Apt	1,000,000	10
Total	6,310,000	59

IDEA First Order District Energy/CHP Screening Tool

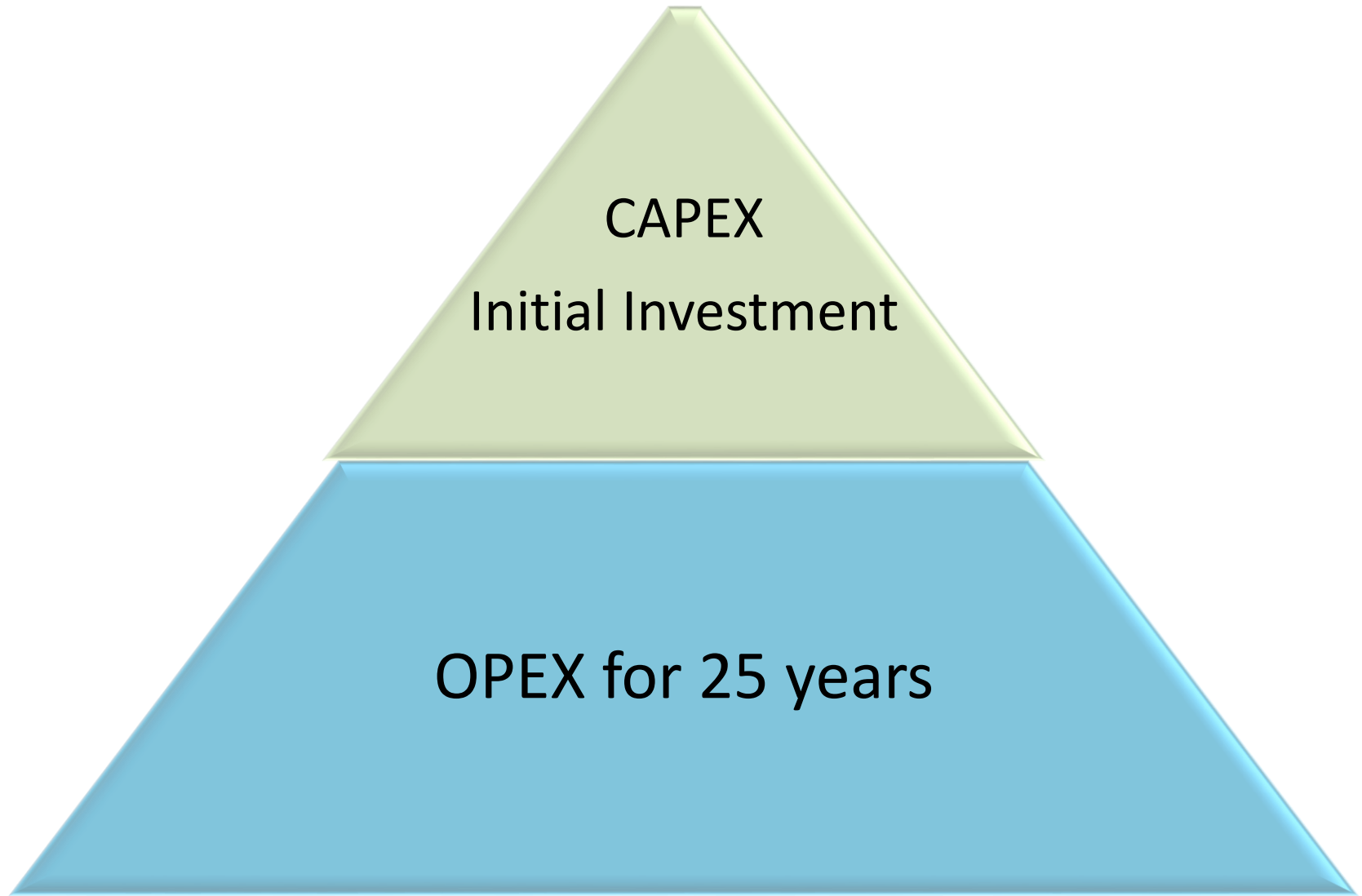
High level understanding of opportunity

- **Data** – Regional Load Profiles, Energy Prices, Labor Rates, Financial Rates, Pipe Cost,
- **Project Definition** - District Composition , Phasing
- **Options appraisal** – Comparing with Baseline
- **Feasibility** - Net Present Value



What should we do next?

Life Cycle Cost = CAPEX + OPEX



Screening Tool Alternatives

- Stand Alone Building Plant – BAU
- Build a District Energy System
- Build a District Energy System with Combined Heat and Power
- Connect to Existing District Steam System

Screening Tool Options



BAU – Stand alone
building system

vs



District Energy system
with CHP

Capital Expense

- Unit Cost estimates by system type
 - Boilers
 - Chillers
 - Electrical CHP equipment
 - Distribution Piping
 - Building SF Costs (n Roof, mechanical room)
- Debt Service

Operating Expense

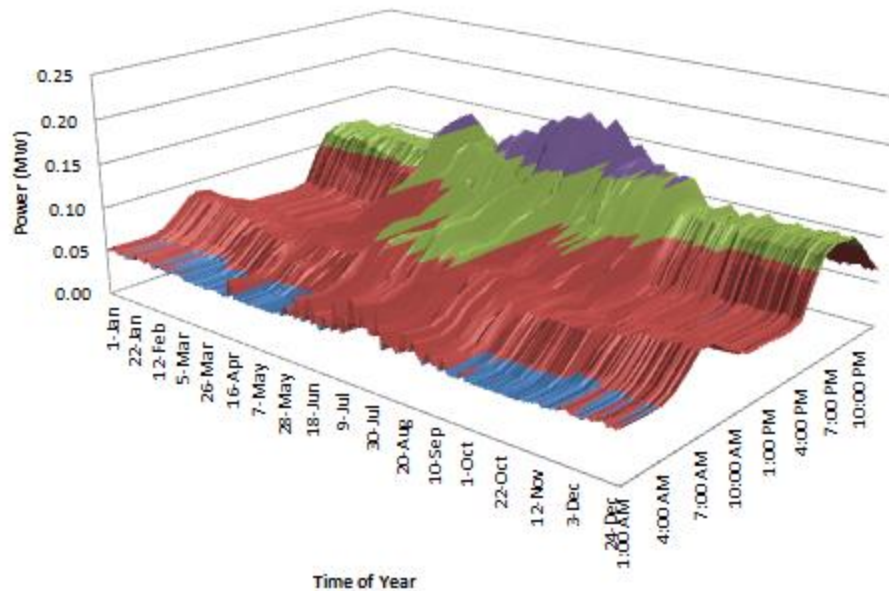
- Energy Costs
- Labor Costs
- Maintenance Costs (LTSA)
- Consumables

Building Energy Demand Sources

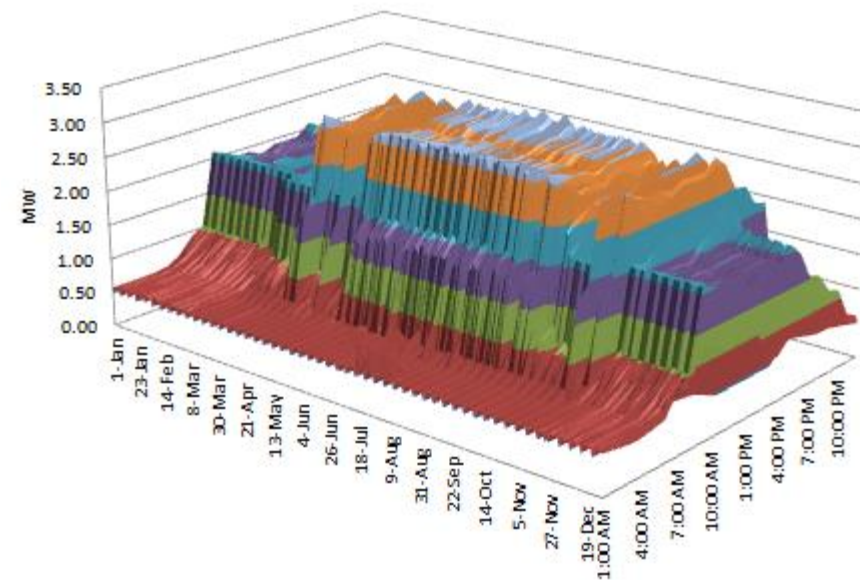
- DOE 8760 hours **reference building** data
OR
- Existing hourly meter data
 - Electric power, natural gas, cooling

Load Profiles – Residential, Office

annual (24 x 365) residential electric load

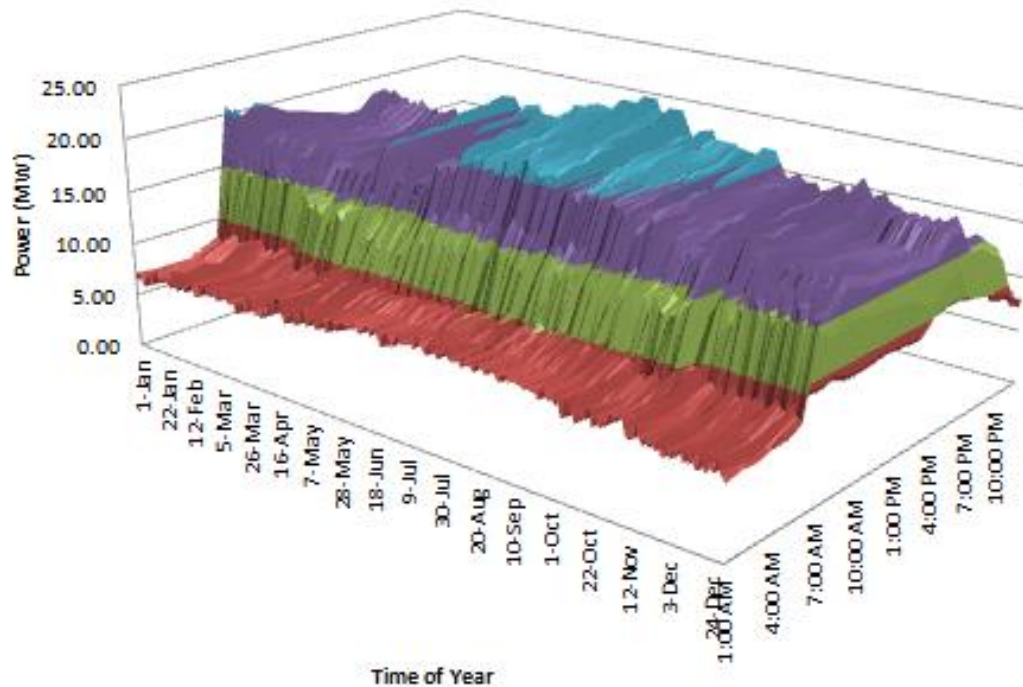


annual (24x365) large office electric demand



District Energy Composite Demand Profile

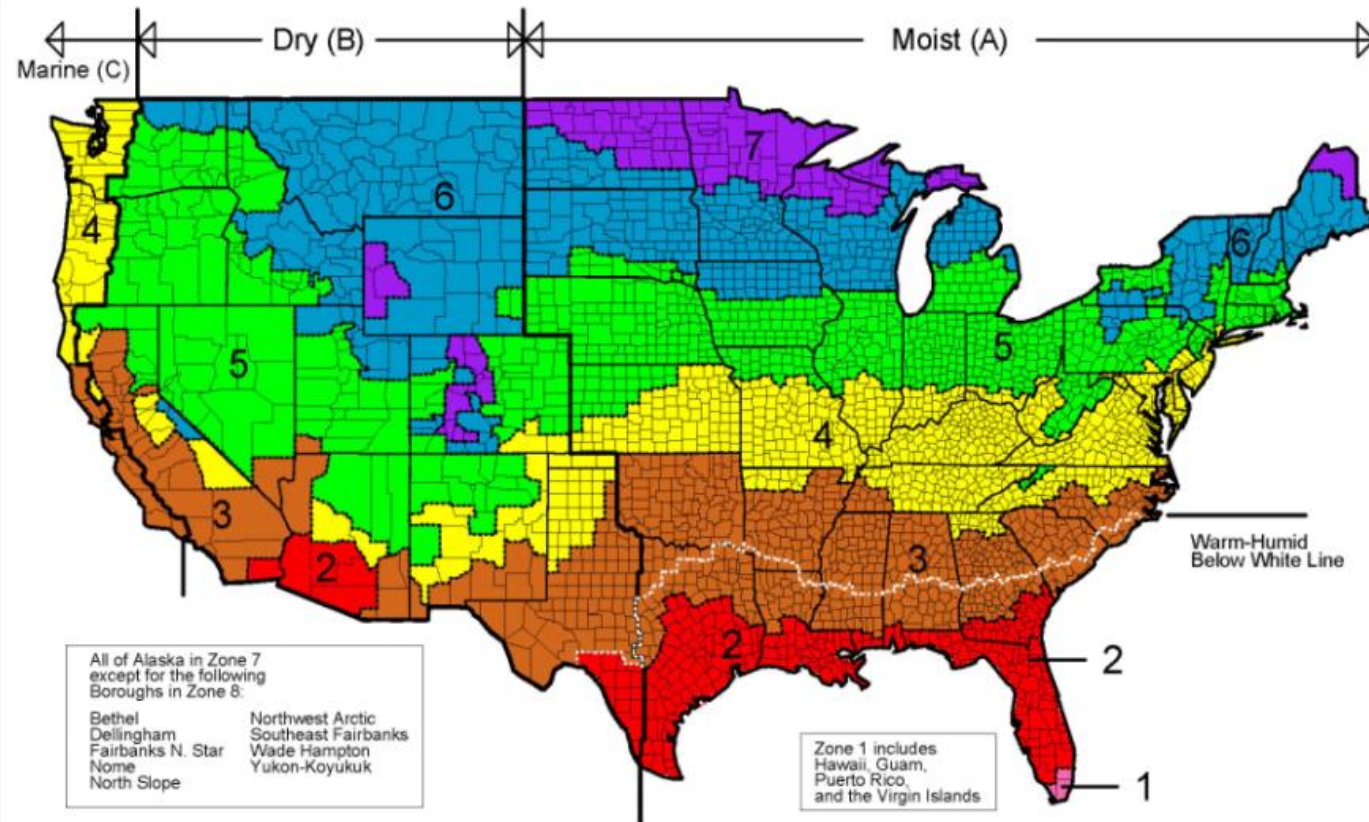
annual (24 x 365) district electric load



Energy Load Profiles

Location Dependent

Climate Zone	Representative City
1A	Miami, Florida
2A	Houston, Texas
2B	Phoenix, Arizona
3A	Atlanta, Georgia
3B-Coast	Los Angeles, California
3B	Las Vegas, Nevada
3C	San Francisco, California
4A	Baltimore, Maryland
4B	Albuquerque, New Mexico
4C	Seattle, Washington
5A	Chicago, Illinois
5B	Boulder, Colorado
6A	Minneapolis, Minnesota
6B	Helena, Montana
7	Duluth, Minnesota
8	Fairbanks, Alaska



Economic Considerations

- Discount Rate/ Hurdle Rate
- Escalation Rates
 - Electricity
 - Natural Gas
 - General Inflation
- Loan Terms

Phasing & Site Master Plan

PRELIMINARY DEVELOPMENT PROGRAM		
USE	QUANTITY	DEVELOPMENT AREA
Residential	1,191 units	1,536,250 SF
Commercial	208,750 SF	208,750 SF
Office	606,000 SF	606,000 SF
Hotel	150 rooms	150,000 SF
Structured Parking	2,215 spaces	750,750 SF
Open Space	5.8 acres	n/a
GRAND TOTAL		3,251,750 SF

Illustrative Plan Key

- MEDIUM DENSITY RESIDENTIAL
- HIGH DENSITY RESIDENTIAL
- RETAIL AND MIXED-USE*
- ANCHOR OFFICE BUILDINGS
- HOTEL
- COMMUNITY CENTER
- STRUCTURED PARKING
- SURFACE PARKING

* MIXED-USE MAY CONTAIN COMMERCIAL, OFFICE, AND/OR RESIDENTIAL USES.

(BOTTOM) Urban Design Plan



IDEA District Energy Screening Tool Processing Summary

- **Excel Spreadsheet**
- **Inputs**
- **Derive Composite Energy Load Profiles**
- **Calculate annual operating costs of alternatives**
- **Develop cash flow projections, compute NPV of alternatives – COST ONLY**

District Energy Screening Tool

- **Provides a way to:**
 - Explore Concepts with Team
 - Organize Data
 - Evaluate Sensitivity
 - Educate Team
- **Quantifies high level estimates to get to:**

