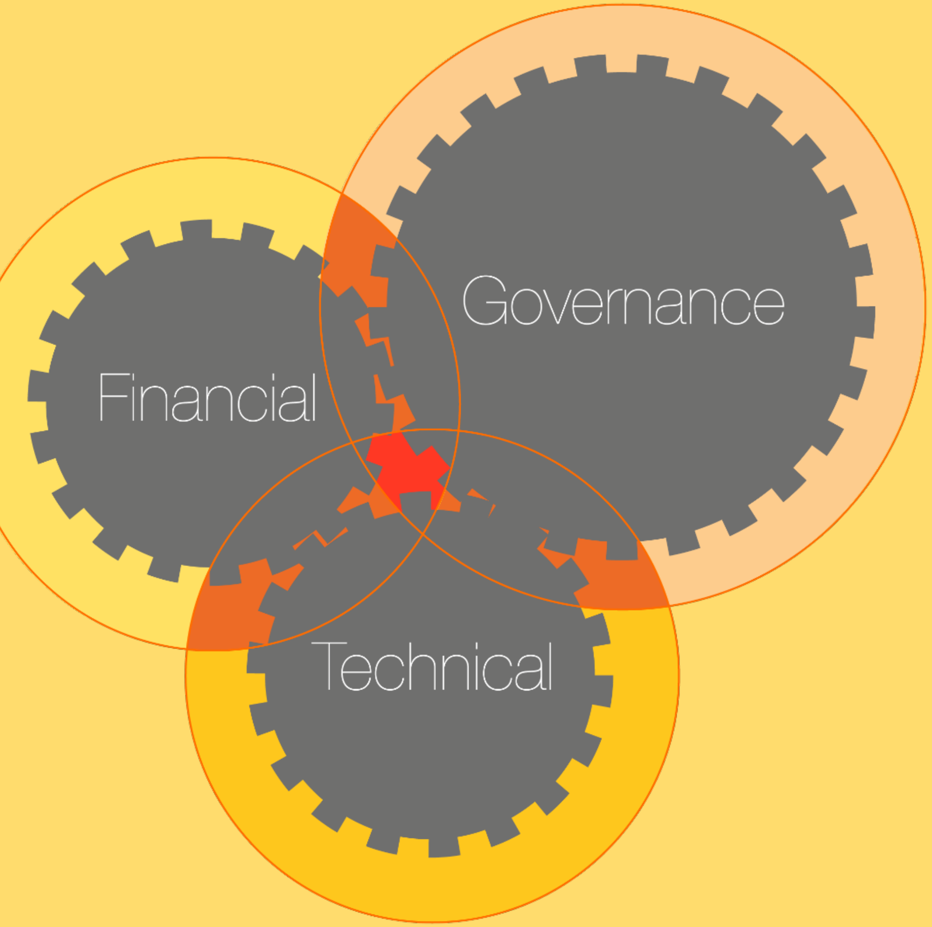
Journeys Through Business Models - Overview



Laxmi Rao, IDEA

Critical Steps for Choosing Business Models

Objectives

Identify & Prioritize

Risk

Affects developers, investors/ lenders

Mitigation > Identify, understand and allocate to the right party

Money

Appropriate funding for stage of DE system lifecycle

Understanding Risk

Objectives Risk – Impacts Control

- Managed by the degree of control exercised through a governance structure

Design Risk – Impacts Capital Cost and System Performance

- Inappropriate selection of technologies, equipment size
- Incorrect design parameters - operating temperatures and pressures

Construction Risk – Impacts Schedule & Budget

- Delays in construction schedules due to unanticipated project phasing changes
- Delays in equipment procurement
- Encountering unforeseen subterranean obstructions

Demand Risk – Impacts Revenue Projections

- For **new** developments
  - proposed buildings not built due to a downturn in the property market
  - customers do not sign connection agreements.
- For **established** systems
  - customers fail to pay for or consume the projected amounts of energy.

Understanding Risk

Operational Risk – Impacts Performance & Uptime

- Lack of or poor commissioning.
- Insufficient system maintenance

Commercial Risk – Impacts Customers & Investors

- Challenge of balancing customer payments with the cost of service and return on investment

Capacity Risk – Impacts Project Delivery & System Performance

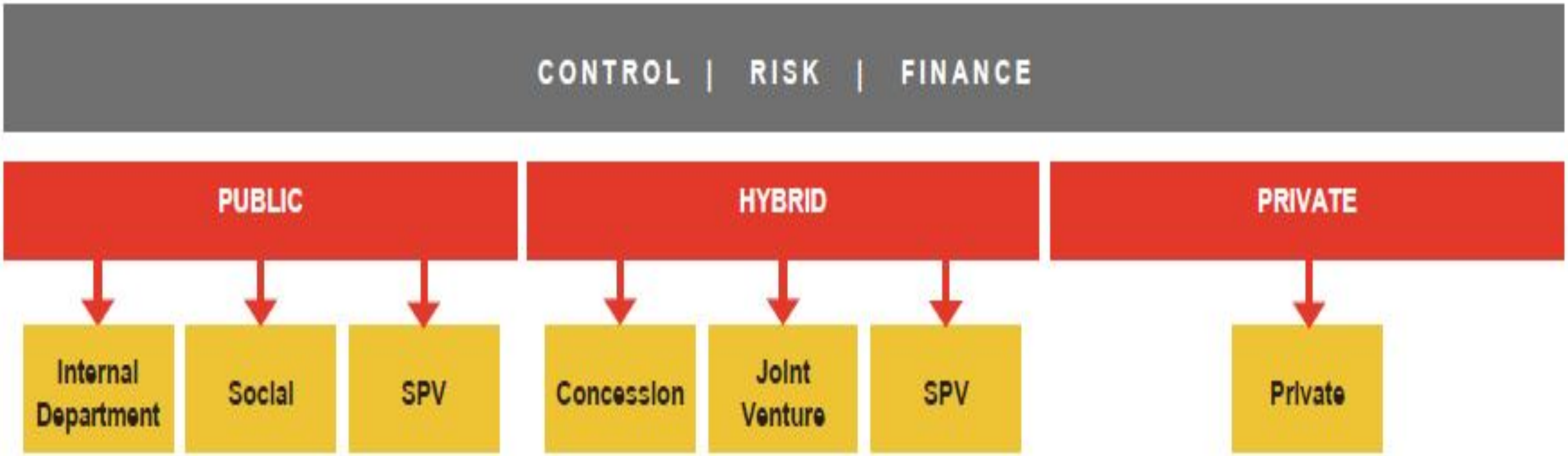
- Inadequate specific skills and competencies in-house

Financial Risk – Impacts Investors

- Ability to deliver return on investment relative to the sources of capital available

Business Models - Spectrum

FIGURE 4.2: OVERVIEW OF BUSINESS MODEL SPECTRUM



Public - Private Partner Roles with Risk Allocation

	OPTION	DESCRIPTION	RISK ALLOCATION	MUNICIPAL/COUNCIL
Public	1	Entirely public sector led, funded, developed, operated and owned	Public sector retains all risk	Public sector procures contracts for equipment purchase only. Procurement could be direct, or via a publicly owned arm's-length entity
	2	Public sector led: entirely publicly funded, greater use of private sector contractors	Private sector assumes design & construction risk, and possibly operational risk	Public sector procures turnkey asset delivery contract(s), possibly with maintenance and/or operation options
	3	Public sector led, private sector invests/takes risk in some elements of the project	Private sector takes risks for discrete elements (e.g., generation assets)	As 2, with increased private sector operational risk, and payment or investment at risk
	4	Joint venture: public sector & private sector partners take equity stakes in a special purpose vehicle	Risks shared through joint participation in JV vehicle / regulated by shareholders' agreement	Joint venture: both parties investing and taking risk
	5	Public funding to incentivize private sector activity	Public sector support only to economically unviable elements	Public sector makes capital contribution and/or offers heat/power off-take contracts
	6	Private sector ownership with public sector providing a guarantee for parts of project	Public sector underpins key project risks	Public sector guarantees demand or takes credit risk
	7	Private sector ownership with public sector facilitating by granting land interests	Private sector takes all risk beyond early development stages	Public sector makes site available and grants lease/license/wayleaves
Private	8	Total private sector owned project	Private sector carries all risks	No or minimal public sector role (e.g., planning policy / stakeholder engagement

Business Models: Public

Internal Department

- DE system project is developed within a department of a governmental body
- Governmental body acts as the local authority with full system ownership
- Project is funded from the public balance sheet of the local authority

Social

- Municipality establishes DE system as a community-owned not-for-profit cooperative
- Common in Europe(Denmark)-heat customers become cooperative members & own system
- Vote for representatives who select board members who control the company

Special Purpose Vehicle (SPV)

- Wholly owned subsidiary independent from the local authority
- Created with the purpose of owning, operating and maintaining a DE system
- One or more public sector entities may own shares in the SPV
- Established as a company limited by guarantee based on shares owned by the participating organizations

Business Models: Hybrid

Concession

- Public sector initiates & develops project, development and continues to own assets
- Contracts with private operator as concessionaire for a specified term, with renewal option
- Public partner typically guarantee long term heat loads

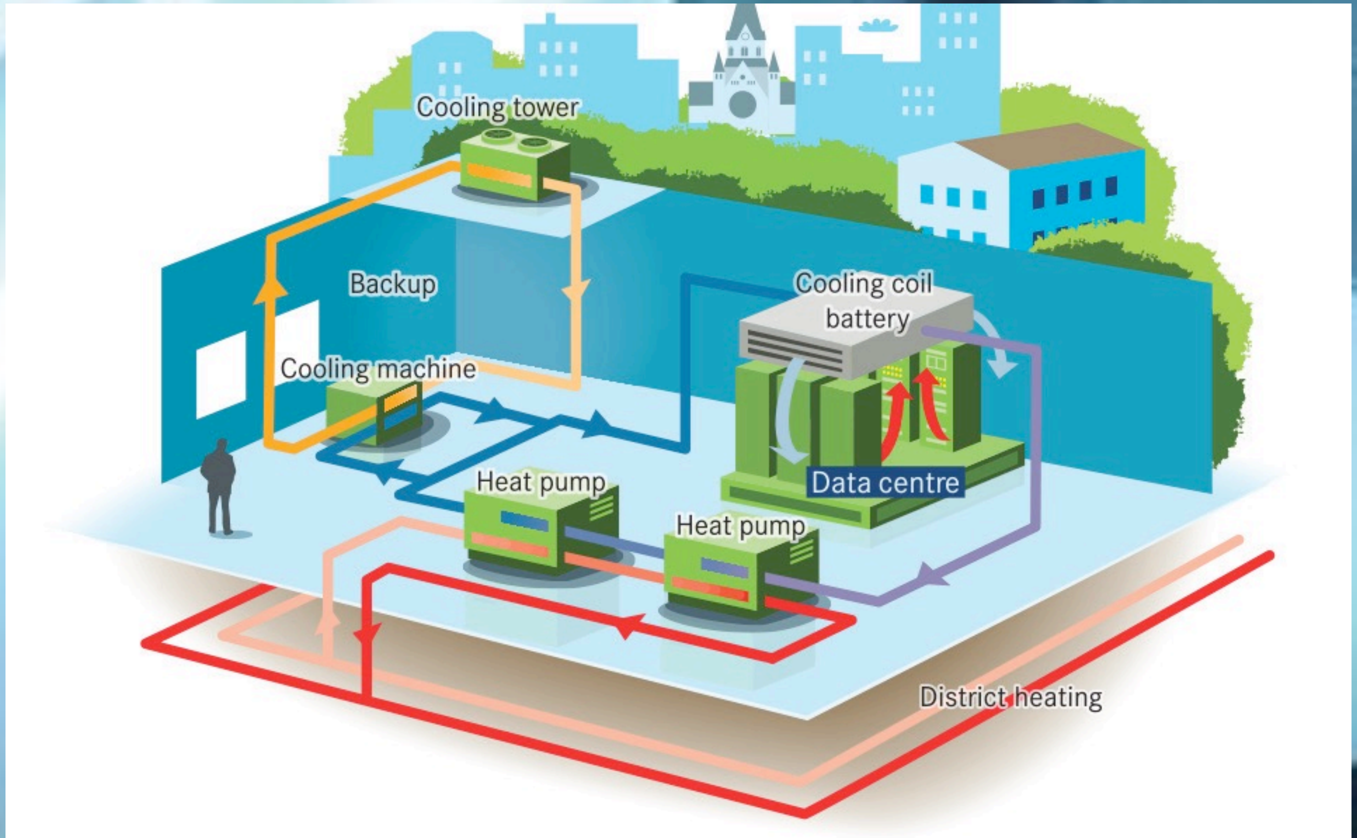
Joint Venture

- Company limited by guarantee with partners ownership shares based on equity invested
- Public partner - land & access to lower-cost debt capital
- Private partner – skills/expertise, shorter procurement process & access to external capital

Special Purpose Vehicle (SPV)

- Wholly owned subsidiary created for owning, operating and maintaining a DE system
- Ownership is split between public & private entities.

Prosumer



Cooling tower
Backup
Cooling machine
Cooling coil battery
Data centre
Heat pump
Heat pump
District heating

Business Models: Private

- Private sector fully owns, operates and controls the DE project
- Financing is through private debt and/or equity
- Financing costs higher than those for public sector sources
- Results in higher expectation on the rate of return on investments

Strengths & Weaknesses

TABLE 4.1: STRENGTHS AND WEAKNESSES OF VARIOUS BUSINESS MODELS

PUBLIC SECTOR MODELS		
	STRENGTHS	WEAKNESSES
INTERNAL DEPARTMENT	• Access to lower-cost public sector financing • Generate revenue for municipality • Deliver aggregate demand and provide public sector anchor loads and reduce demand risk • Better control on flexible development and network growth • Internal oversight and regulation • Greater control on objectives such as carbon savings and affordable tariffs	• May have limited ability to raise public debt • Lack of ring-fenced budget can create risk on internal department municipal budgets • Need to develop internal skills and build capacity • Must comply with longer public sector procurement process
SOCIAL	• Not-for-profit approach allows lower tariffs • Better control on flexible development and network growth • Greater control on objectives such as carbon savings and affordable tariffs	• Cannot rely on credit rating of public organization • Cannot exit to other owners – owned in perpetuity by members and cannot access equity funding.
SPV	• Can secure lower-cost public finance via its public sector parent, particularly if the heat customers are public entities • Parent outsources technical risk to SPV • Separate SPV business plan and budget insulate parent organization • Greater control over objectives such as carbon sav-ings and affordable tariffs	• Must provide financing • Must carry commercial risk • Must comply with longer public sector procurement process

Strengths & Weaknesses

PUBLIC-PRIVATE HYBRID MODELS		
	STRENGTHS	**WEAKNESSES**
CONCESSION	• Leverage third-party financing • Technical and commercial risk transferred to concession operator • Concessionaire provides necessary skills • Shorter private sector procurement process • Ability to align with the social and environmental objectives of the public sector	• Reduced control for public partner • Loss of flexibility – concessionaire may decline to accept heat from sources not under its control or connect customers where cost of connection exceeds higher hurdle rate • Liabilities are consolidated into public sector accounts • Customers see public partner guarantor of last resort in conflict situations • Need to provide higher private sector rates of return may result in higher tariffs
JOINT VENTURE	• Can draw on public and private sector financing to achieve a blended rate • Medium degree of control allows flexible development • Risk shared between partners • Separate business plan • Can choose private sector procurement route • Risk shared between partners	• Possible early exit by a partner may compromise strategic objectives and constrain flexibility • Return on capital requirements will determine tariff rates • Longer procurement process required by public partner
SPV	• Outsource technical risk to SPV • Separate SPV business plan and budget insulate parent organization	• Must provide financing • Must carry commercial risk

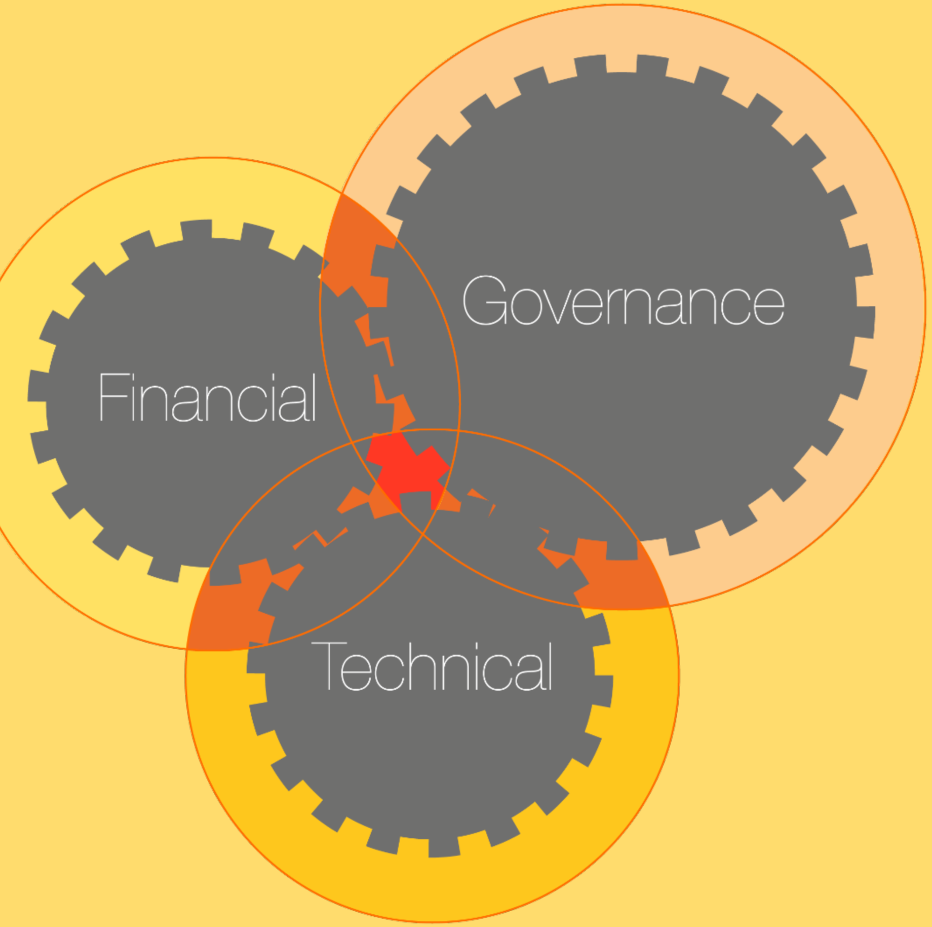
Strengths & Weaknesses

PRIVATE MODEL		
	STRENGTHS	WEAKNESSES
	• Access to capital • Ability to leverage expertise in technology and best practices • Shorter project development time due to proven track record and project management skills	• Higher rate of return expected • Tariffs higher compared to public model • Cannot access low-cost infrastructure funding available to public sector • Customers are tied into a private company and tariffs

Migrating Business Models

Case	Migration path	PUBLIC			HYBRID			PRIVATE
		Internal Department	Social	SPV	Concession	Joint Venture	SPV	Private Utility
Aberdeen, UK:	Arm's-length not-for-profit		•					
Aarhus, Denmark:	Municipally owned & run	•						
Birmingham, UK:	Run as a concession				•			
Norman, USA:	Initially owned and operated by the university. Currently owned by university with private concessionaire for operations and maintenance				•			
Paris, France:	City owned system with Engie as Concessionaire				•			
Phoenix, USA:	Private DE Utility							•
Rotterdam, Netherlands:	Joint venture					•		
Sangam, South Korea:	KDHC is an SPV owned by public entities Korea Electric Power Company, Seoul Metropolitan City government, Korea Energy Management Corporation			•				
Stockholm, Sweden:	Fortum Varme AB is a JV formed by Finnish energy company Fortum, and the City of Stockholm					•		
Toronto, Canada:	For major investments operated as SPV with two public shareholders;			•				
	Now run as a private DE utility							•
Vancouver, Canada:	Run as municipal utility subject to public oversight board	•						
Wick, UK:	Started as public social;		•					
	Moved to public SPV;			•				
	Currently private							•

Journeys through Business Models Best Practices & Lessons Learned



PUBLIC Business Model

Case: Aarhus, Denmark

Anna Chittum, Gridkraft/IDEA

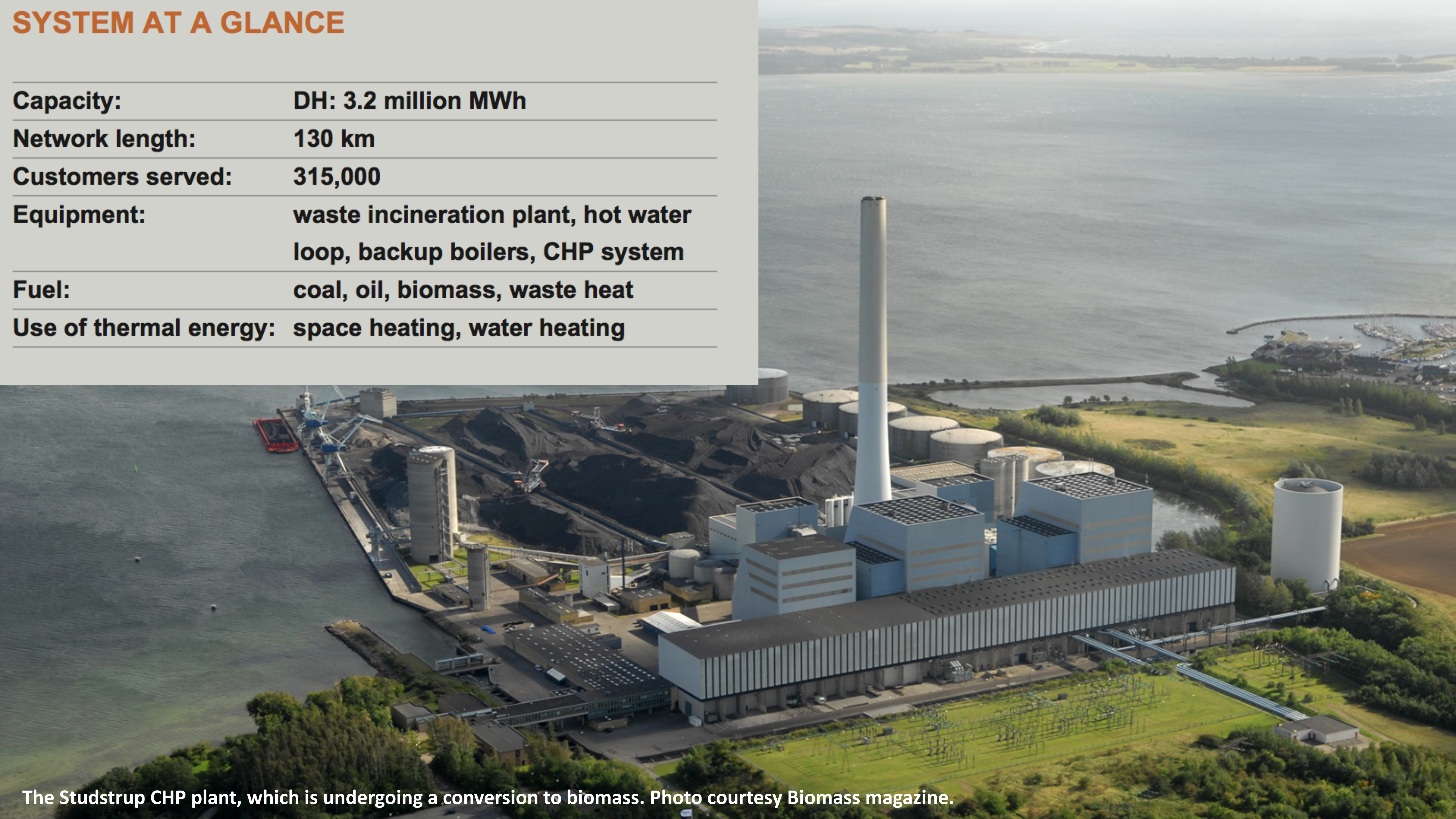
Aarhus, Denmark

Population 315,000

Aarhus Photos: Creative Commons

SYSTEM AT A GLANCE

Capacity:	DH: 3.2 million MWh
Network length:	130 km
Customers served:	315,000
Equipment:	waste incineration plant, hot water loop, backup boilers, CHP system
Fuel:	coal, oil, biomass, waste heat
Use of thermal energy:	space heating, water heating



The Studstrup CHP plant, which is undergoing a conversion to biomass. Photo courtesy Biomass magazine.

Lessons Learned

- The establishment of clearly articulated environmental goals that will be aggressively pursued lays the foundation for groundbreaking conversations with external partners (e.g., DONG Energy)

- Once established, a local district heating company can use its respected brand to further deploy district energy beyond the municipal borders

Financing

- AffaldVarme Aarhus run as not-for-profit
- Studstrup plant owned by DONG Energy (private)
- To make investment in Unit 3 plant upgrades to burn wood pellets, AffaldVarme Aarhus and DONG worked in close relationship with national regulators to spread risk
  - Total conversion cost: 1.3 billion DKK ($190 million USD)
  - Established proportion of upgrade to be funded by DONG
  - Established proportion of upgrade to be funded by AffaldVarme Aarhus
  - Assessed rate impacts to consumers
- Separate city-owned heat plant also converted to biomass

Governance

Lisbjerg CHP plant

- AffaldVarme Århus acts as quasi-public agency
- City council approves major investments
- AffaldVarme Aarhus system planning deeply integrated with land use planning at municipal level
- City goal: make investments in DH system toward CO_2-neutral goals
  - Adopted plan clarifying three potential resource scenarios
- National goal: eliminate coal & oil in district heating systems by 2030

Strategies for Success

STRATEGIES FOR SUCCESS

RISK

- Municipalities have the ability to compel connection of buildings to the district heating system, so the heating company was able to approve investments with the expectation that the number of customers would grow
- The city of Aarhus has understood the business needs of DONG Energy and has sponsored the regulatory requests necessary to economically incentivize DONG to invest in full biofuel powering of Studstrup's Unit 3

INFORMATION

- The Aarhus City Council adopted a climate plan outlining three clear scenarios for making the district heating CO_2-neutral by 2030, thus offering clear guidance to the private sector about what the city would be willing to support in the long term

MONEY

- Major investments necessary for the new CHP system were approved by city leaders, thus giving confidence that the district heating company could make the investments with full faith that the investments could be recouped through customer rates
- DONG Energy invested their own money in the upgrade of boiler Unit 3 of Studstrup because they had full support by the DERA that their investments were necessary and would be reflected in future rates. They also understood that AffaldVarme Aarhus was taking on the bulk of the risk associated with the biomass conversion

PEOPLE

- The city of Aarhus and DONG Energy have worked very closely to align goals related to CO_2 emission reductions

The Journey

JOURNEY

City established public district heating company as arm of city government with involvement of regional heat plants including incineration plant and electric generator

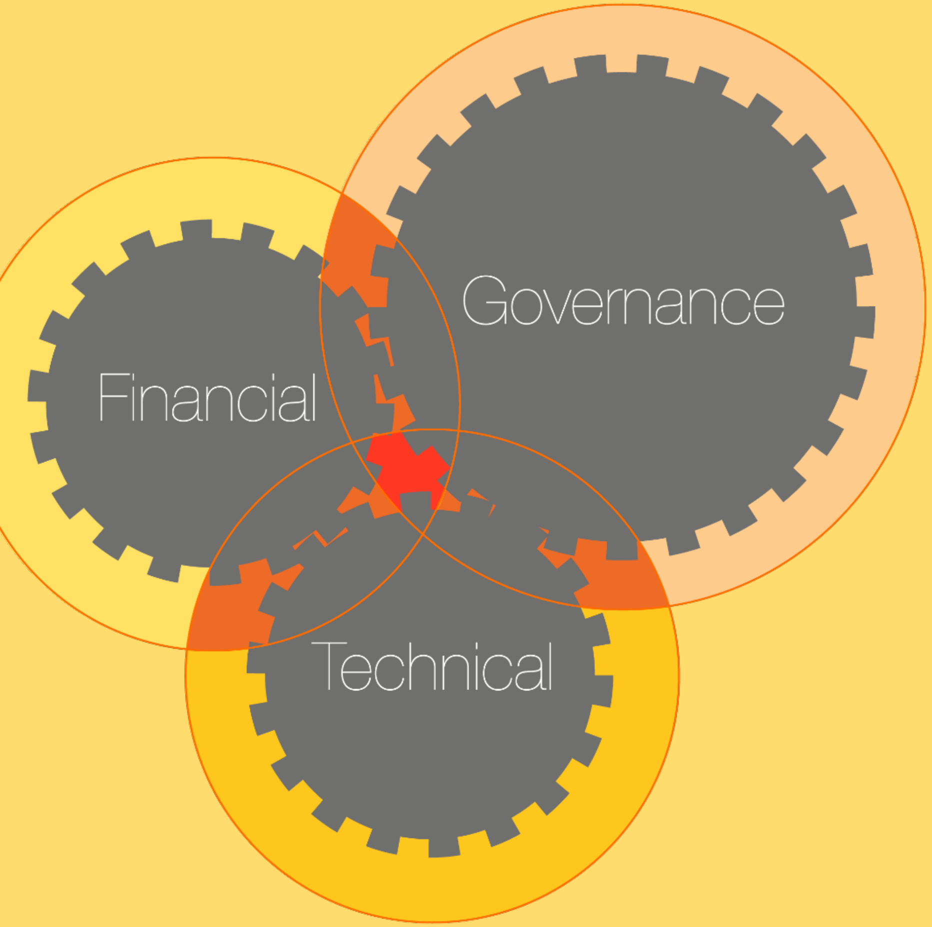
→

The system grew to heat 95% of the homes in Aarhus and expanded to incorporate several nearby towns into one integrated system

→

New environmental goals drove city to lead new effort to work directly with private sector heat suppliers to obtain the heat supply they needed and develop new business models regarding investment

Journeys through Business Models
Best Practices & Lessons Learned



HYBRID Business Model

Case: San-gam, S. Korea

Jong Jun Lee, Korea District Heating Corporation

Overview

SYSTEM AT A GLANCE

Capacity:	DH: 278 MWh (240 Gcal/h); DC: 180 MWh (160 Gcal/h); CHP: 4 MW
Buildings served:	163
Equipment:	LFG and SRF boilers, LNG peak load boiler, absorption chillers
Fuel:	SRF, LFG, LNG
Use of thermal energy:	space heating and cooling

Sangam Integrated District Heating Plant

Financing

- *Long-term contract with the Seoul Metropolitan Government enabled KDHC to utilize waste fuels and operate the Waste to Energy facilities.*
- *Seoul derives revenues of $5.5 million annually from the sale of waste fuels to the KDHC.*
- *Government invested $138 million in this LFG project, for pipelines to extract the LFG gas and building facilities to dispose of sewage sludge and leachate.*
- *KDHC invested $150 million for pipelines to connect the nearby CHP plant to get heat supply to Sang-am and extend the Seoul metropolitan district heating network.*
- *KDHC manages its projects via debt and equity financing.*

Governance

- *KDHC was founded in 1985 as a public enterprise for promoting energy conservation & improving living standards through the efficient use of district heating.*
- *Korean government remains KDHC's largest shareholder with 34.6% ownership.*
- *Korea Electric Power Company (KEPCO) holds 19.6%.*
- *Other shareholders are government-owned Korea Energy Management Corp. (KEMCO), the Seoul Metropolitan Government, employees and the general public.*
- *Shareholders can make revisions to the company's articles of incorporation, decide on the appointment of directors and approve the settlement of accounts at the general shareholders' meeting.*

Strategies for Success & the Journey

● Strategies for Success

RISK

- The ability of the government to designate integrated energy supply zones reduces the risk for DH supply providers like KDHC that can count on a revenue base and potential growth
- KDHC can reduce its risk for additional investments in the DH infrastructure by leveraging connections to the Seoul metropolitan district heating network

INFORMATION

- The Integrated Energy Support Act provides valuable information on planned DH supply zones and helps with longer-term planning of DH companies
- The South Korean RPS enables the use of local resources to reduce waste

MONEY

- The role of large public sector shareholders in KDHC enhanced its ability to raise money in the private markets
- The government-funded extraction of LFG from the Sangam landfill created a unique opportu-nity for KDHC to help meet environmental and economic objectives
- Continued investment to extend the metropolitan network allows KDHC to optimize capital investment to serve new customers

PEOPLE

- The partnership among residents of Sangam, the Seoul metropolitan government and KDHC was critcal in avoiding NIMBY issues and using local resources to provide DH services

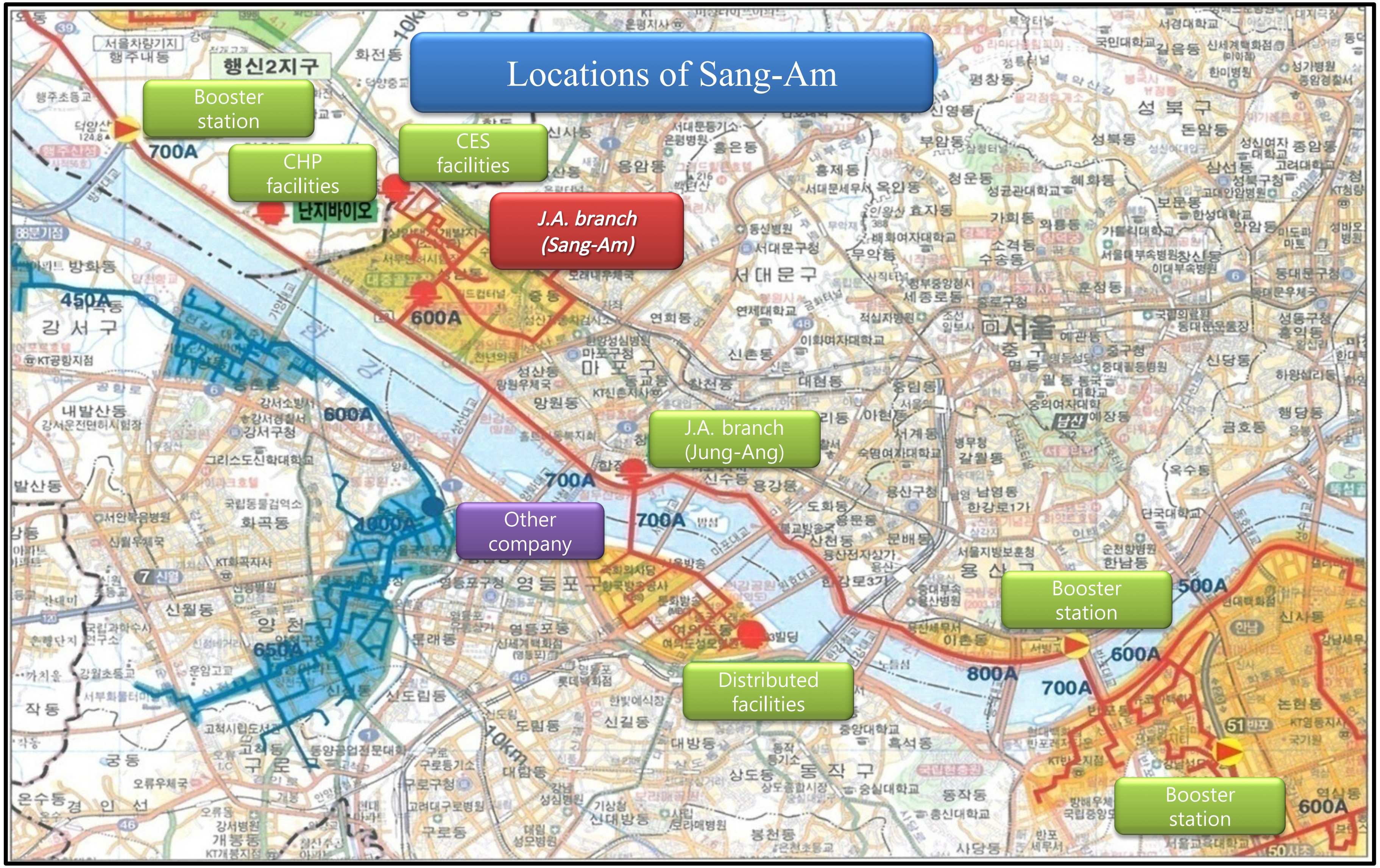
● The Journey

Multiple public entities formed an enterprise (KDHC) for the purpose of saving energy and improving living standards by providing efficient district heating to 1.3 million homes

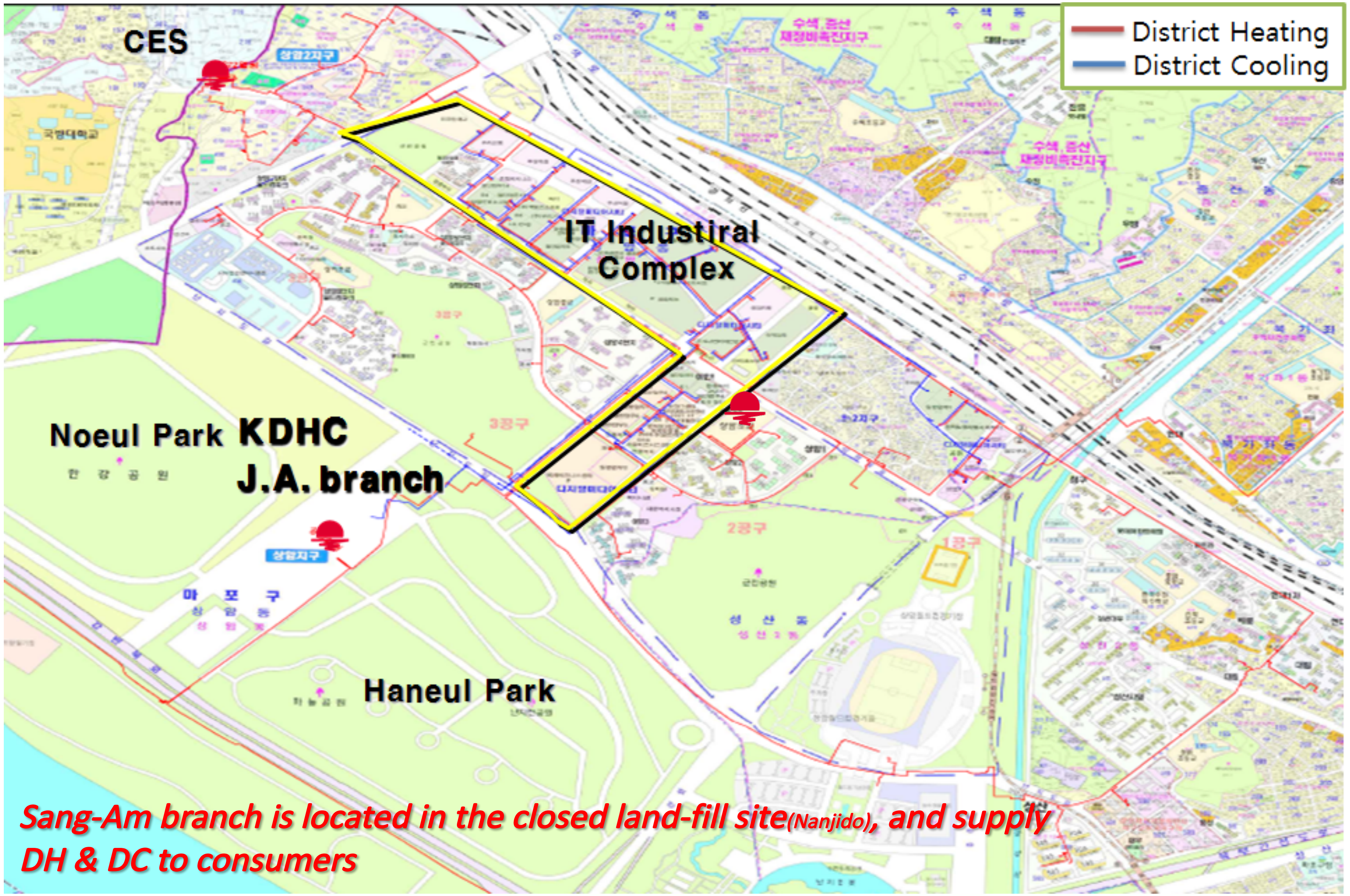
→ Seoul government invested in LFG pipeline project to make the massive Sangam landfill available as a LFG resource for DH

→ Seoul metropolitan district heating network continued to expand. Designating DH zones helped reduce risk for DH suppliers

Facility location



Facility location



Sang-Am branch is located in the closed land-fill site(Nanjido), and supply DH & DC to consumers

Facility location

LFG extraction holes was installed at the beginning stage for supplying LFG to KDHC Sang-am branch

Facility Status(District Heating)

DH facilities of J.A branch

As of JAN 2016.

Type		Capacity	Remark
Jung-Ang	Heat exchangers (for generator steam)	#4 : 129Gcal/h,137.5MW #5 : 240Gcal/h,245.0MW	369 Gcal/h
	LNG hot water boilers	20Gcal/h X 2EA	40 Gcal/h
Sang-Am	LFG boilers	25Gcal/h X 2EA 6Gcal/h X 1EA	56 Gcal/h
	LNG steam boiler	53Gcal/h X 1EA	53 Gcal/h
	Incinerators	250Ton/Day X 3EA	34 Gcal/h
Sang-Am 2 area	Community electricity service	(3MW + 3.28Gcal/h) X 2EA PLBs 8Gcal/h X 2EA	6MW 22 Gcal/h
Nanji	Biogas engines	(1.5MW + 1.5Gcal/h) × 2EA	3MW 3 Gcal/h
Total			9MW 577Gcal/h

Facility Status(District Cooling)

DC facilities and others

As of JAN 2016.

Type		Capacity	Remark
DC facilities	Absorption chillers (using steam or hot water)	1,500USRT × 7EA, 800USRT × 7EA	48.3 Gcal/h
	Turbo chillers	1,500 USRT × 14EA	63 Gcal/h
	Turbo chillers (in LG CNS)	810 USRT × 4EA	10 Gcal/h (for emergency)
	Ice storage system	12,600 USRT × 1TYPE	38 Gcal/h
	Total		159.3 Gcal/h
Network system	Heat exchanger (from Goyang to J.A. branch)	35 Gcal/h × 2EA 33 Gcal/h × 2EA	136 Gcal/h
	Heat exchanger (from Nambu to J.A. branch)	30 Gcal/h × 2EA	60 Gcal/h
Heat storage and pipeline	Heat accumulator	91 Gcal/h	20,000㎥×1EA(528Gcal)
	DH pipeline	115.8 Km × 2	Supply and return line
	DC pipeline	9.1 Km × 2	Supply and return line
	Distribution line	22.9kV , 2.5Km	

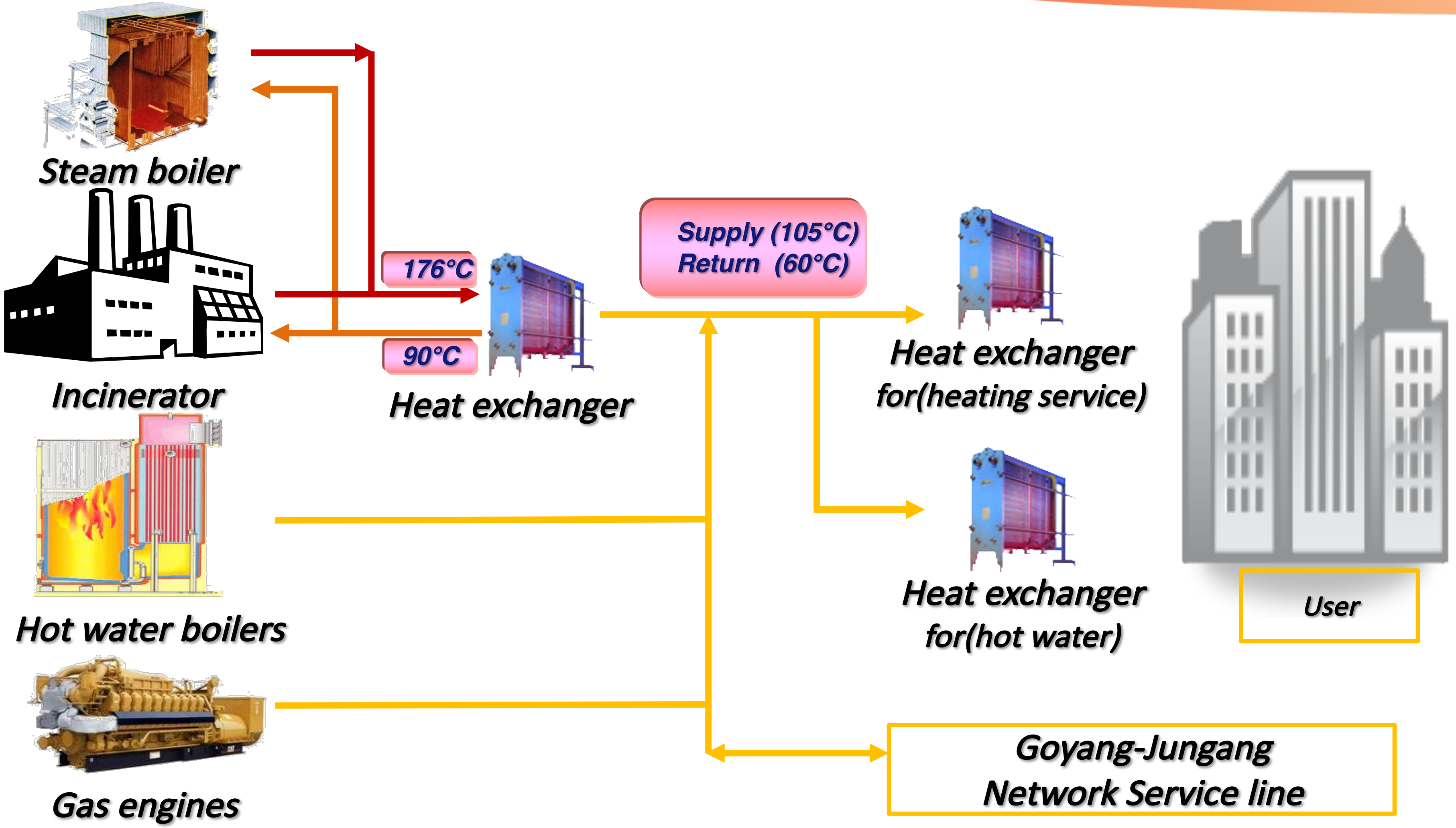
Customer Status of J.A

As of JAN 2016.

Type		Status	
		Contents NO. of consumers (places)	Contract capacity of consumers (Gcal/h)
DH Service	Collective housing	78,512	516
	Business buildings	153	286
	Public buildings	11	19
DC Service	Business buildings	35	199
Total supply capacity (DH/DC)		821/199	

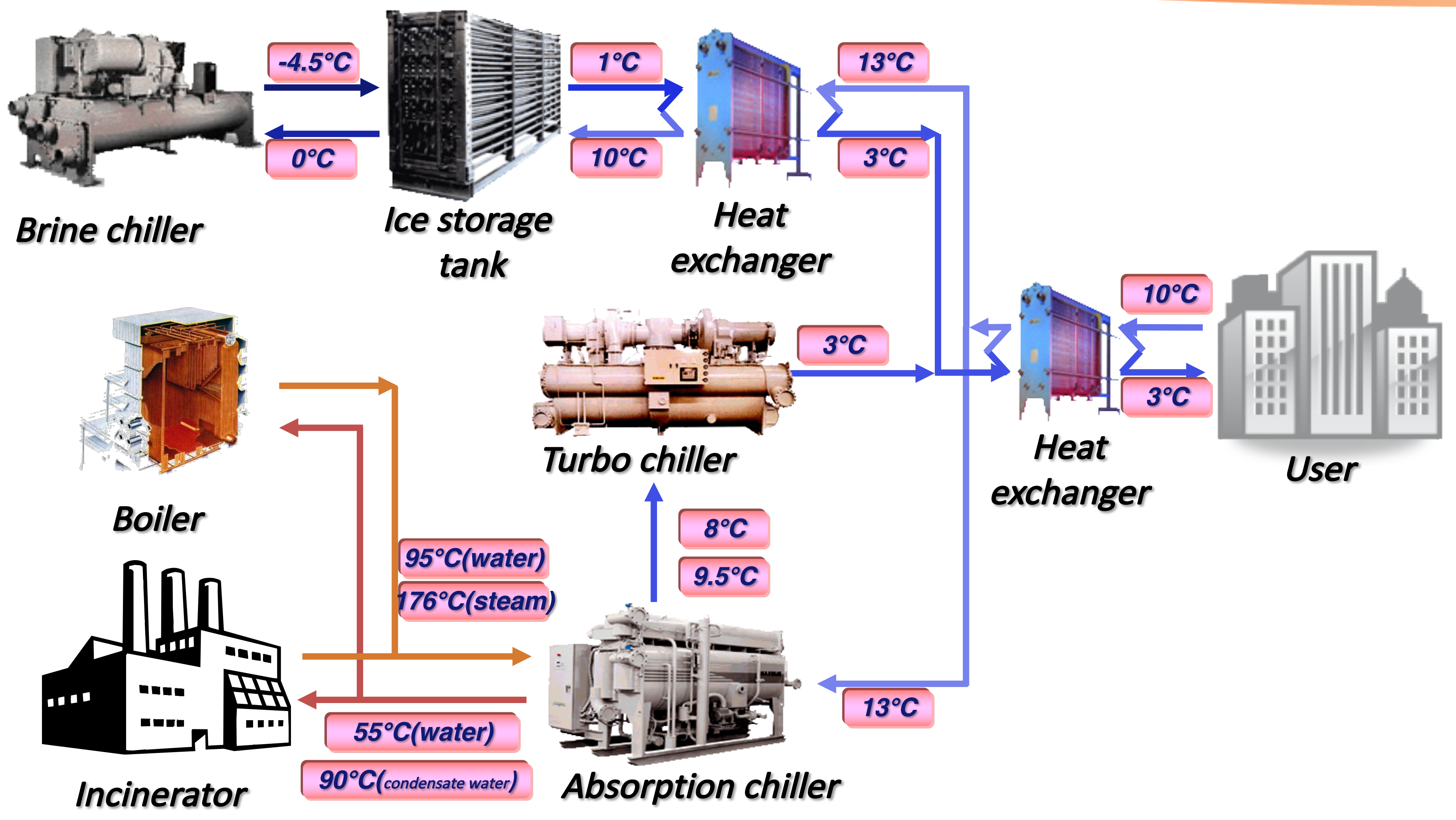
J.A. branch supply district heating and cooling to multiple users at once collective housing, buildings, and other locations

DH Supply Diagram



J.A. branch operates many boilers and gas engines. These facilities burning the LNG, waste and biogas provide heat to our customers and other locations

DC Supply Diagram



J.A. branch operates many chillers. Absorption chillers make a cold water by using steam or hot water.

Biogas harvesting process diagram

(BIOGAS COMBIND HEAT & POWER PLANT)

Introduction

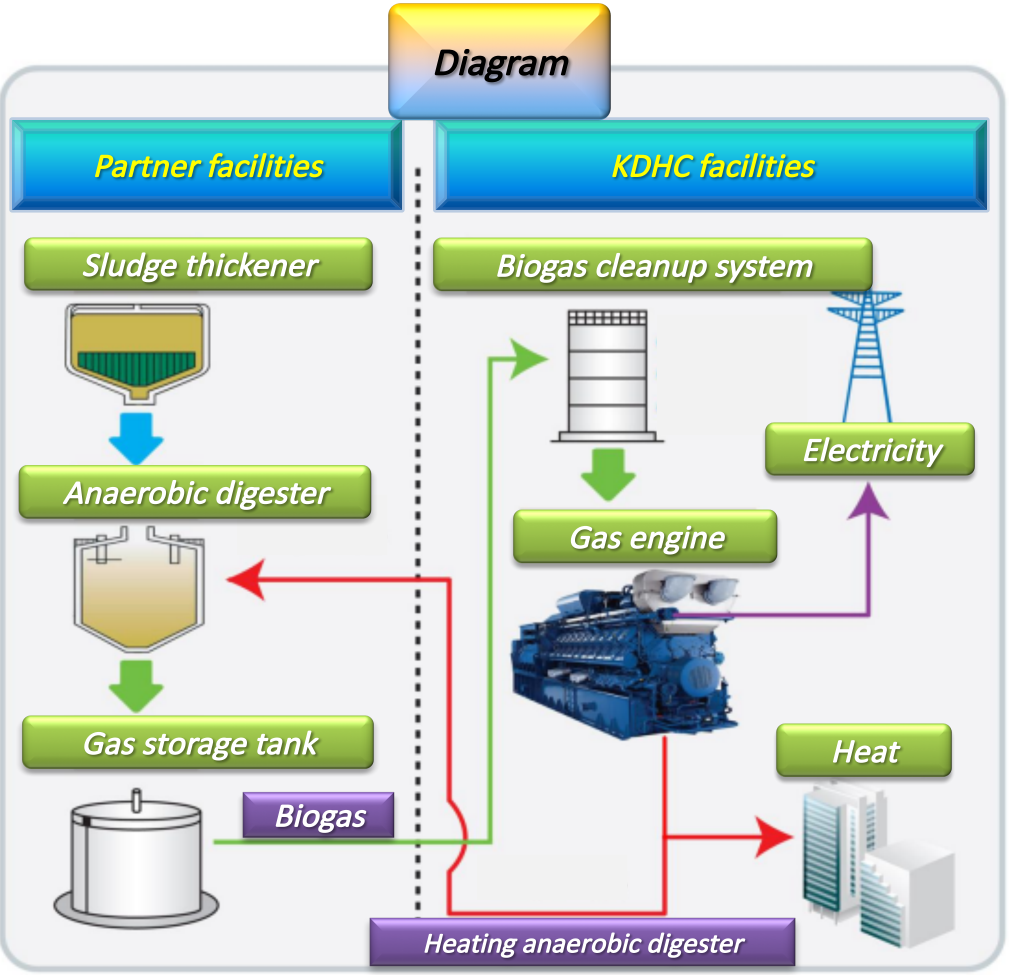
These plants using biogas make heat and electricity generated in the process of wastewater disposal

Facilities

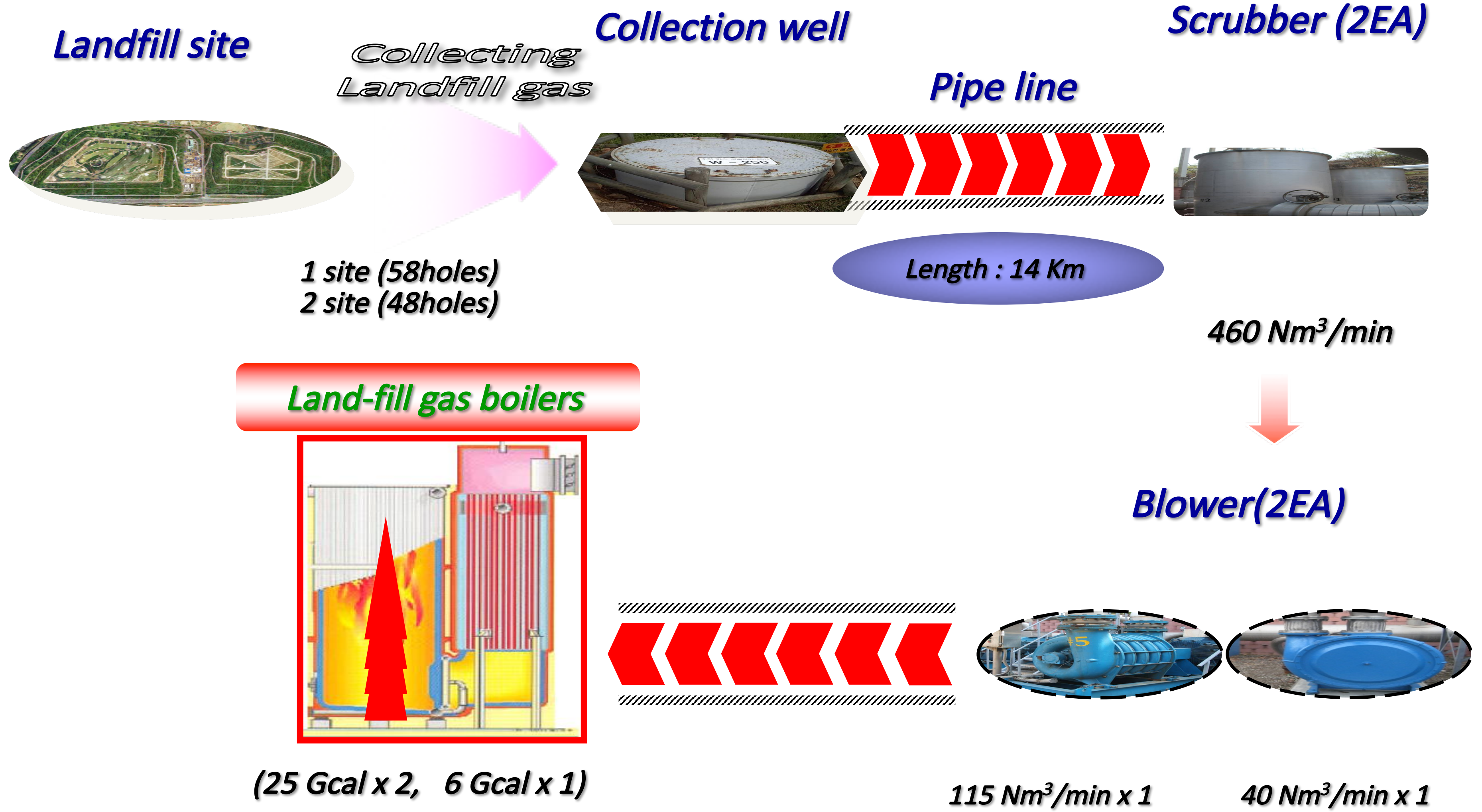
Gas engine : 2EA
Gas cleanup system
Heat exchanger(for exhaust gas)

Capacity

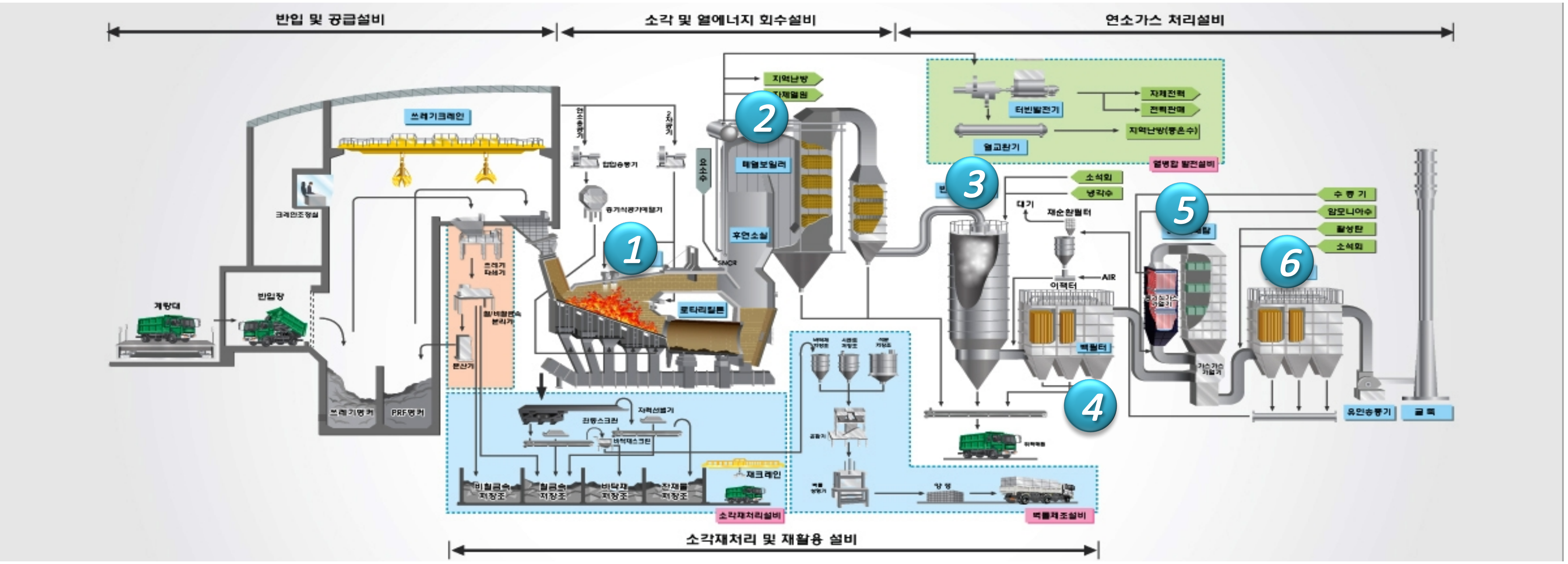
Power : 1,530kW X 2EA
Heat : 1,488kcal/h X 2EA



LFG harvesting diagram



Incinerator system diagram

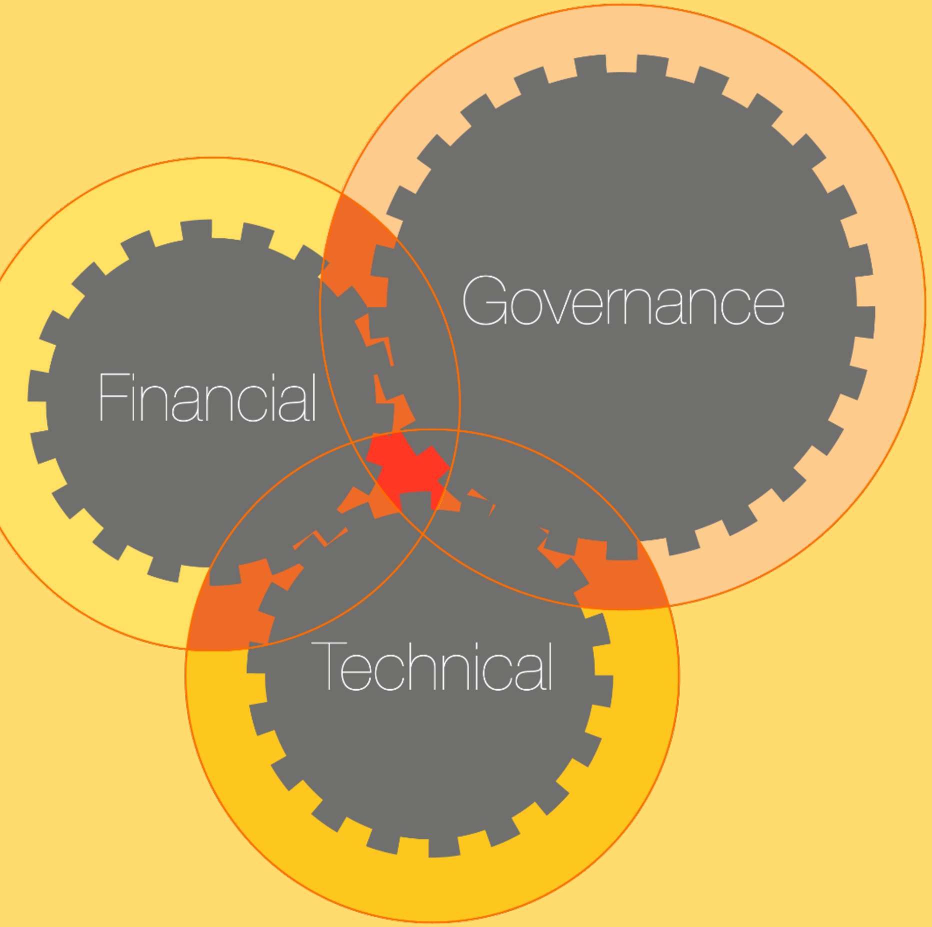


1 Incinerator	2 Waste heat boiler	3 Chemical reaction	4 Filter	5 SCR	6 Filter
Burning waste	Making a steam by using waste heat	Reducing acid gas(HCL, Sox) and heavy metal	Eliminating dust, acid gas(HCL, Sox) and heavy metal	Reducing Nox and dioxin	Eliminating dioxin (less than 0.01ng) and air pollutant

Lessons Learned

- ***The Integrated Energy Support Act provided valuable information on designated planned DH supply zones, de-risks customer connection uncertainties and helps with longer-term planning of DH companies.***
- ***The South Korean RPS enabled the use of local resources to reduce waste.***
- ***Leveraging LFG resource in Sang-am helped meet environmental goals.***
- ***The long-term contract with the Seoul Metropolitan Government enabled KDHC to utilize waste fuels and operate the Waste to Energy facilities.***
- ***Use of CHP to meet heating and electricity needs was made possible by public sector energy efficiency and electricity supply partners KEPCO and KEMCO***

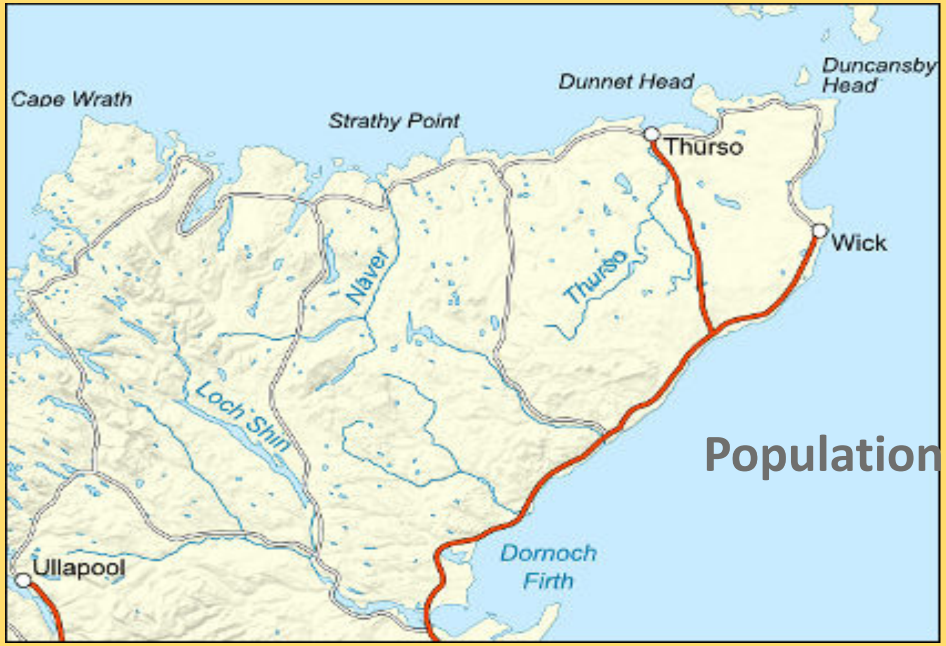
Journeys through Business Models
Best Practices & Lessons Learned



PRIVATE Business Model

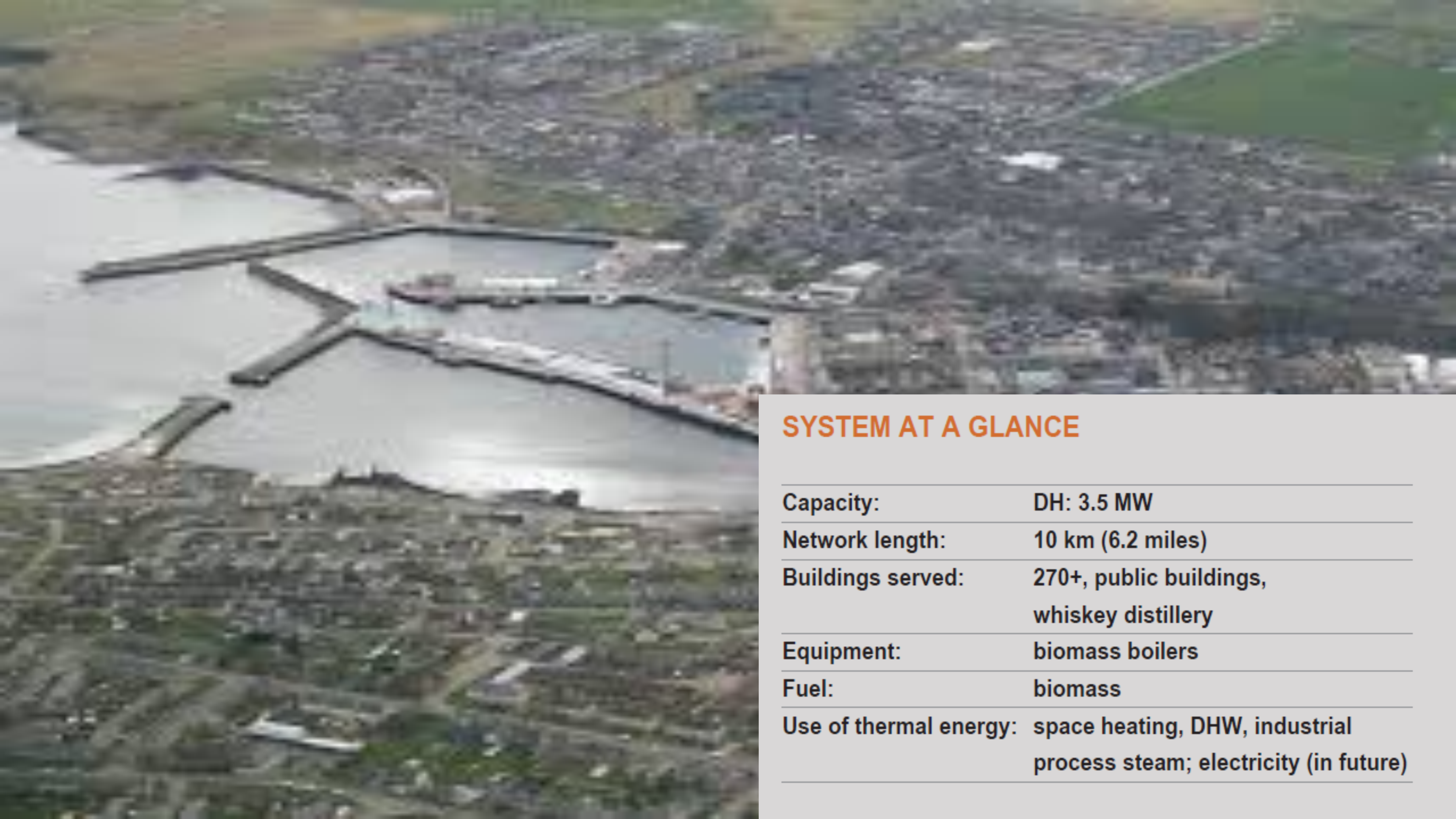
Case: Wick, United Kingdom

Michael King, District Energy Development Ltd



Population 7,000

Pultneytown Distillery, Inver House Distillers



SYSTEM AT A GLANCE

Capacity:	DH: 3.5 MW
Network length:	10 km (6.2 miles)
Buildings served:	270+, public buildings, whiskey distillery
Equipment:	biomass boilers
Fuel:	biomass
Use of thermal energy:	space heating, DHW, industrial process steam; electricity (in future)

Financing

- Established as a community-owned entity, Caithness Heat & Power (CHAP).
  - Phase 1: waste heat from distillery for 243 homes. £1.54m grant from UK Government. Community Energy program and £1.6m from municipality's Fuel Poverty Program.
  - Phase 2:£1.38m Community Energy Program grant for gasified biomass CHP
- Gasifier problematic. Company in difficulty. Bought out by municipality for nominal £1.00
- Municipality invests £11.5m to keep project afloat. Decides to abandon (2009). Auctions assets
- Assets purchased by Ignis Energy with £3m private equity capital from Ludgate Capital Investment
- Consolidates:
  - Reverts to heat-only boiler.
  - Secures steam supply contract with distillery
  - Residents given choice – 90% remain on network. Install meters to secure revenues
  - Expands network to non-residential load (Assembly Rooms + others)
  - Secures heat supply contract with regional hospital (Nov 2015)
- Re-finances with100% sale to Green Investment Bank and Equitex (Jan 2016)
- New owners invest £10m in purchase and expansion including CHP + island CHPs
- Sub-contract operations to specialist O&M company and development to a separate company

Governance

- Established by municipality as a community-owned entity, Caithness Heat & Power (2004). Members include distillery, housing association, municipality, local community group.

- Each member has board representation

- Buy-out by municipality it becomes a municipal Special Purpose Vehicle (SPV. Board comprises of six local councillors

- Asset purchase by Ignis Energy becomes wholly-owned private limited company.

- Sale to Green Investment Bank and Equitex as wholly-owned private limited company

Strategies for Success

STRATEGIES FOR SUCCESS

RISK

- Use technologies with a proven track record
- Reduce bad debt risk with pre-pay meters for residential customers
- Reduce seasonal demand risk with industrial connection
- Hospital connection reduced demand risk, giving investors confidence
- Larger scale delivers greater revenues – but need to develop demand

INFORMATION

- Coducted heat and resource mapping study
- Undertook technical feasiblity study
- Developers had proven track record for biomass CHP

MONEY

- Grants and public subsidy helped during development stage
- Equity investor was willing to take development risk
- Insitutional investors are willing to take on de-risked projects
- Larger-scale CHP provides greater benefits but requires larger investment

PEOPLE

- Stakeholders provided innovative and focused management
- Clear goals and objectives were maintained throughout project lifecycle

The Journey

Mission and vision underpinned by early load mapping and technical feasibility study

→

Initial vision retained. Project re-configured. Management replaced. Risk transferred to equity investor

→

De-risked project attracted institutional investors through transfer of ownership

Lessons Learned

- Government development support for heat load and resource mapping
- Long term approach is required to development projects at scale – phased stages
- Deploy proven technology to make project feasibility robust
- Securing revenues streams provides investor confidence
- Experienced project developer provides confidence to potential customers
- Equity investors are willing to accept risk and back a competent project developer
- Securing anchor customer de-risks project to satisfy institutional investors risk appetite