



NY - GEO 2026
March 24-25, 2026 | Brooklyn, NY



Beyond BTUs:

Making kW a Recognized Thermal Standard

Moderator: Bill Nowak / *NY-GEO Board*

Panel: José Acuña / *KTH (Sweden)* & Kim Ojanne / *Rototec*

Bob Wyman / *Self*

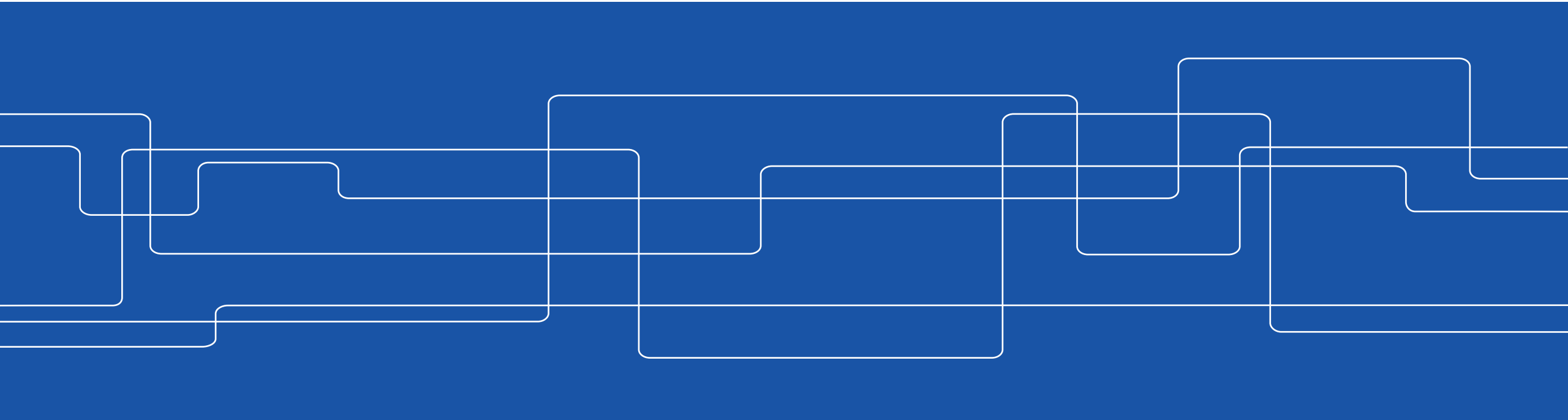
Mark Kleinginna / *Emergent Urban Concepts*

Zeyneb Magavi / *HEET*



Understanding GSHPs through kW and kWh

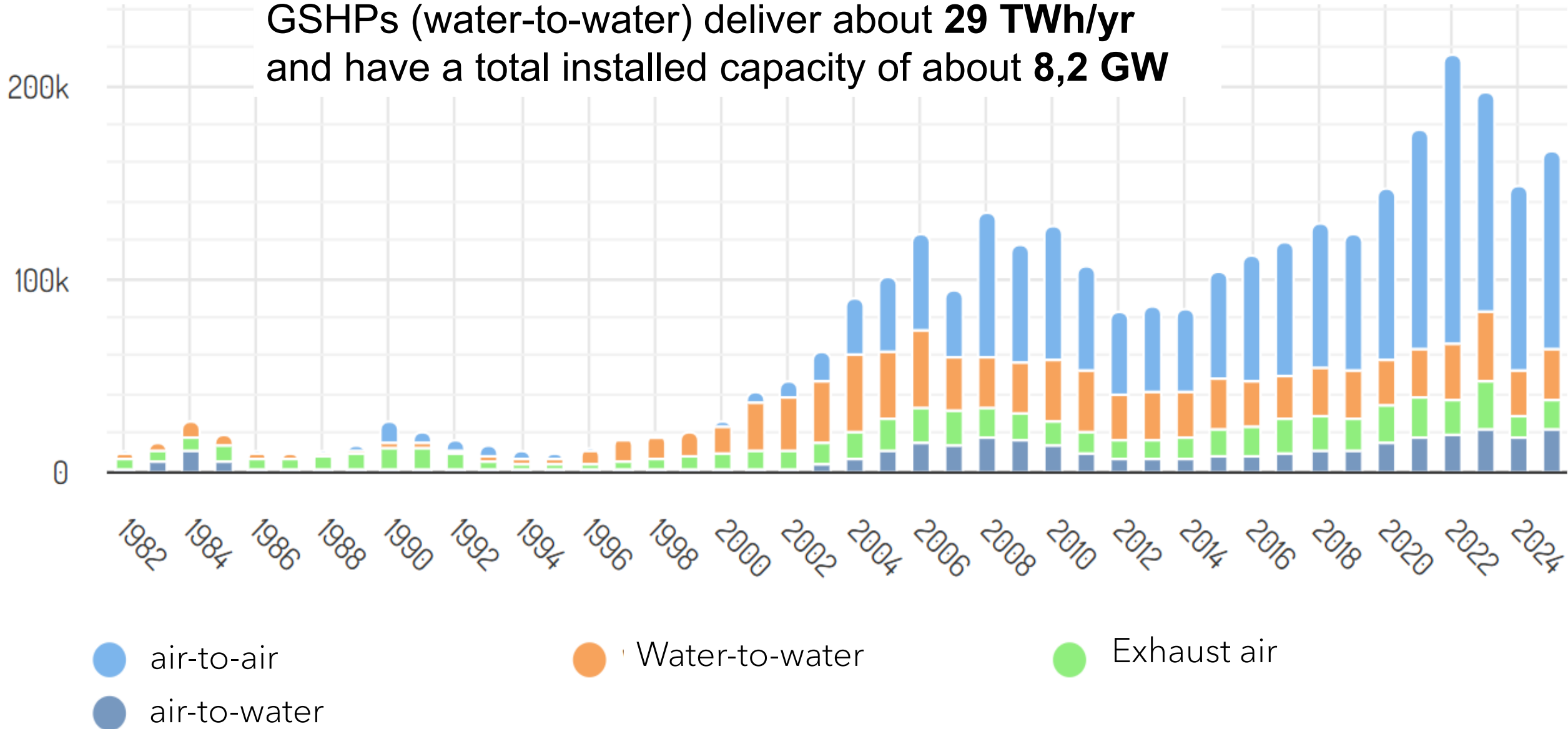
Dr. José Acuña





Heat Pump sales in Sweden (number of units)

GSHPs (water-to-water) deliver about **29 TWh/yr** and have a total installed capacity of about **8,2 GW**

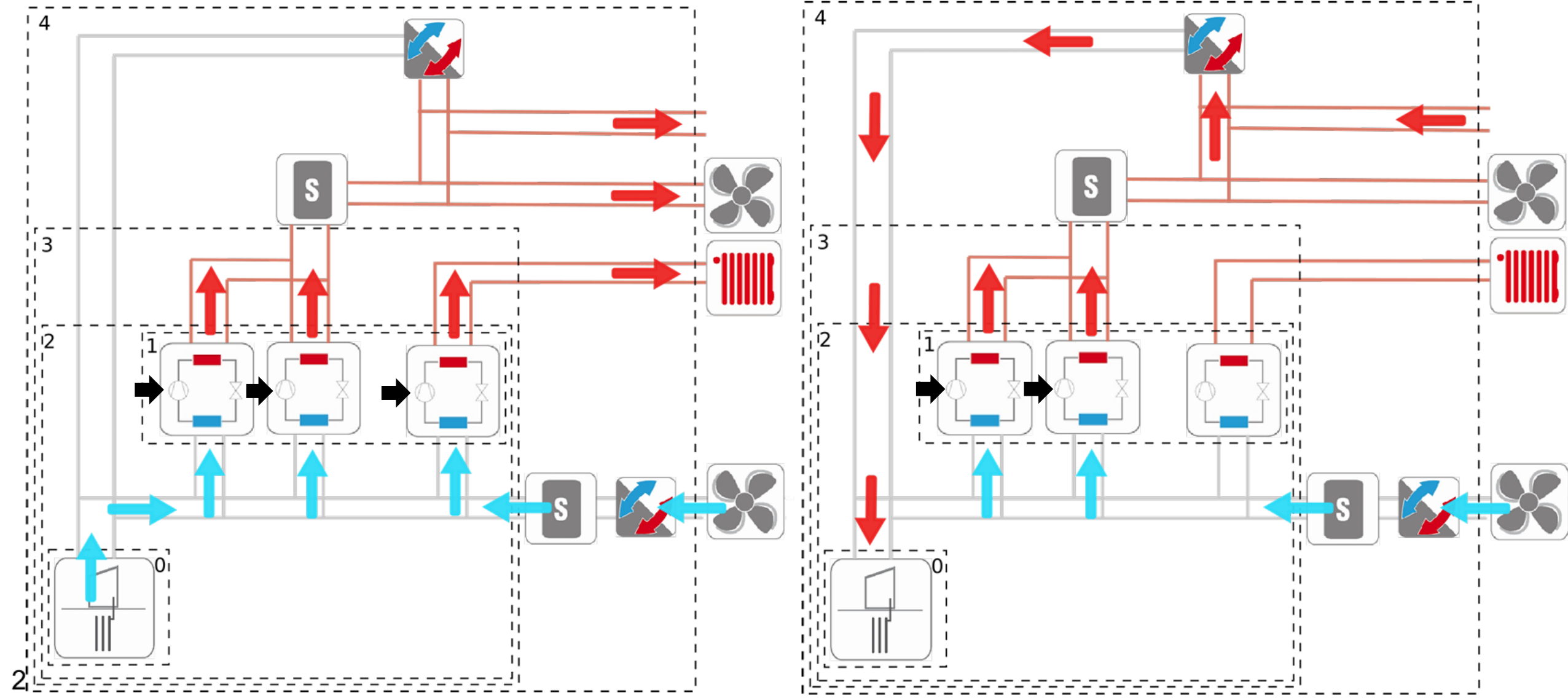




Typical Thermal and Electric Energy Units (heat pump context)

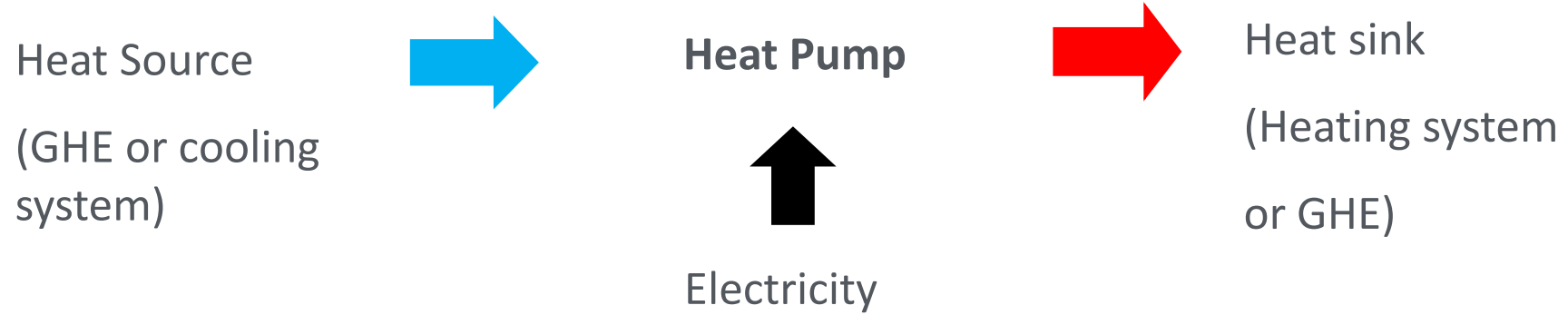
	Type	USA	SWEDEN
Energy	Thermal	BTU	kWh
	Electrical	kWh	kWh
Power	Thermal	Tons of Refrigeration / BTU per hr / MBH	kW
	Electrical	kW	kW

Power and Energy Balance in GSHP systems





Power and energy balance and COP



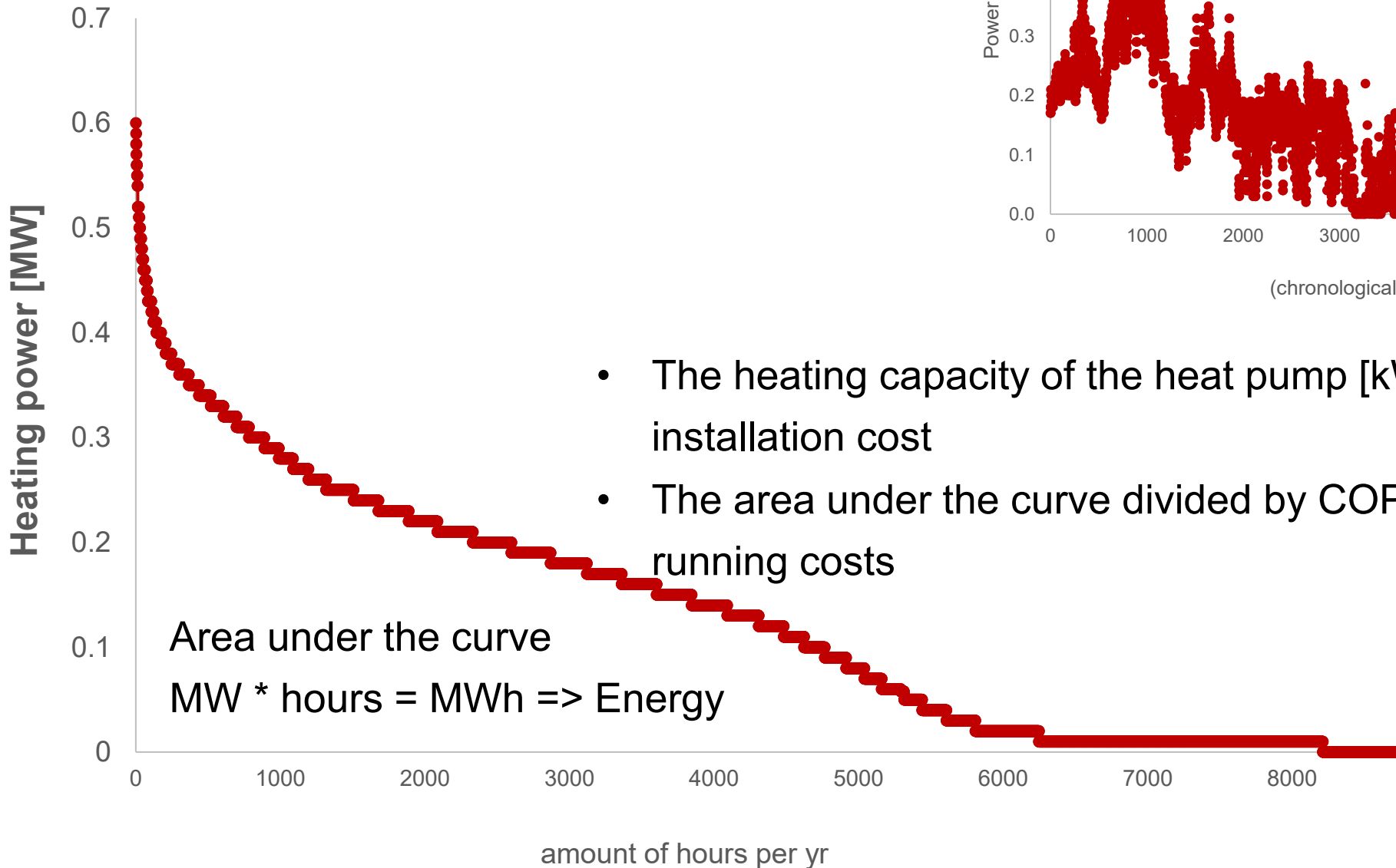
$$\text{COP heating} = \frac{\text{Red bar}}{\text{Black bar}}$$
$$\text{COP cooling} = \frac{\text{Blue bar}}{\text{Black bar}}$$

This power and energy balance as well as the heat pump COP are valid at any time and during any period

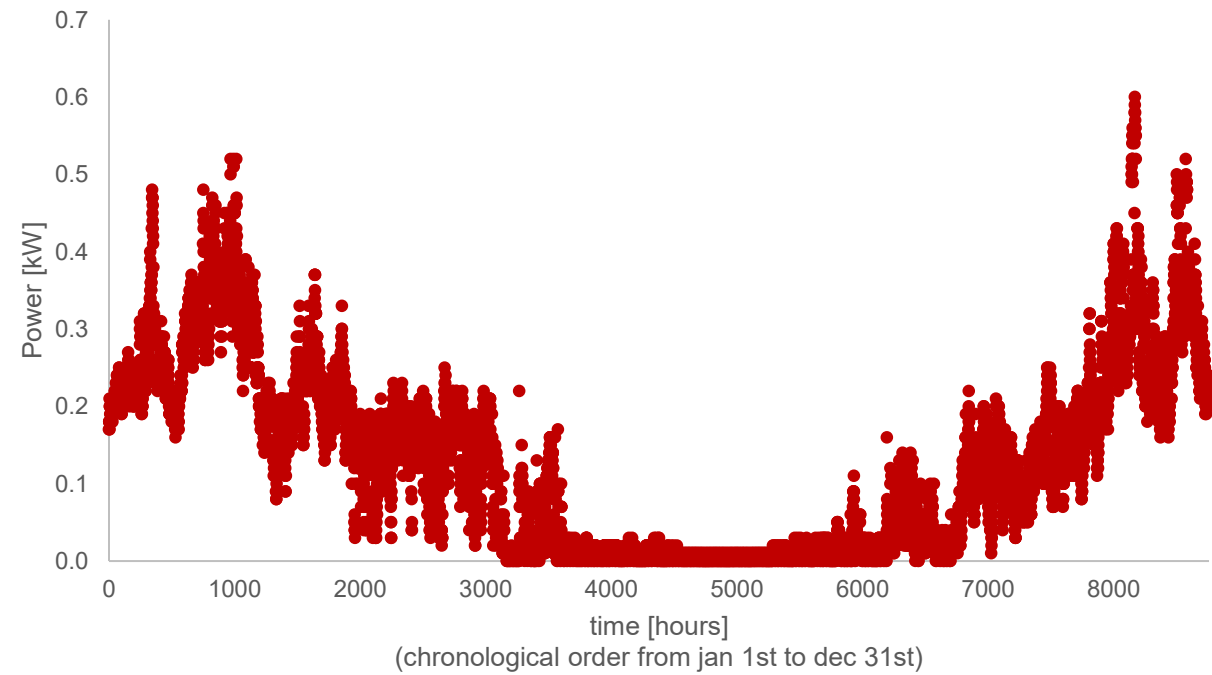
$$\text{Blue bar} + \text{Black bar} = \text{Red bar}$$



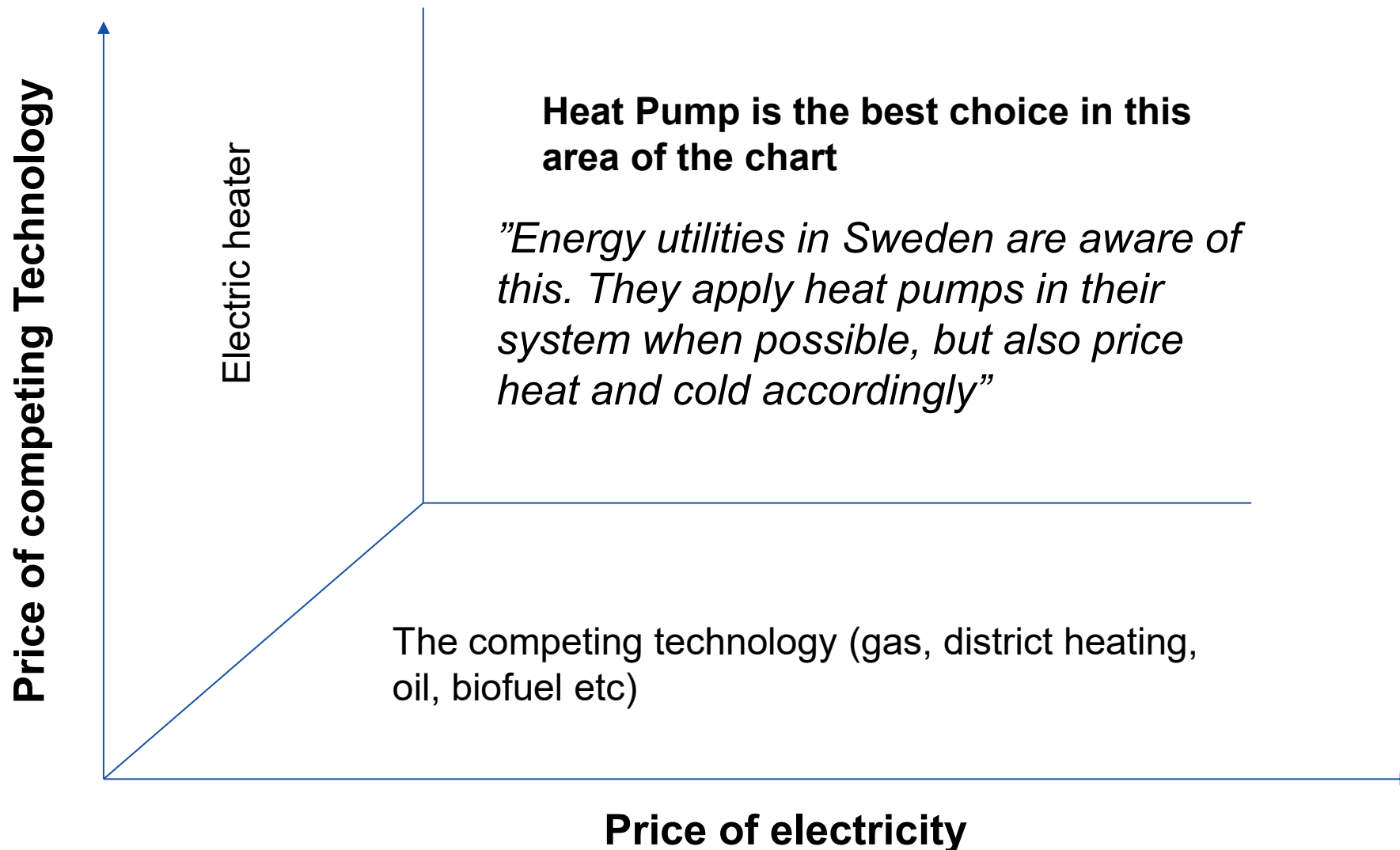
Analogy between heating power, energy and costs



- The heating capacity of the heat pump [kW] is proportional to the installation cost
- The area under the curve divided by COP each hour is proportional to running costs



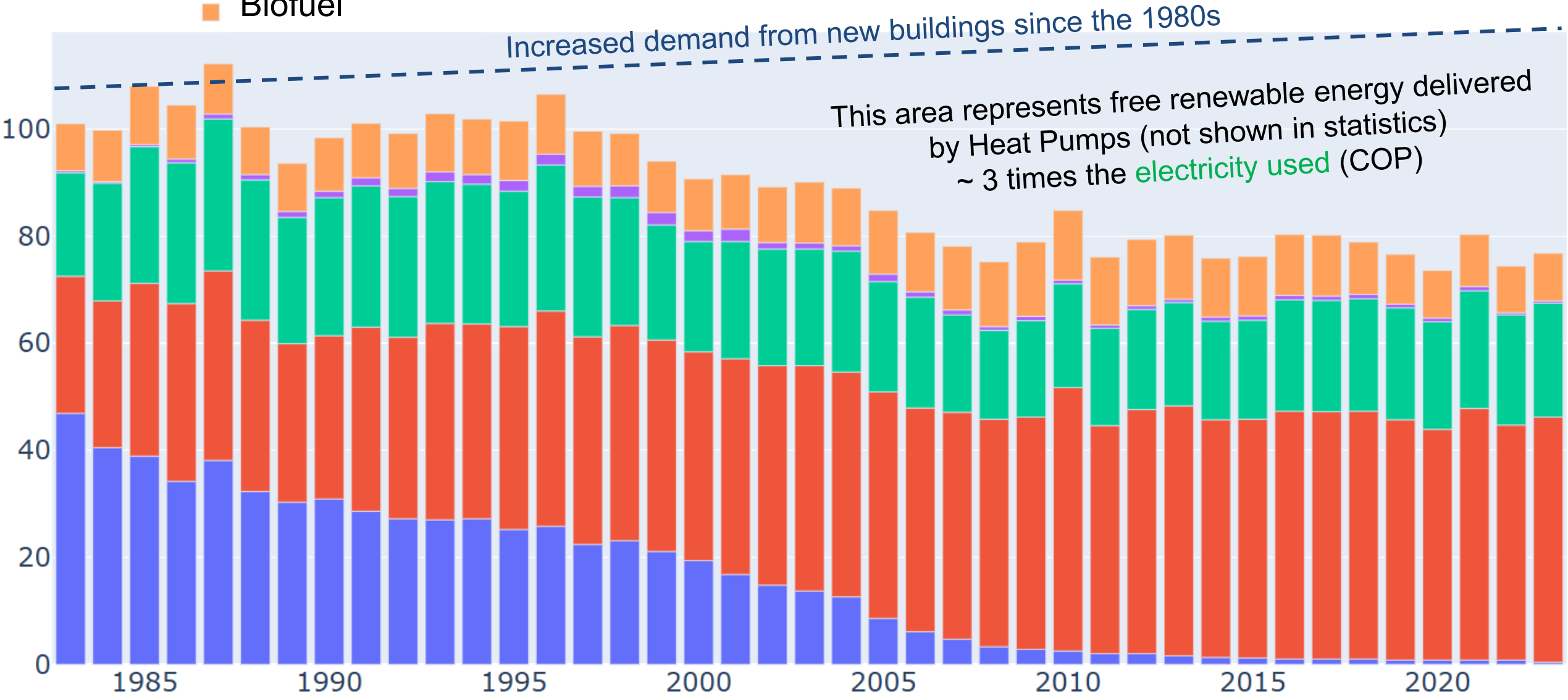
Which technology to choose?





- Oil
- District Heating
- Electricity
- Gas
- Biofuel

Energy use for heating and domestic hot water in Swedish buildings [TWh]





Thank you!

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Modernizing Renewable Thermal Energy Accounting

The Case for Replacing BTU and Tons with kW and kWh

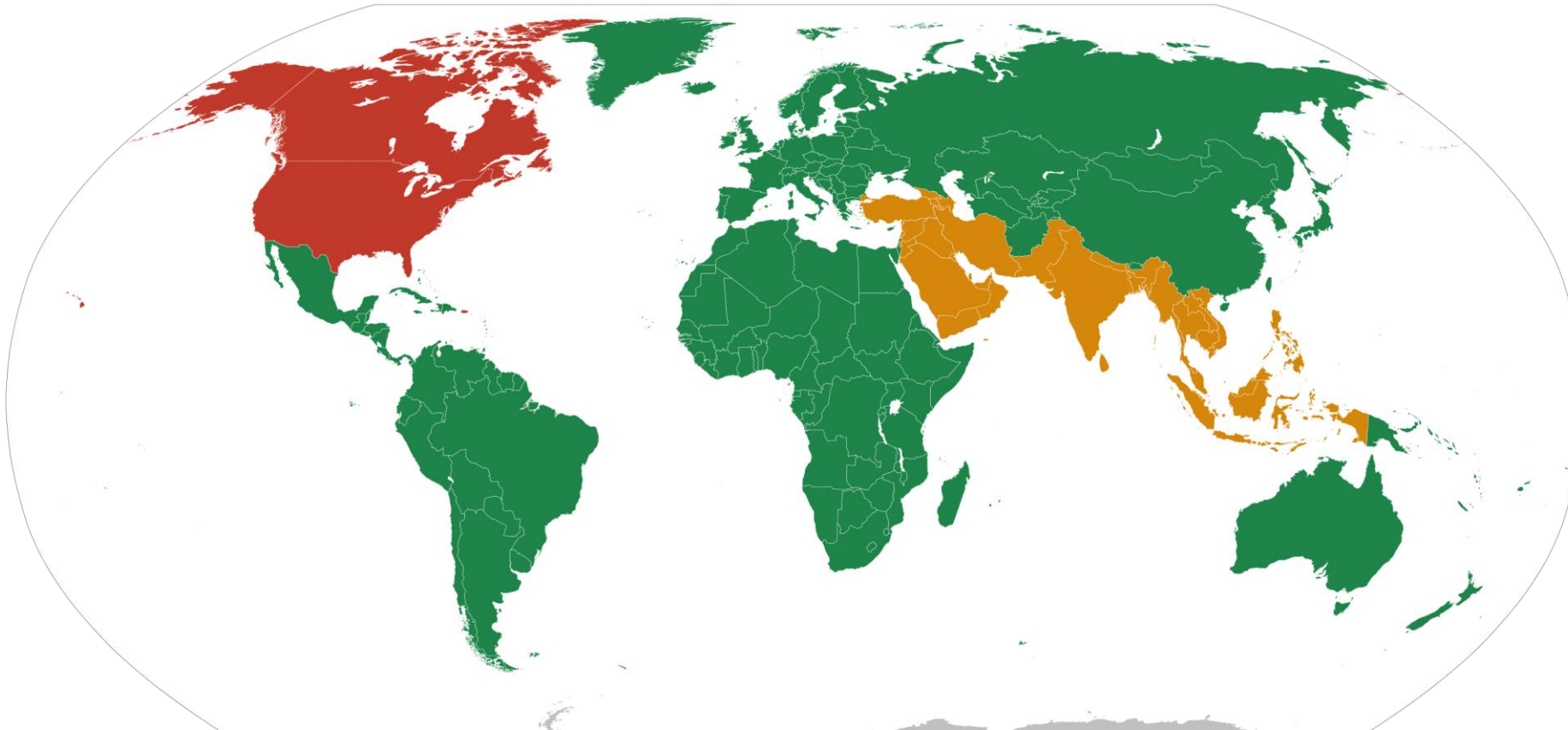
NY-GEO Conference 2026 • Bob Wyman

BTU and Tons are 19th-century units rooted in ice and steam. The regulatory ecosystem, the credit markets, and the electrified future all speak kW and kWh. It is time the equipment nameplate caught up.

kWh

North America Is Now Almost Alone with BTU & Ton

The US and Canada are the only major developed markets still rating HVAC equipment in BTU and Tons.



Unit Used in HVAC

BTU / Tons

United States
Canada

kW (SI standard)

Note: UK & Australia officially use kW. BTU appears only in some imported products.

Horsepower (HP + SI)

India · Pakistan
Middle East
SE Asia · Malaysia
Singapore · Indonesia

The BTU/Ton holdout is a North American phenomenon. Every GHP manufacturer serving global markets already produces kW-rated equipment. The domestic US/Canada label survives purely by inertia — and at increasing cost to the industry.

Australia · New Zealand

The Case for kW & kWh

Why BTU and Tons no longer fit the renewable thermal ecosystem

Federal Law

26 USC 48 sets ITC thresholds in kW. Contractors perform unit conversions at legally and financially consequential moments.

Policy Visibility

IEA & EIA track all renewables in kWh. GHPs are systematically undercounted — invisible in national energy policy debates.

Grid & Demand Response

Utilities work in kW for peak demand. FERC Order 2222 and demand-response programs require kW-native equipment data.

Decarbonization & ESG

Scope 1 & 2 corporate reporting needs compatible units. Tons create inconsistencies that auditors and frameworks will flag.

Consumer Clarity

Homeowners read kWh on utility bills. kW ratings let them estimate GREC earnings directly from the nameplate.

International Alignment

Every global manufacturer already rates in kW. The US BTU label adds cost and complexity for no offsetting benefit.

The Regulatory Ecosystem Already Speaks kW

Federal law, utility tariffs, grid programs, and building codes — all use kW and kWh.

26 USC 48 — Investment Tax Credit

Sets eligibility thresholds in kW, including the 1 MW threshold that determines which ITC structure applies. Contractors must convert tons to kW at a legally and financially consequential moment.

Utility Demand Charges

Commercial and residential tariffs (e.g. ConEd SC1-IV) impose peak demand charges in kW. Building managers optimizing those charges need kW-native equipment ratings to do the analysis directly.

PACE Financing & Investment Pro Formas

Developers and lenders evaluate projects using \$/kW capital cost and \$/kWh levelized cost — the same metrics applied to solar and storage. A GHP in tons forces translation in every pro forma.

FERC Order 2222 — Distributed Energy Resources

Opens wholesale markets to aggregated DERs. The entire order is denominated in kW. GHPs enrolled in demand-response programs must be registered in kW with grid operators.

ENERGY STAR & Building Codes

NYC Local Law 97, LEED, and ENERGY STAR benchmark performance in kWh/sf. GHP systems specified in tons must be translated before fitting energy models and compliance calculations — daily friction for every engineer.

EIA / IEA Energy Statistics

National and international energy agencies track all renewables in kWh. GHPs using incompatible units are systematically undercounted and underrepresented in energy transition modeling and policy analysis.

The GREC & T-REC Market: All Denominated in MWh

Four independent programs, from 2012 to today — every one chose MWh as its unit.

New Hampshire Est. 2012	Maryland HB 1007 (2021)	Virginia SB 508 (2024)	Pennsylvania & PJM Region Ongoing
1 T-REC = 1 MWh	1 GREC = 1 MWh	1 GREC = 1 MWh	1 AEC = 1 MWh (Tier II)
Market rate (ACP-constrained)	\$65 – \$100+ per credit	ACP set at \$45/MWh	Market rate via PJM-GATS
First-in-nation RPS thermal carve-out. Covers biomass, solar thermal, and GHP. Proved thermal REC markets are legally and administratively feasible.	Dedicated GHP carve-out in Tier 1 RPS. Post-2022 systems earn premium credits. Registered via PJM-GATS. 25% of carve-out must serve low-income facilities.	GHP added to RPS compliance. Registration requires a nameplate photo — rated in BTUs — for a program denominated entirely in MWh.	All 13 PJM states + D.C. eligible for lower-class GRECs. PJM-GATS is the shared MWh tracking infrastructure serving the full region.

The Market Has Already Decided: MWh

Every GREC and T-REC program independently converged on MWh. The equipment nameplate is the last holdout.

13

**PJM States +
Washington D.C.**

The entire PJM region participates in geothermal REC markets via PJM-GATS — all denominated in MWh.

4

**Independent Programs,
1 Unit Chosen**

New Hampshire (2012), Maryland, Virginia, and Pennsylvania — all independently chose MWh. No coordination required.

\$45–\$100+

**Per MWh Credit
(VA to MD range)**

Real market prices, real homeowner income — all priced in MWh. The nameplate says BTU; the check says MWh.



The Nameplate Irony:

Virginia's GREC registration requires a photo of the heat pump nameplate — which speaks in tons and BTUs — to enroll a system in a program denominated entirely in MWh. The industry photographs the evidence of its own unit mismatch and submits it to a kWh-native regulator. The conversion happens invisibly every time. kW-native ratings eliminate it at the source.

The GHP Nameplate Is the Odd One Out

Every stakeholder in the ecosystem speaks kW/kWh — except the equipment rating standard.

The Nameplate Speaks...

4 Tons of Cooling Capacity

48,000 BTU/hr Heating Output

3.5 Tons — half-ton increment only

COP requires a hidden unit conversion (1 Ton = 3.517 kW)

No direct link to electricity cost or GREC value

VS

The Ecosystem Speaks...

26 USC 48: ITC threshold in kW

Utility bills and tariffs: kWh

PJM-GATS GREC registry: MWh

FERC Order 2222 (DERs): kW

ENERGY STAR / NYC Local Law 97: kWh

The nameplate is the sole point of friction in an otherwise unified kW/kWh ecosystem.

The GHP Is the Odd Component in Its Own Project

From PACE loans to whole-home electrification packages, every other component speaks kW.

PACE Financing & Investment Analysis

Developers and lenders evaluate renewable projects using \$/kW capital cost and \$/kWh levelized cost. A GHP quoted in tons requires translation in every pro forma, creating apples-to-oranges comparison risk against solar, wind, and storage.

Performance Contracts & M&V

Energy service companies (ESCOs) guarantee savings in kWh under IPMVP — the international M&V protocol used for performance contracting in schools, hospitals, and municipal buildings. A BTU-rated GHP creates a unit seam at every reporting period.

Whole-Home Electrification Packages

GHP + heat pump water heater + EV charger + battery storage + solar are increasingly sold as integrated kW/kWh portfolios. The GHP rated in tons is the single component that breaks the unified load analysis every energy auditor must perform.

District Heating & Thermal Networks

Heat is beginning to be bought and sold in emerging thermal energy networks. European district heating markets denominate contracts in kWh as standard. An industry quoting in BTUs is poorly positioned to participate in that growing market infrastructure.

Tons Are Too Blunt a Measuring Stick

The unit is precise by definition — but in practice, half-ton increments obscure real capacity differences consumers deserve to see.

No manufacturer makes a 3.3-ton unit. Systems come in whole and half-ton increments only. A consumer comparing two quotes has no granular basis for comparison. In kW, the same systems reveal real, continuous capacity differences — differences that affect performance, electricity cost, and GREC earnings.

System Quote	Tons Label	Actual kW Output	Difference vs. Quote A	Est. Annual GREC Income
Quote A	3 tons	10.6 kW	—	Baseline
Quote B	3.5 tons	12.3 kW	+16%	~\$85–\$140/yr more
Quote C	4 tons	14.1 kW	+33%	~\$160–\$260/yr more

When a homeowner participates in a GREC program, understanding actual kW output has direct financial consequences. Tonnage labels hide those differences behind a coarse grid.

kW Makes the GHP Efficiency Story Tell Itself

COP should be: kWh of heat output ÷ kWh of electricity consumed. Simple, transparent, visible on the nameplate.

Today: Hidden Conversion Required

1. Nameplate: 48,000 BTU/hr heating output
2. Nameplate: 5 kW electrical input
3. Must know: 1 kW = 3,412 BTU/hr
4. Convert: $48,000 \div 3,412 = 14.07$ kW thermal
5. COP = $14.07 \div 5 = 2.81$
6. Most consumers — and many contractors — never complete this calculation correctly.



With kW Ratings: Transparent

1. Nameplate: 14.1 kW heating output
2. Nameplate: 5.0 kW electrical input
3. COP = $14.1 \div 5.0 = 2.82$

That's it. No conversion. No hidden math.

A COP of 3–5 is the GHP industry's single strongest competitive argument against fossil fuel heating. kW-native ratings let that argument speak for itself — on the nameplate, at the point of sale, to every consumer who can read a label.

What Needs to Happen — and Who Can Make It Happen

The destination is clear. The path requires coordinated action from industry, regulators, and manufacturers.



AHRI Standards Petition

The Air-Conditioning, Heating, and Refrigeration Institute sets equipment rating standards. A formal industry petition — backed by a coalition of GHP manufacturers, installers, and advocacy groups — is the necessary first step. A dual-labeling period (tons + kW) reduces transition friction for existing contractors.



DOE Regulatory Engagement

The Department of Energy has authority to set minimum efficiency standards and labeling requirements for HVAC equipment. Regulatory engagement — backed by GREC market data and the 26 USC 48 alignment argument — can accelerate AHRI action and provide a federal mandate.



GREC Program Coordination

State GREC administrators (MD PSC, VA SCC, PA PUC) and PJM-GATS should align registration requirements to kW-rated equipment. Requiring kW capacity data on GREC applications creates a market-pull from the credit side — an incentive independent of AHRI action.



Industry Data & EIA Visibility

EIA and IEA invisibility is correctable. A coordinated industry data initiative — GHP installations reported in kW and kWh — begins building the statistical record that supports future policy arguments, RPS carve-outs, and infrastructure funding.

Your grandchildren won't be talking about BTUs.



Electrification programs, climate commitments, and air quality standards point toward one destination: a world where fossil fuel heating is a small residual, not the dominant technology. That world is coming — in decades, perhaps longer, but it is coming.



The primary argument for keeping BTU — compatibility with fossil fuel heating systems — dissolves with those systems. Defending BTU for fossil fuel compatibility is defending a technology that public policy is deliberately phasing out.



We know where this ends. The only question is whether the geothermal industry leads the vocabulary change — shaping AHRI standards, capturing EIA visibility, dominating the GREC markets — or waits to be dragged through it. Why wait?

2050

Measurement: The Demand to be Energetic (to kW or kWh)

Mark Kleinginna

Emergent Urban Concepts



“Everyone last year was talking about TENs from the natural gas utility perspective, now all we are hearing about TENs is from the electric grid side”

- An unidentified speaker at the TENs panel yesterday

How do we design the Electric Grid and why is it important?

- The electric grid is sized to meet local and regional instantaneous “design day” demands (expressed in kW)
- Thermal Networks provide an unloading of the electric grid locally AND regionally
- The payment for electric generation capacity is made in \$/MW-yr. (ISO Capacity Market)
- The payment for electric transmission capacity is made in \$/MW-mo. (ISO Network Transmission)
- The payment for electric distribution capacity is made in \$kW-mo. (EDC Tariff)

Beat the Peak (Actually Design Day).



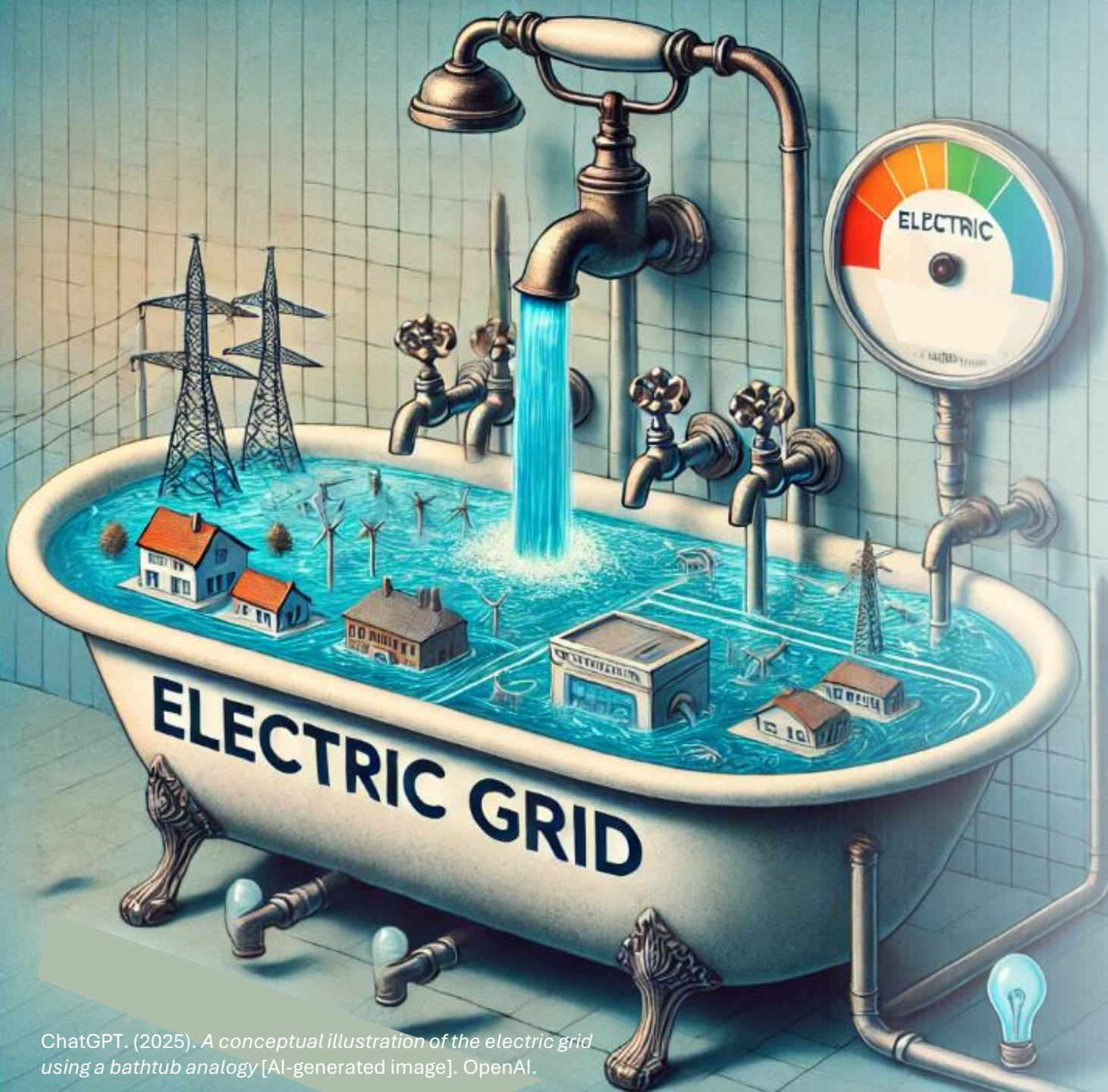
<https://hackaday.com/2016/02/22/a-field-guide-to-the-north-american-utility-pole/>

The biggest value proposition NYGEO members can provide in a decarbonized future **is peak electric demand modulation.** Policymakers and regulators must as soon as possible equitably value thermal energy infrastructure and traditional electric network infrastructure.

The ONLY Way to monetize the value of the TEN to the Grid is to get paid in \$/kW....

If we, as developers of TENs want our crack at that pot of money...we need to work all the way back through our equipment and speak in those units throughout....





Imagine the grid (thermal and electric) acting like a bathtub; energy is put in and taken out in multiple ways . . . and this must be in balance across both infrastructure systems.

The only way to translate across it is to speak in common units (kW)

Q. But doesn't the energy matter as opposed to the demand (kWh vs. kW)?

A. Only to the extent that costs across the systems are **CAUSED** by the annual energy vs. the design demand



MEASUREMENT MATTERS

ZEYNEB MAGAVI

MARCH 2026



Which units of energy may seem irrelevant given it is the same amount of energy, BUT matching units with electric energy increases understanding that can help drive transformative change.

- ▶ **PUBLIC**
- ▶ **POLICY MAKERS**
- ▶ **PLANNERS**
- ▶ **INVESTORS**

ONE ENERGY BILL

In Framingham, residents connected to the geothermal network get a bill that includes thermal energy. Customers had to learn to recognize the energy savings across total energy.

Meter Number	Current Read	Previous Read	Current Usage	Reading Type
P019588	677	653	24	Actual

Service Reference: 90749950
24 x Therm factor of 1.0306 = 25 Therms Billed Usage for 30 Days

Monthly Therm Use						
Oct	Nov	Dec	Jan	Feb	Mar	Apr
28	51	107	147	131	94	70
May	Jun	Jul	Aug	Sep	Oct	
29	30	17	14	18	25	

Meter Number	Current Read	Previous Read	Current Usage	Reading Type
2714657	5523	5675	-152	Actual

Service Reference: 90749949

Monthly kWh Use						
Apr	May	Jun	Jul	Aug	Sep	Oct
0	0	0	0	0	0	25
Nov	Dec	Jan	Feb	Mar	Apr	
65	388	530	564	12	0	

October: 28 Therms Gas Bill + 25 kWh Electric Bill

One 'THERM' is 100,000 BTUs

So 28 Therms is 2.8 Million BTUs... is 820.4 kWh

Looks the same, BUT REALLY 32 TIMES THE ENERGY!



ENERGY IS ENERGY & EFFICIENCY MATTERS

Highest monthly bills:

Gas: 4307 kWh, Electric 564 kWh. **7.5 TIMES!!**

4307 kWh x 90% efficiency gas boiler = 3876

IF COP of 1 > 3876 kWh (electric resistance)

IF COP of 2 > 1938 kWh (ASHP)

IF COP of 4 > 969 kWh (Geo Heating & Cooling)

IF COP of 6 > 646 kWh (Geo Network)





INTEGRATED POLICY & PLANNING

For example, policy such as an RPS can more easily be adapted to be met by avoided kWh through geothermal network deployment.

Which energy infrastructure, where, and when can optimize our investments.

HOW TO MOVE TO kWh (TH)

Align all geo orgs to commit to switching

Get the DOE OG (Office of Geothermal) on board

Integrate the units into legislation where reasonable

Write a clear and simple white paper for regulators

Systematically identify policies or programs to update



kW & kWh (TH)

ZEYNEB MAGAVI

MARCH 2026



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