Unassuming the assumptions:

Lessons in Mexico

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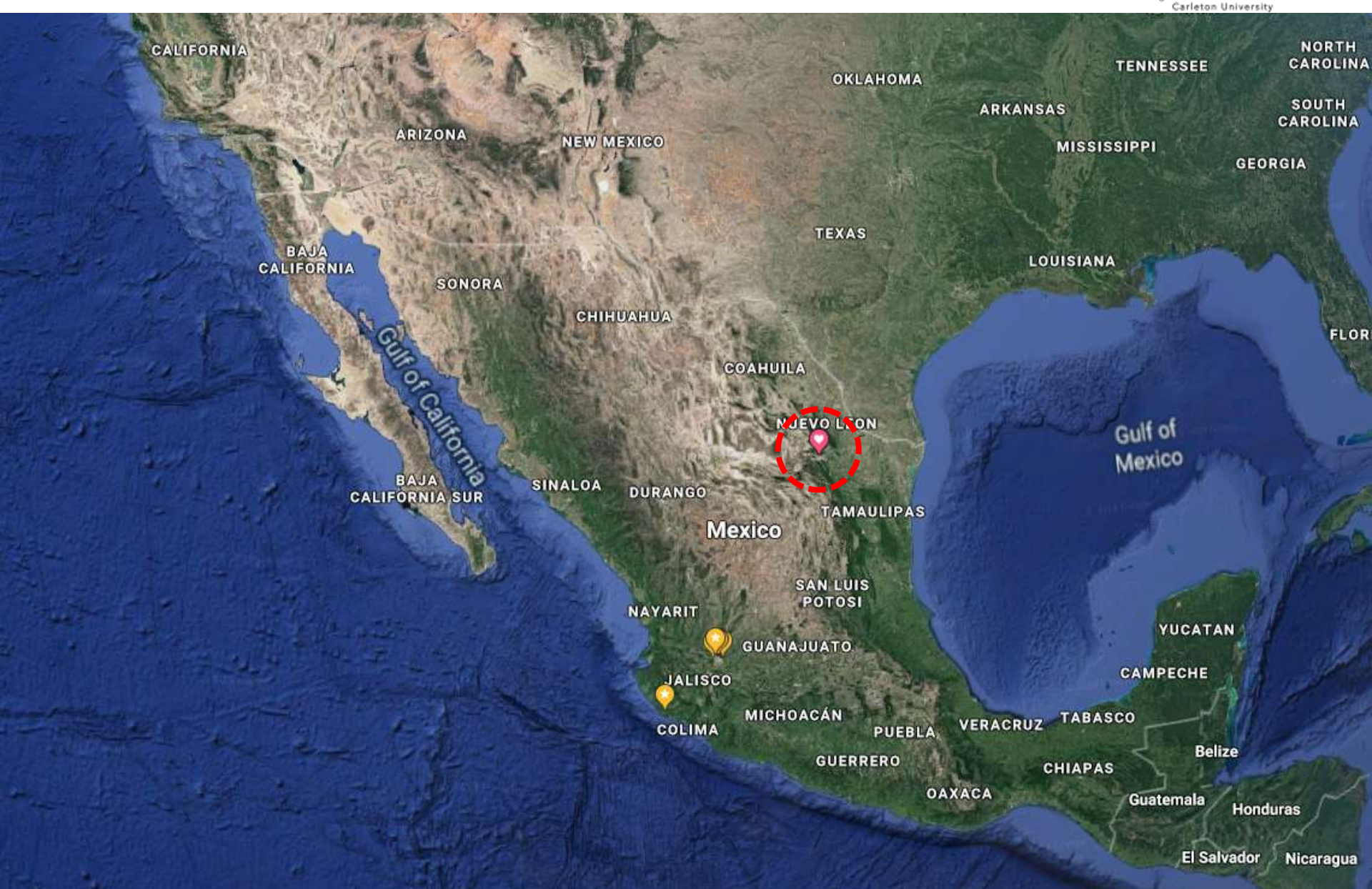
Background

- MITACS internship w/ Canadian consultancy/developer
- Sustainability oriented
- Recent expansion to Mexico
- Partnered with local architecture firm
- Some exposure to BPS

Backgroud


CALIFORNIA
ARIZONA
NEW MEXICO
OKLAHOMA
TEXAS
ARKANSAS
TENNESSEE
NORTH CAROLINA
SOUTH CAROLINA
MISSISSIPPI
GEORGIA
LOUISIANA
BAJA CALIFORNIA
SONORA
CHIHUAHUA
Gulf of California
COAHUILA
NUEVO LEON
Gulf of Mexico
BAJA CALIFORNIA SUR
SINALOA
DURANGO
TAMAULIPAS
Mexico
SAN LUIS POTOSI
NAYARIT
GUANAJUATO
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CAMPECHE
JALISCO
MICHOACÁN
COLIMA
PUEBLA
VERACRUZ
TABASCO
GUERRERO
CHIAPAS
Belize
OAXACA
Guatemala
Honduras
El Salvador
Nicaragua

Backgroud

- Mid-upper class urban home (x 110 units)
- 3 storeys, 150m^2, 3 bedrooms, 5 PTAC units w/ resistive heating , 2-5 occupants
- All-electric, net-metered, PV capacity

Issue

Trace 700 & EnergyPlus

Different model behaviours shown across 4 scenarios

High & Low occupancy,
Proposed & Reference construction

Overall Goals

1. Accurately forecast energy consumptions to decide PV capacity

2. Assess different BPS tools for in-house adoption

3. Validate regional assumptions to be re-used in future projects

Questions

1. Which software is more dependable?

2. Is the number correct?

3. What weather file to use?

- Companies won't share models or libraries
- Reported residential consumption data limited

Approach (1)

- Learned Trace700

- Tried to recreate Trace700 model
  - ~40 attempts, on limited info
  - Identified inconsistencies & filed questions
  - “secret sauce”?

- Met with local energy modellers in Monterrey, MX
  - Many questions answered, some points got reflected on the model
  - Gained access to detailed modelling info
  - Learned local norms on space conditioning

Approach (2)

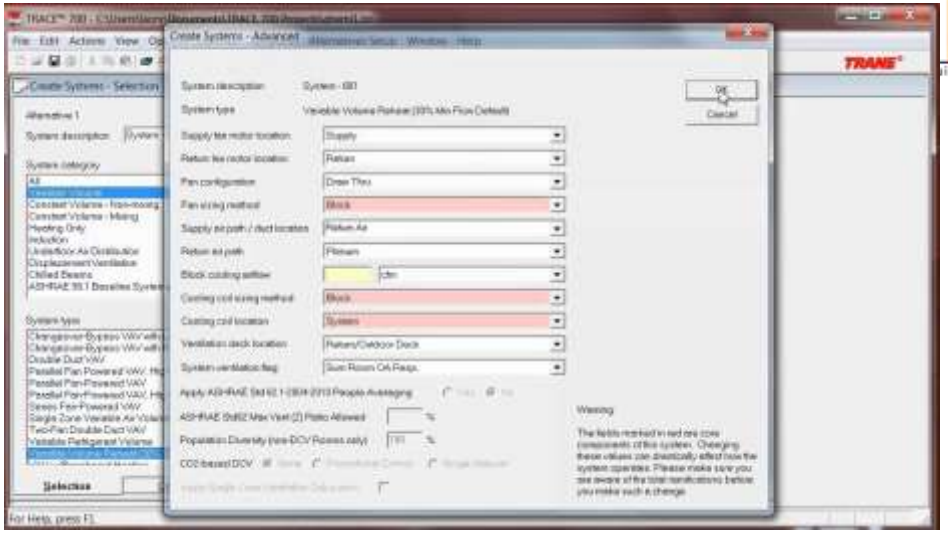
- Recreated existing model in Trace (Δ 1% - 4%)

- Built an EnergyPlus model (Δ 7% - 20% to Trace700)

  (then took a different approach to account for natural ventilation)

- Provided new forecasts & recommendations

Trace 700



- Primarily an HVAC sizing tool
- Local partner's choice based on user-friendliness and reporting
- Most reporting focused on peak load & HVAC sizing
- Aggregated reporting (no hourly temp, only binned histogram)
- No parametric simulation or API

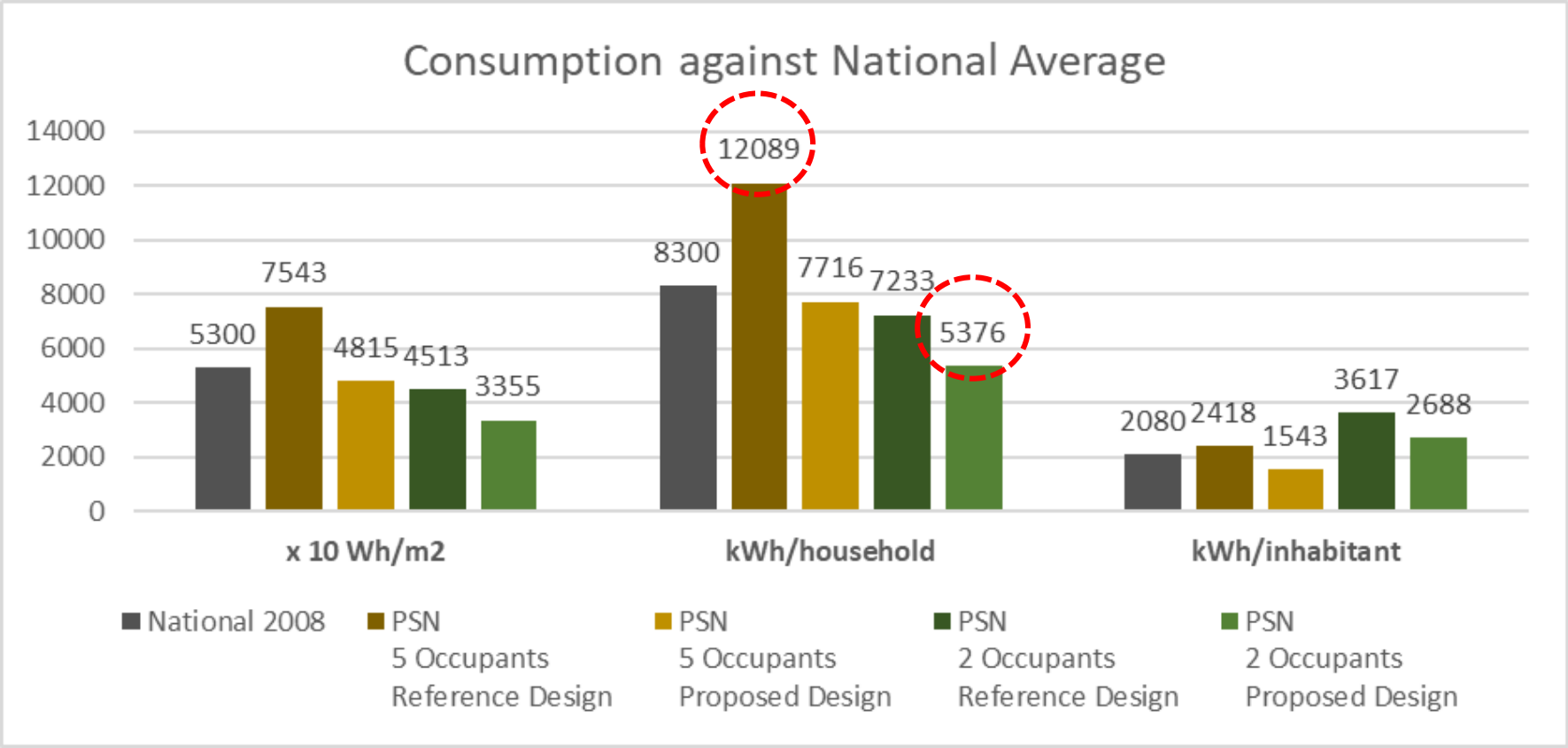
Confusing context

- "Mexicans don't like to heat houses"
  -> perhaps more tolerant of temperatures?
  -> perhaps due to lack of HVAC
  (2008 national stat: 2% of homes have heating)

- "Mexicans mostly rely on natural ventilation for cooling"
  "AC is used just to 'take the edge off'"
  (2008 national stat: 23% of homes have AC)

- "These homes will leverage on the comfort they provide"
  -> so consumption will be higher than average
  -> PV means even cheaper electricity

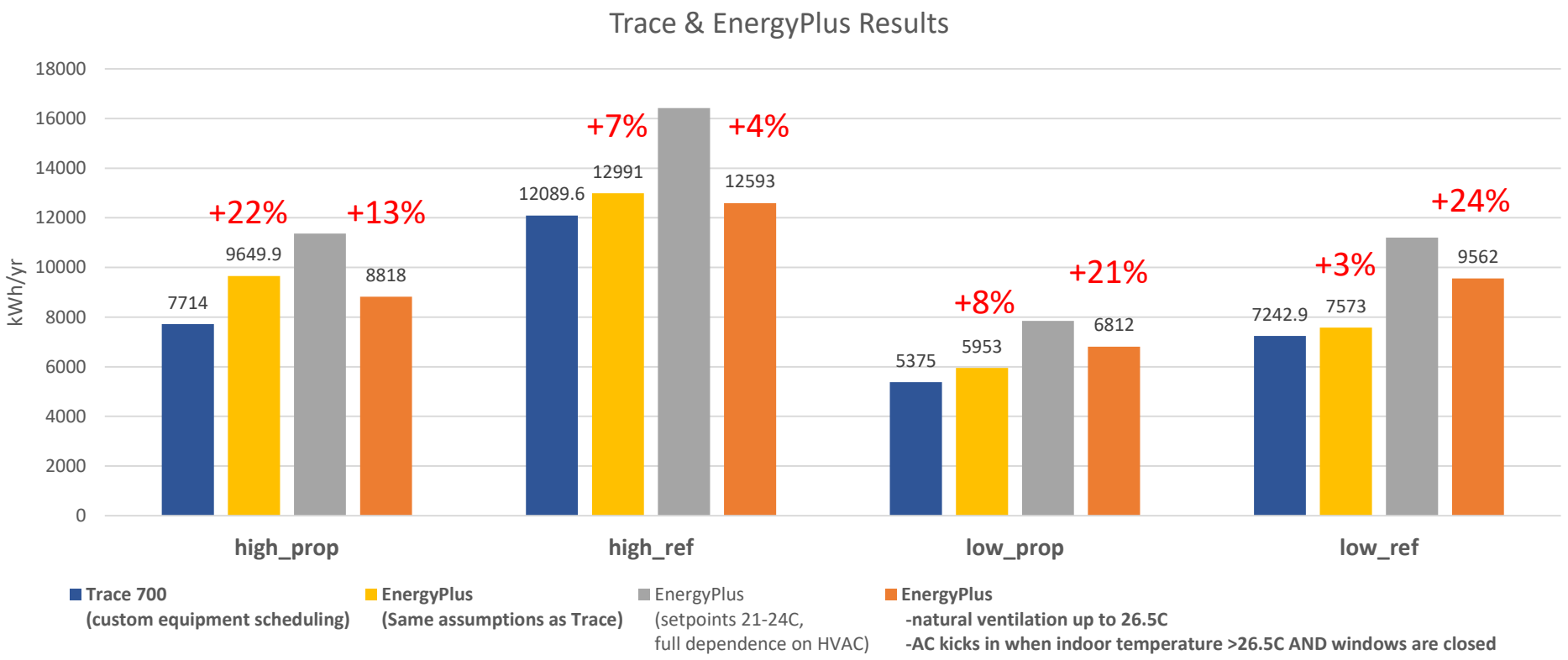
Comparison against National Stats



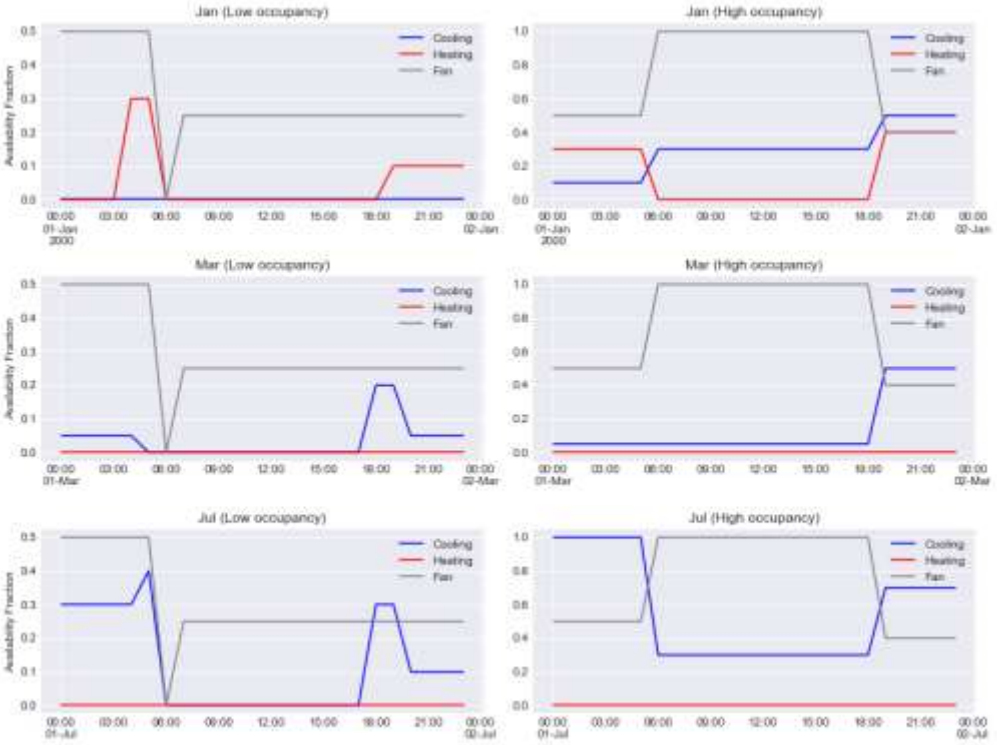
-> However, National stats includes vast areas of poverty, and ignores urban/rural boundaries

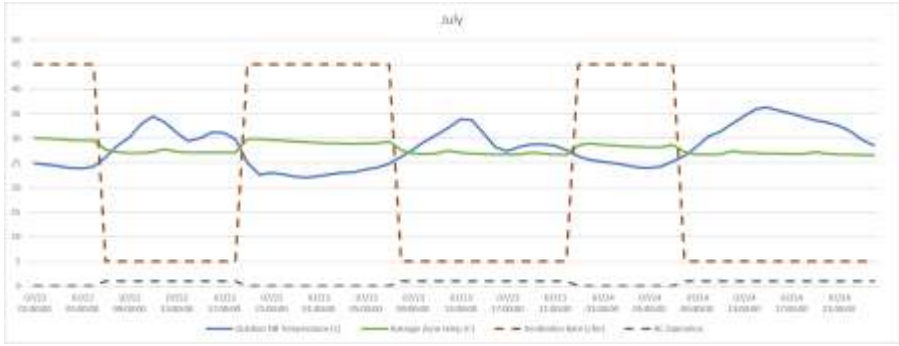
-> This level of HVAC is normal in this city

EnergyPlus model



Different modelling approach





Equipment availability limits → Conditional window operation

Windows open when between OADB 21 C to 26.5 C
AC kicks in when indoor DB > 26.5 C AND windows closed

Software

Trace700

EnergyPlus

Trace700

- Focus on HVAC sizing
- No energy balance

  -> aggregated reporting
  (no hourly data, but just binned histograms)
- Extensive HVAC options, but focused on commercial setup

EnergyPlus

- Focus on Building performance analysis
- Energy balance @ every timestep on all surfaces and zone air

  -> detailed sub-hourly reporting for every variable
- HVAC setup more involved, but everything is possible

Trace700

- Cannot be accessed through scripting (less systematic input)
- Difficult to manage multiple scenarios
- Multi-layered, hidden overrides
- Overridden values reported
- Less transparency – difficult to troubleshoot
- Program support soon to end

EnergyPlus

- Systematic input access through scripting, even for multiple scenarios
- Parametric simulation
- Extensive summary reports
- More transparency

Thank You

Questions?

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