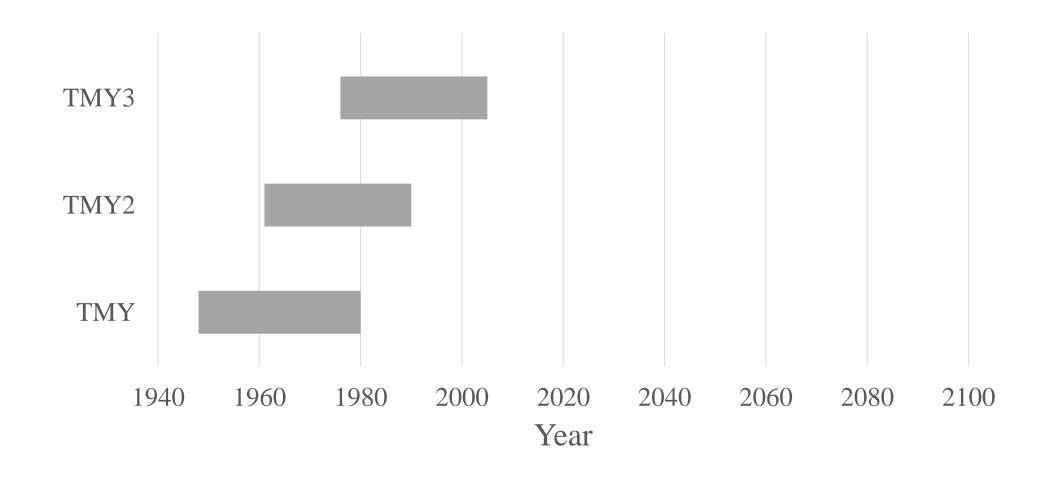
Why design with old data?

Alexandra Calvén, Arup

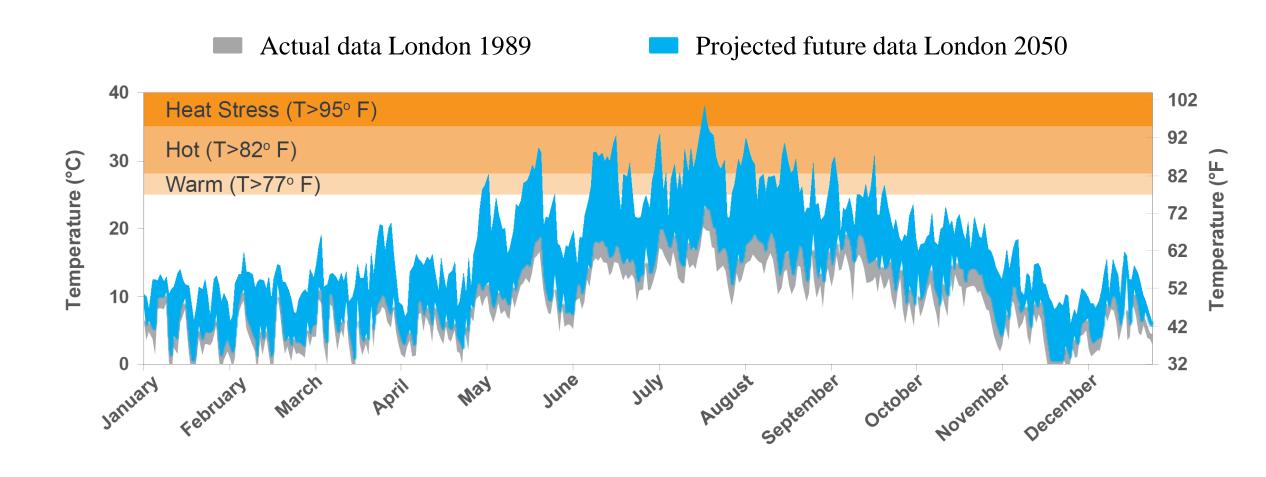


Every day in the US
100,000 Architects &
250,000 Engineers
are using weather data that is
decades outdated.

Outdated design weather files



Why does it matter?



Why does this matter to district energy?

System sizing

1990

Coolin	Heating (99%)	
Dry bulb (DB)	Wet bulb (WB)	Dry bulb (DB)
89.7°F	74.0°F	15.6°F



~ 4,000
Tons



2090

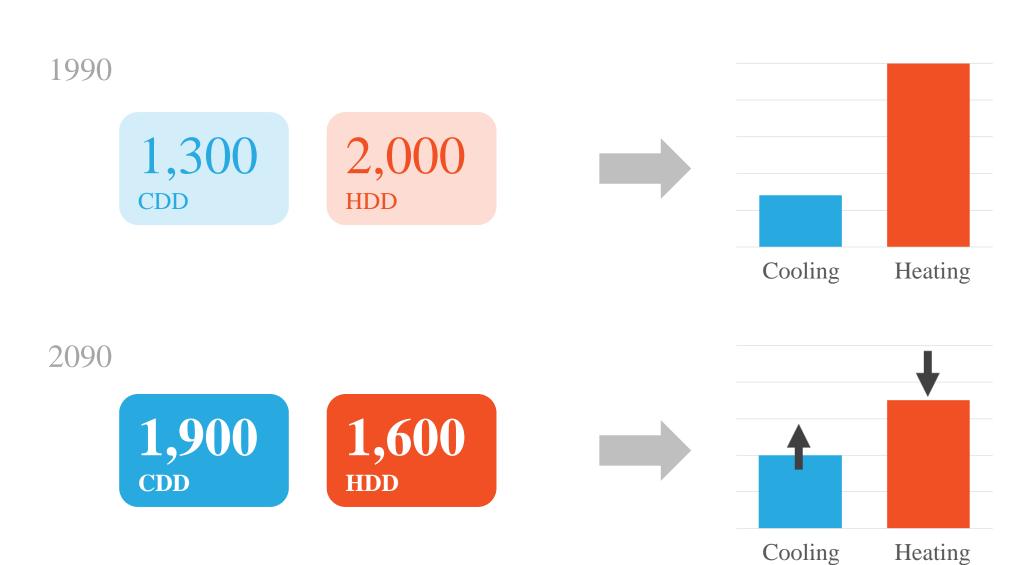
Coolin	Heating (99%)	
Dry bulb (DB)	Wet bulb (WB)	Dry bulb (DB)
93.8°F	78.2°F	18.3°F



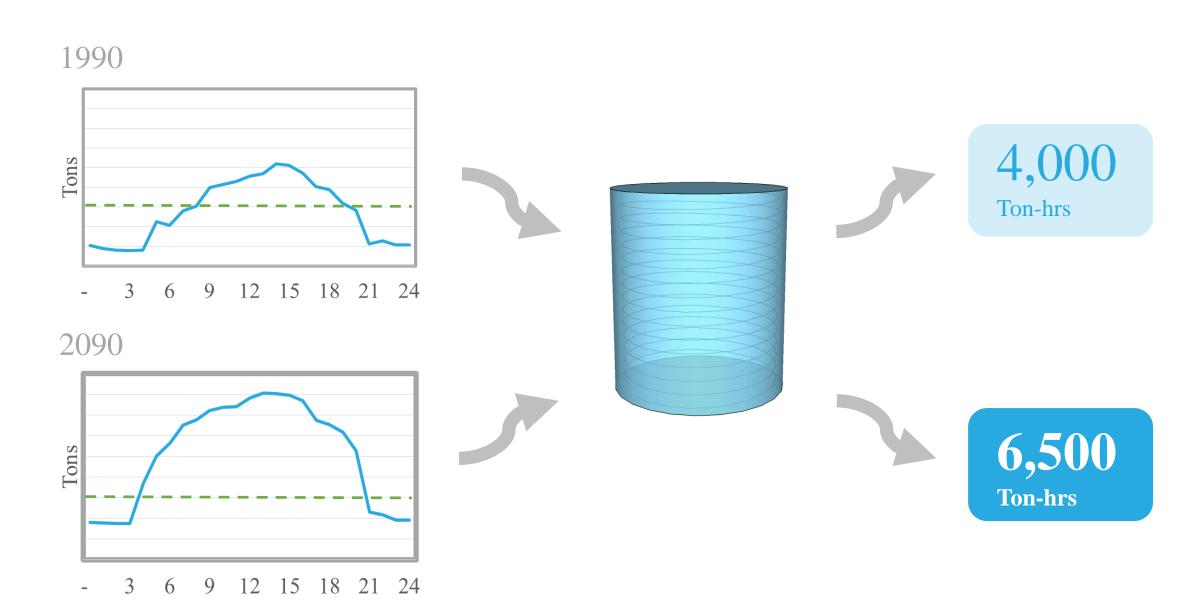




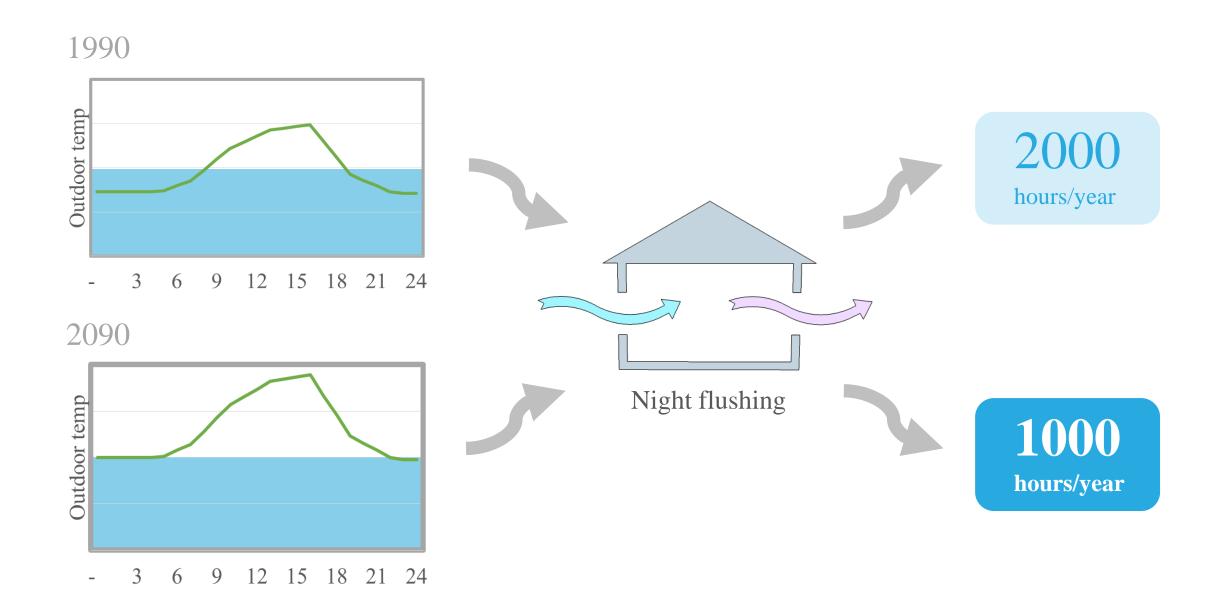
System selection



Thermal storage

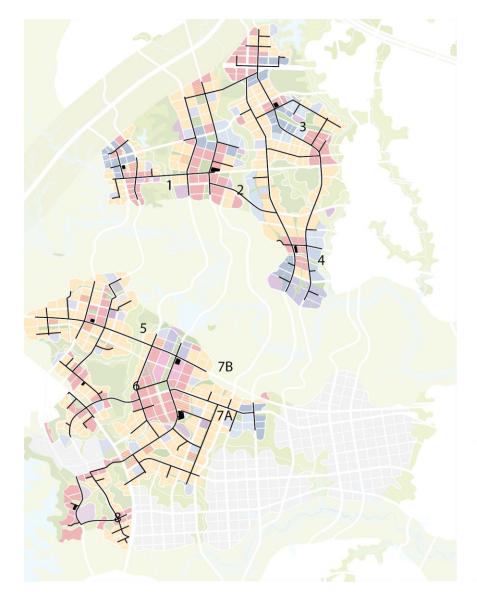


Resilience of passive design strategies



Case study: City-scale energy master plan

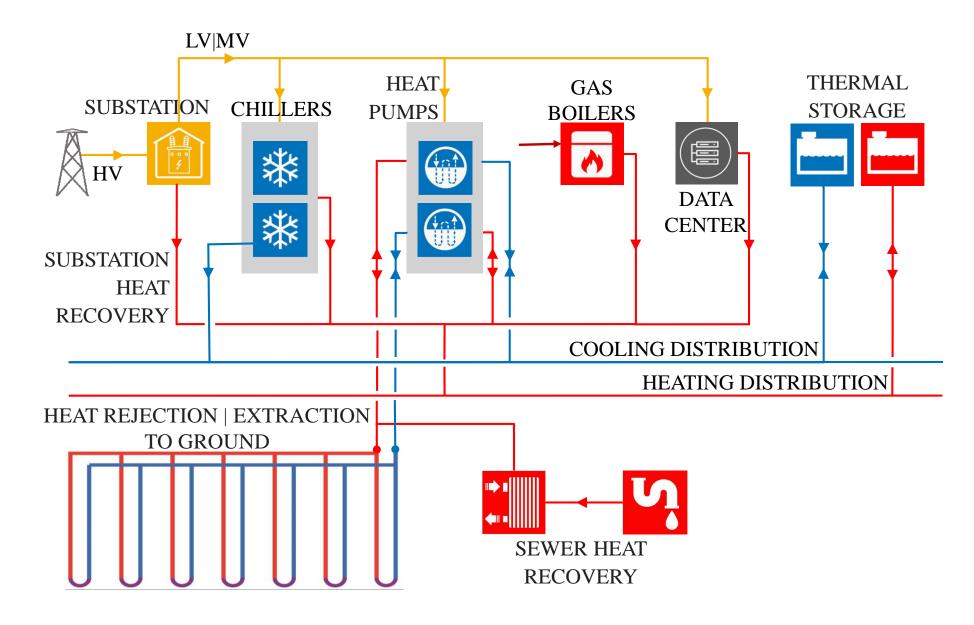
Thermal plant locations, sizes, and distribution



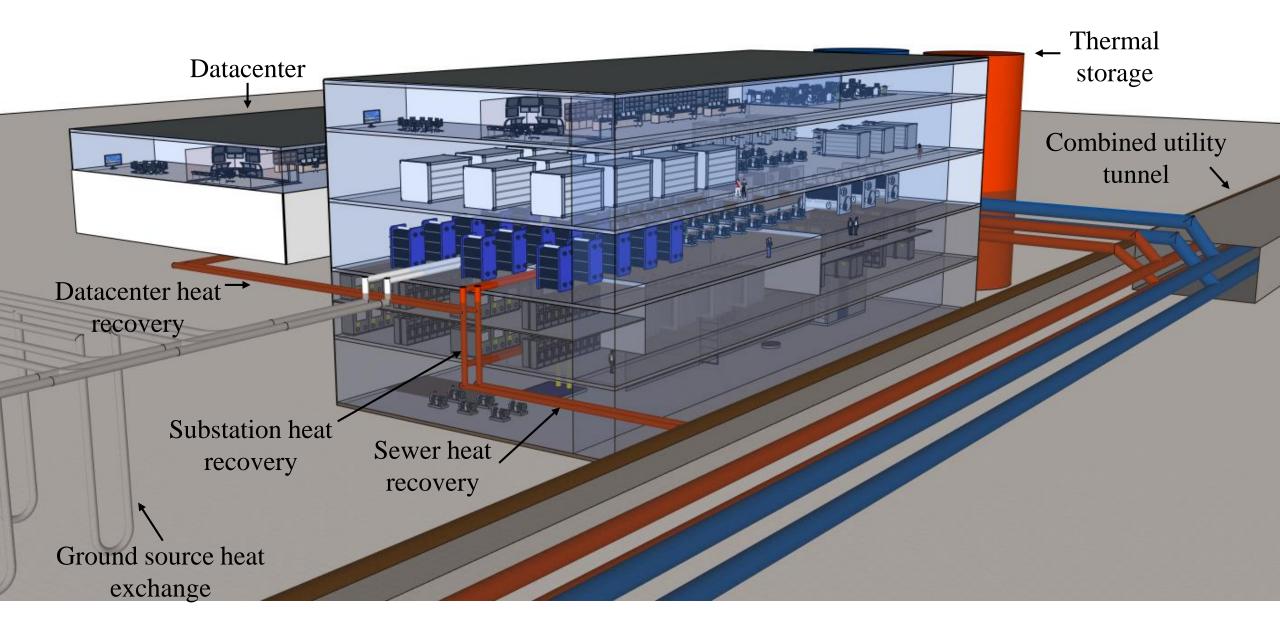
Plant	Peak	Peak	Plant Area
	Heating	Cooling	
	Load	Load	
	MW	MW	sqm
1	33	55	2,137
2	125	197	7,454
3	94	143	5,485
4	28	59	2,221
5	62	79	3,186
6	19	22	1,001
7A	94	129	5,000
7B	74	102	3,960
8	59	59	2,548

- Thermal piping (heating and cooling)
- Central plant (assumes 2 floors)

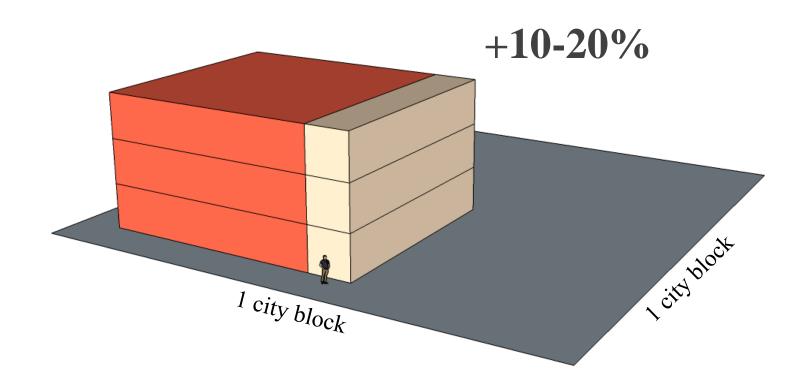
Integrated thermal strategies



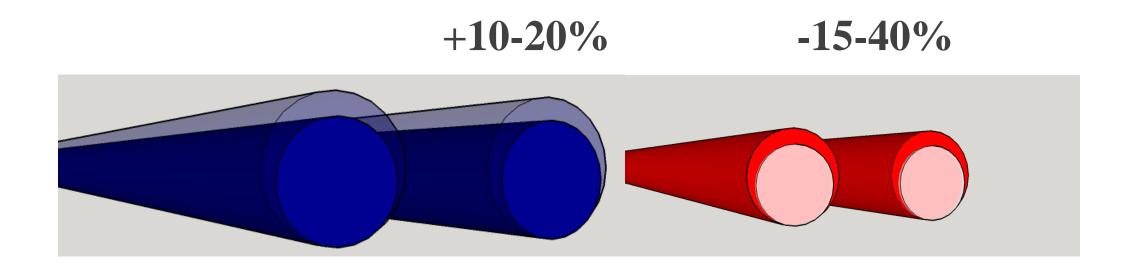
Integrated central utility plant



Impact on plant massing

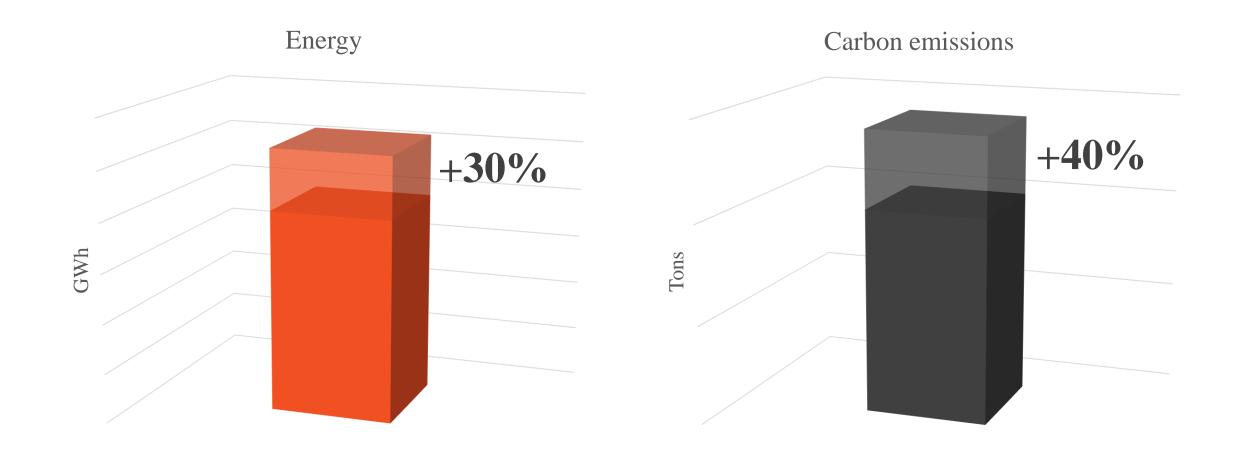


Impact on pipe sizing



- Challenging to upgrade pipes
- Lower chilled water temperature instead?
 - Impact on design buffer
 - Higher operational costs
- Heating system already oversized?

Impact on energy use and carbon emissions

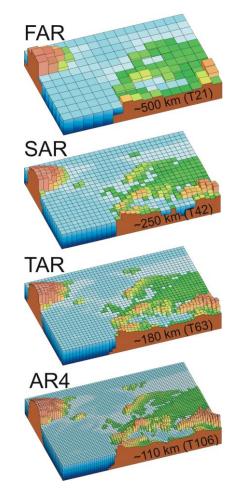


Climate science: Background and future weather projection

Global climate model spatial resolution

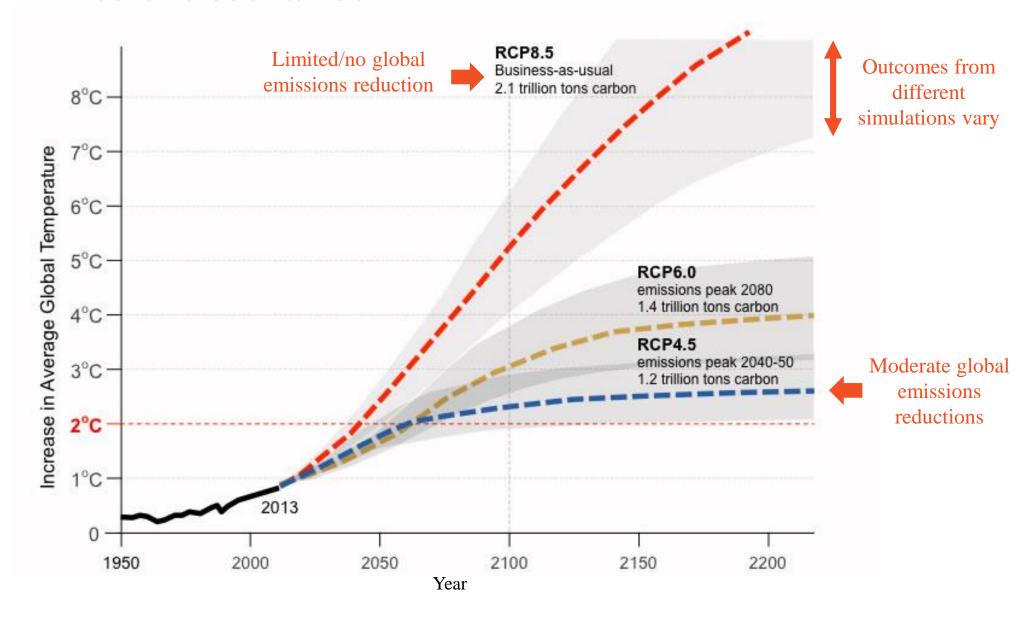
Evolution of IPCC Reports:

- 1. FAR 1990
- 2. SAR 1995
- 3. TAR 2001
- 4. AR4 2007
- 5. AR5 2013

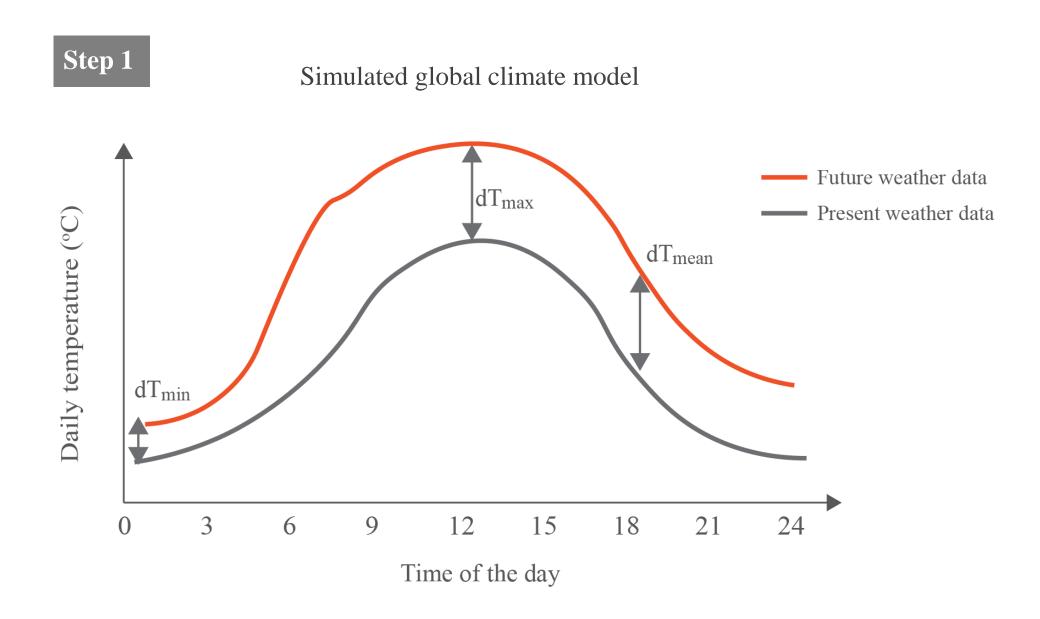


@ IPCC AR4 (2007)

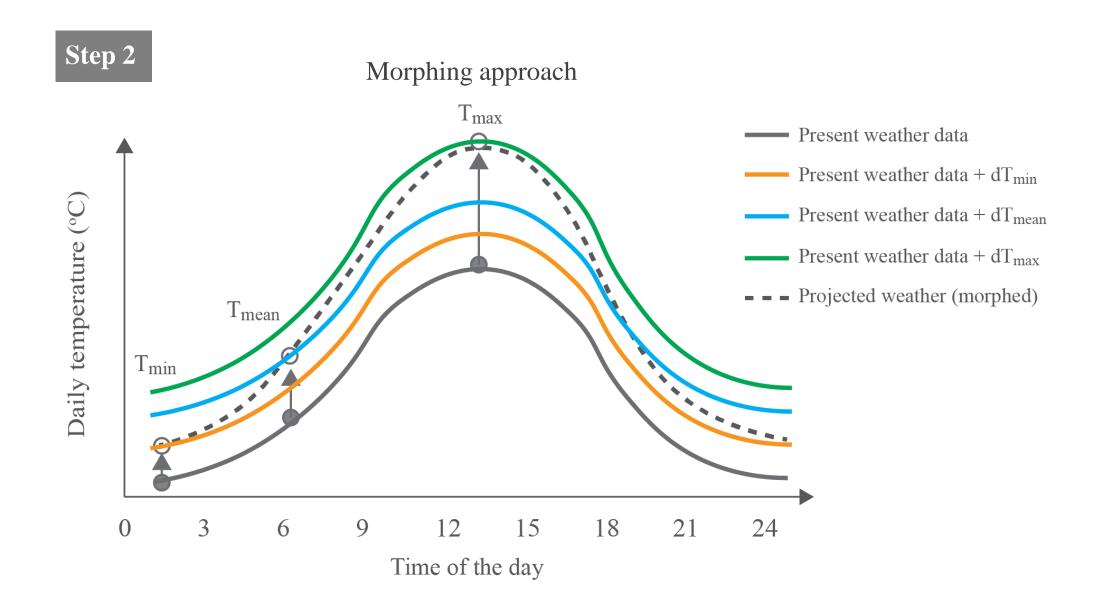
Emissions scenarios



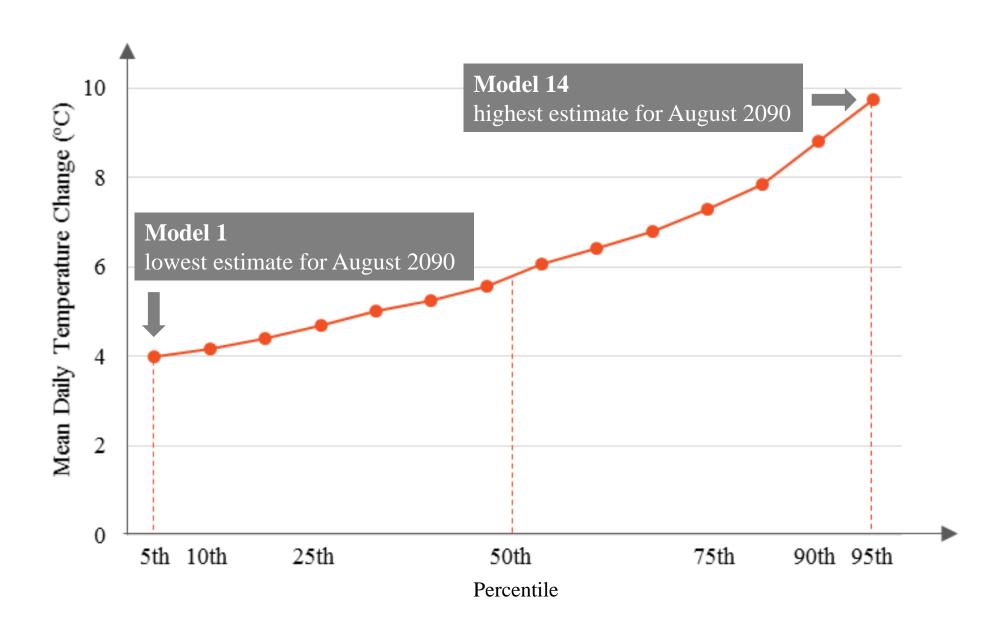
Morphing approach



Morphing approach



Ensemble of climate models



Free visualization on www.weathershift.com

WEATHER SHIFT

Country United_States_of_America ▼

Location San_Francisco ▼

Emission scenario RCP 8.5 ▼

Warming percentile 50% (median) ▼

View Future Weather

or upload EPW file near Shift location

Buildings and infrastructure built today will experience significantly different weather patterns over the course of the 21st century due to the impact of climate change.

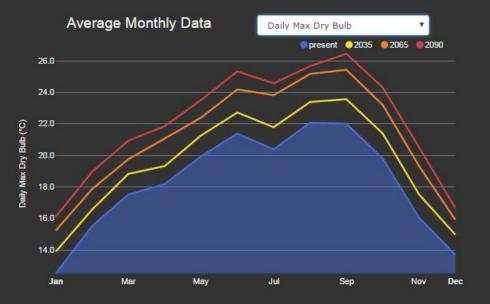
The WeatherShift™ tool uses data from global climate change modeling to produce EPW weather files adjusted for changing climate conditions. (EPW files contain hourly values of key weather variables for a typical year and are intended to be used for simulating building energy requirements.) The projected data can be viewed for three future time periods based on the emission scenario selected to the left.

* This site is preloaded with some EPW files provided to the public domain by the US Department of Energy. For all other shift locations - indicated by an * -- an EPW file must be uploaded as the basis for shifting.

Purchase and Download WeatherShift EPW Files from IES

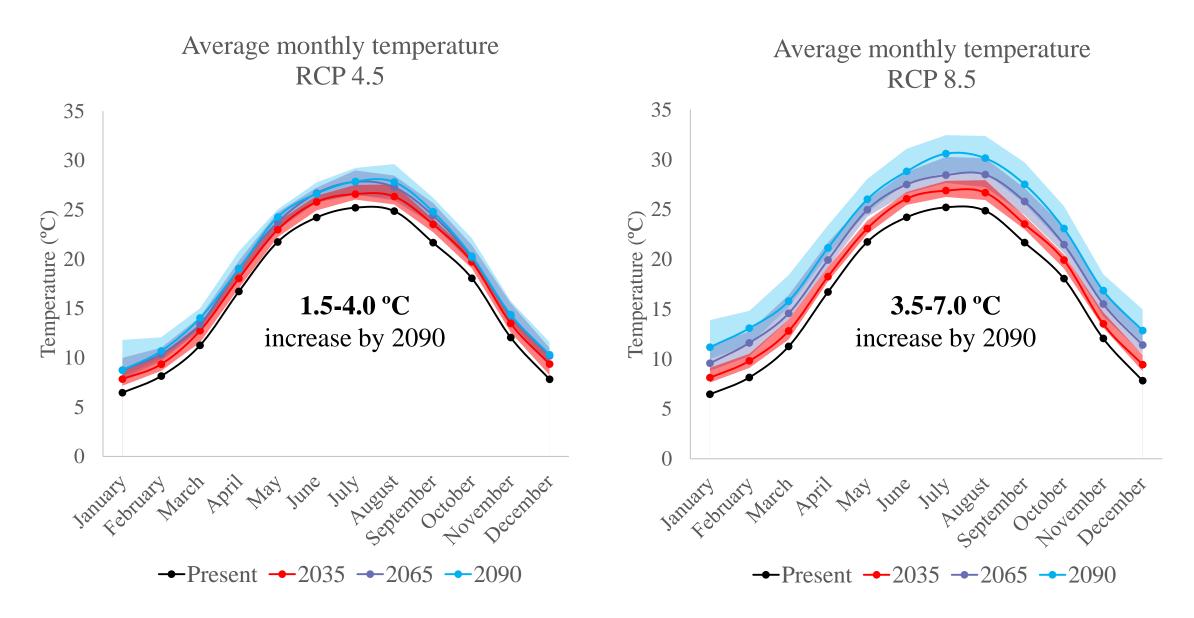


Projected changes in typical weather conditions can be reviewed month-by-month for a number of weather variables.

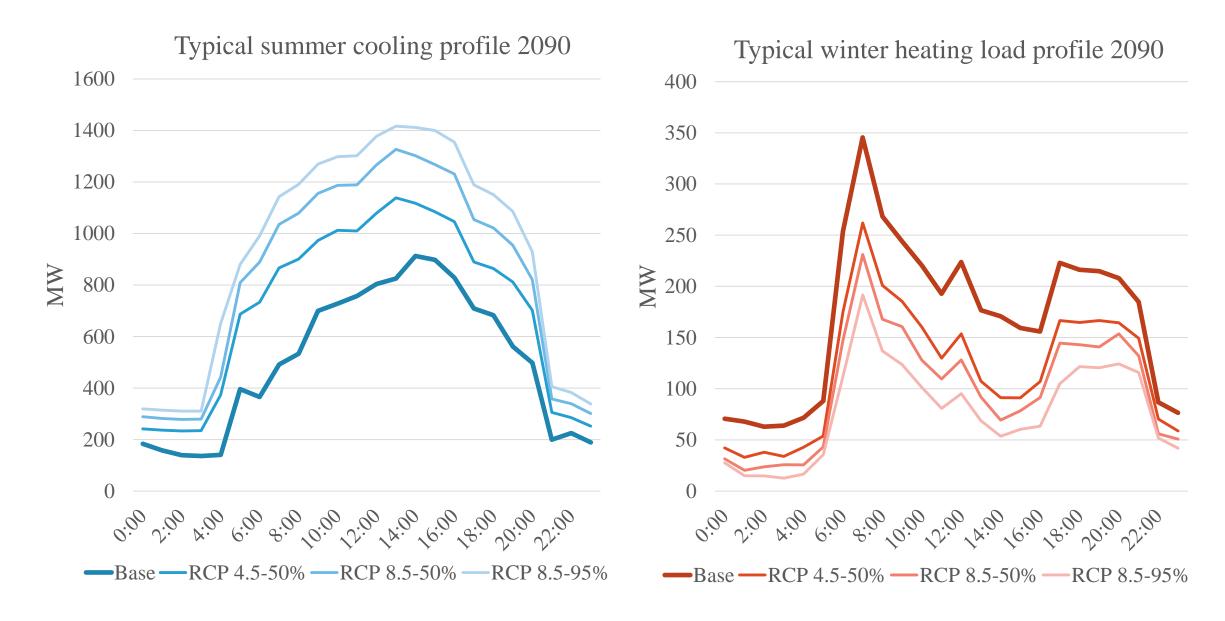




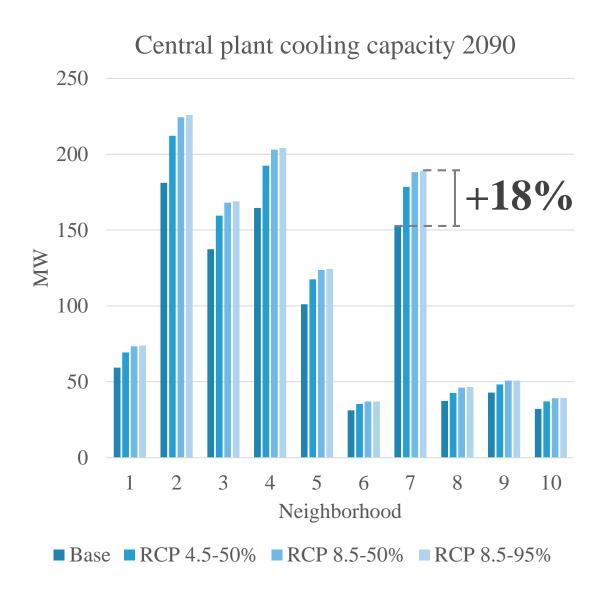
Weathershift analysis

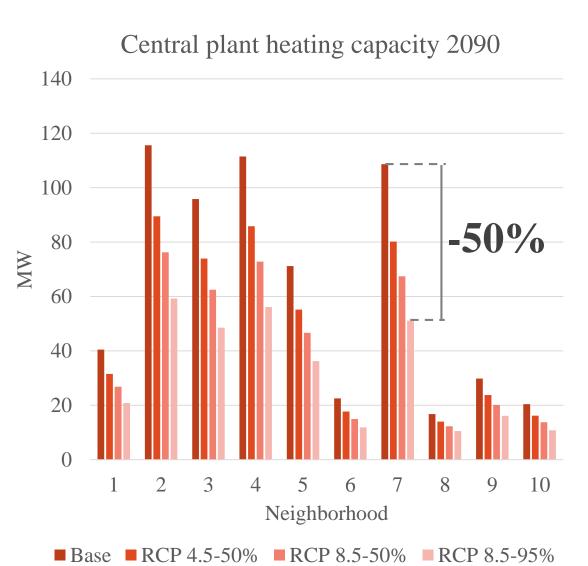


Impact on loads



Impact on plant sizing





Summary

- District energy systems will operate for a long time
- Design for change
- Emerging best practices
 - Solar shift for PV
 - Wind shift for wind power
- Stress test your system



