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Making use of the new Dynamic Daylight Simulation (DDS) file format

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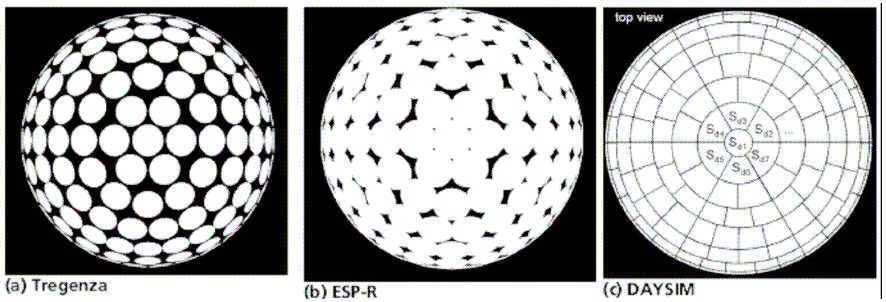
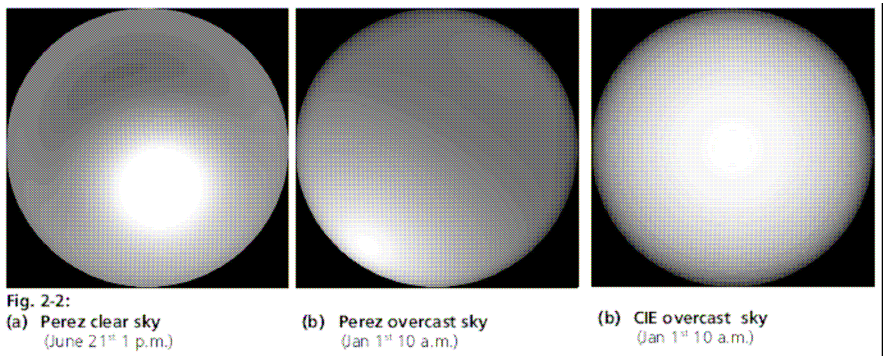
Daylight coefficients (… in a nutshell!)

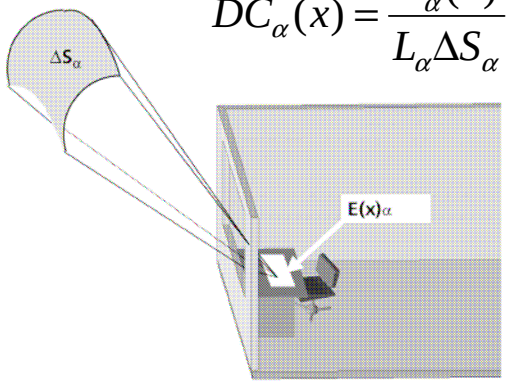
- Sky Division



- Sky Model



$$DC_\alpha(x) = \frac{E_\alpha(x)}{L_\alpha \Delta S_\alpha}$$



images from Reinhart PhD thesis (2001)

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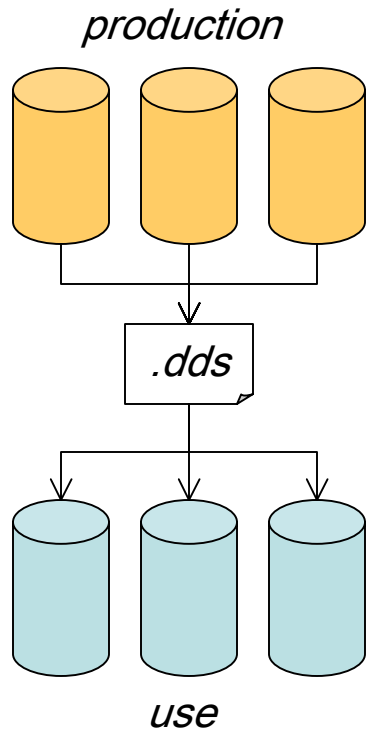
Dynamic Daylight Simulation (DDS)

- Standardized daylight coefficient output (.dds file)

lighting applications (e.g. Radiance)



third party applications (e.g. energy simulation; daylight autonomy)

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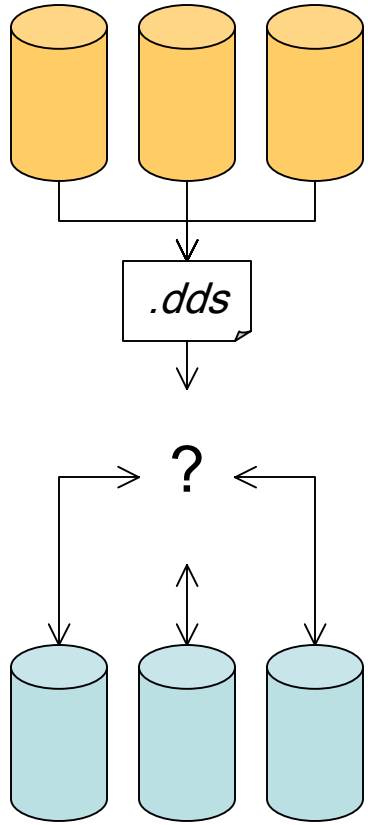
Dynamic Daylight Simulation (DDS)

- DDS module basics
  - process .dds files for intended uses
    - predicting il-luminance & ir-radiance @sensors
  - *in sync* with .dds file concept, e.g.
    - sky division, nb. of sun/sky/ground elements
  - fold DCs with Perez sun/sky efficacies (1990) & all-weather sky model (1993)



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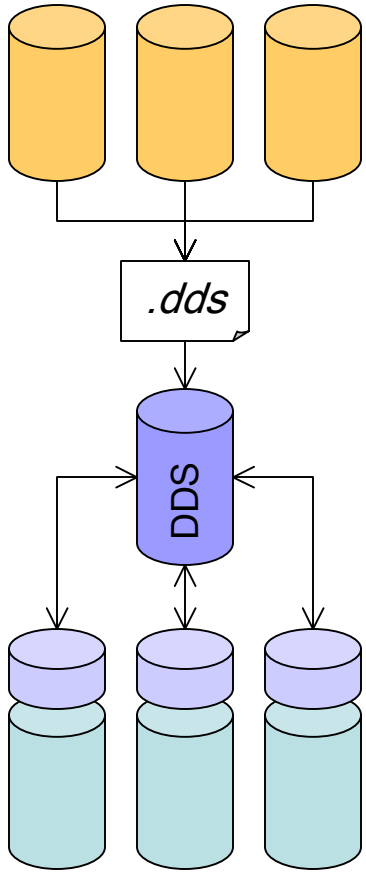
Dynamic Daylight Simulation (DDS)

- DDS module features
  - self-containment
    - most functionality is common to all parent apps
      - i.e. energy simulation vs. daylight autonomy
    - own internal data model of DCs & sun/sky/ground elements
      - independence *vis-à-vis* parent apps (plug & play)
    - variable resolution
      - boundless nb. of zones, sensors, sources
      - sun/sky division scaling factor …



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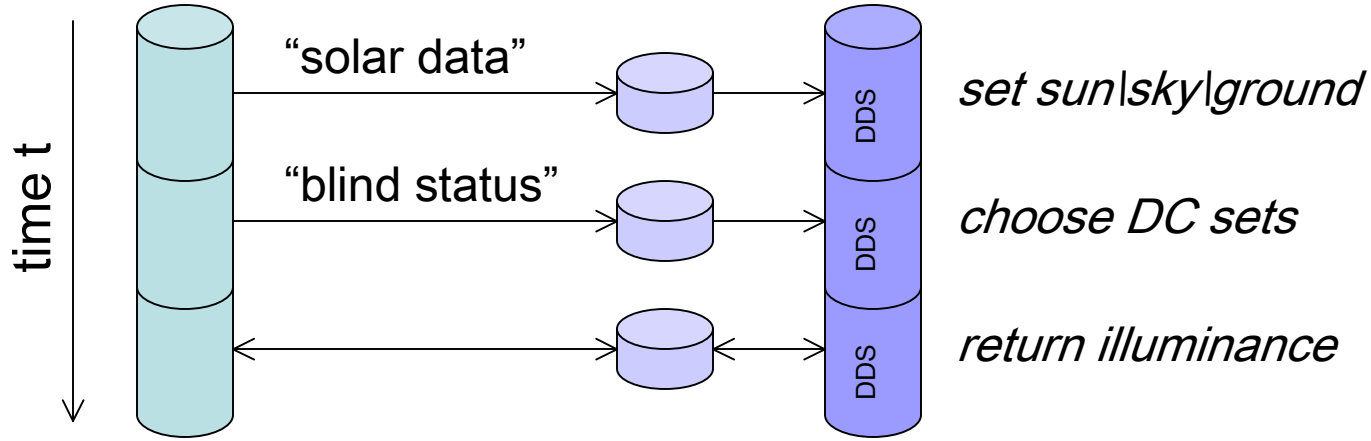
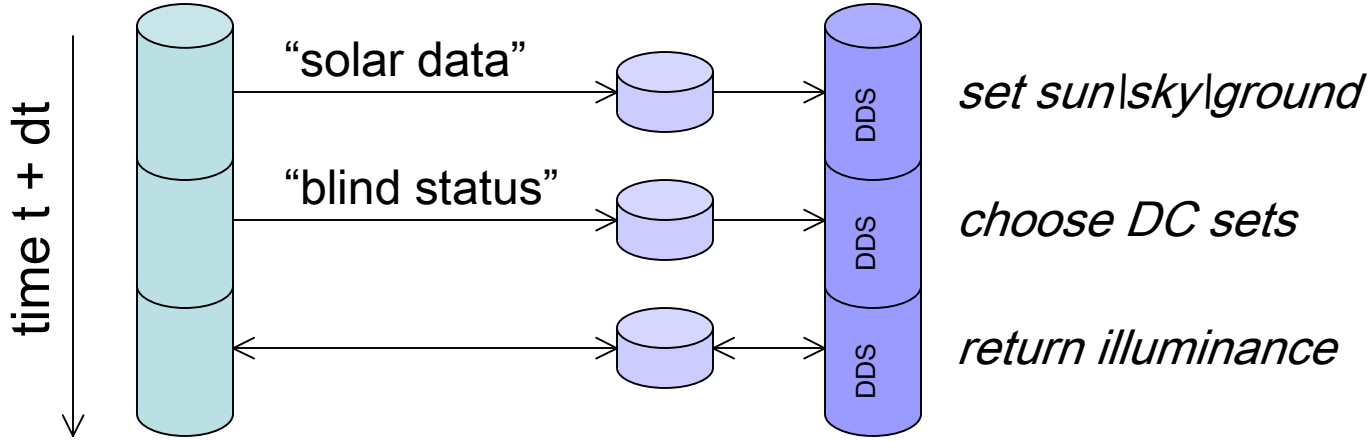
Dynamic Daylight Simulation (DDS)

- DDS\ESP-r



- control?



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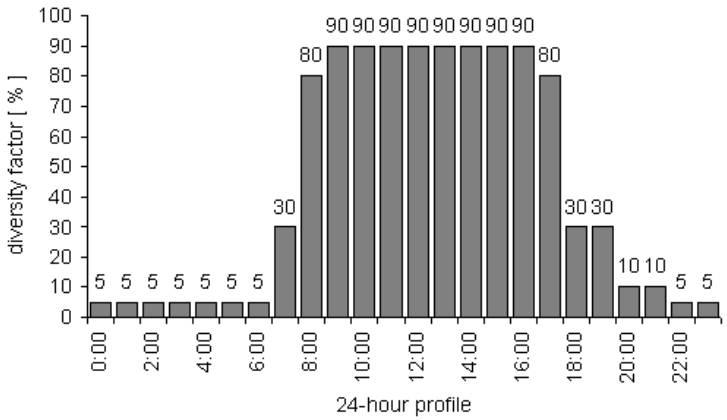
modeling control in energy simulation …

- occupants
  - traditional approach: diversity factors
  - not applicable in zones …
    - with personal control
    - with meteorological-based control
  - incompatible with behavioural models
    - how many occupants?
    - arrival time?



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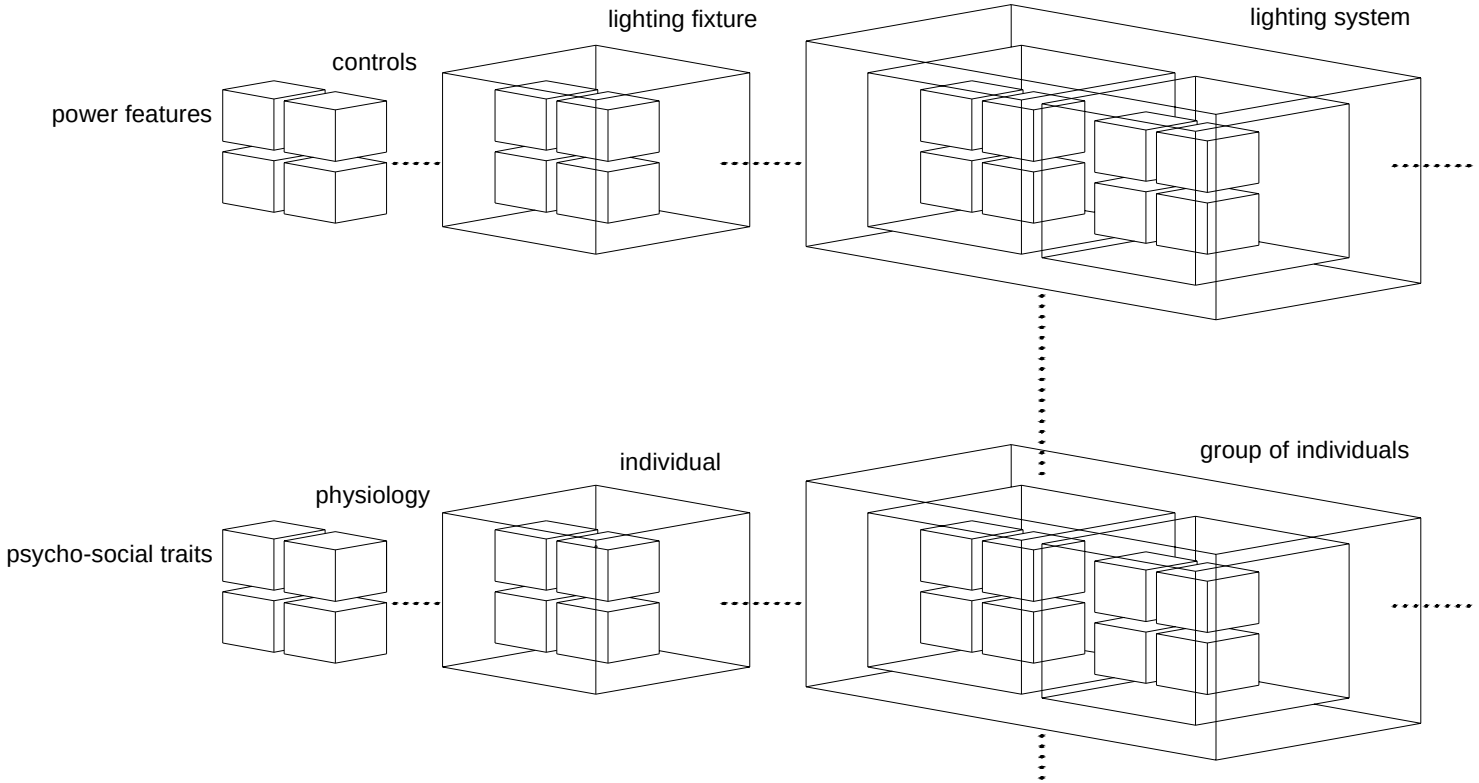
SHOCC

- Sub-Hourly Occupancy Control
  - self-contained, boundless *child* module
  - object-oriented (e.g. individuals)



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SHOCC

- Sub-Hourly Occupancy Control
  - predicts population mobility
    - arrivals\departures\absenteeism
    - stochastic variations
  - tracks history of all entities
    - past events (e.g. arrived when?)
    - future events (e.g. leaving when?)
  - attributes psycho-social traits
    - personal predisposition *vis-à-vis* manual
    - e.g. active vs. passive blind & lighting users

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SHOCC

- Sub-Hourly Occupancy Control
  - population mobility
  - occupancy-sensing control (e.g. lighting, IT)
  - advanced behavioural modelling\simulation
    - Lightswitch2002 (www.buildwiz.com)
  - extended to control … operable window use, task lighting, etc.
  - overrides any desired variable in parent application
  - future expansion independently of parent applications

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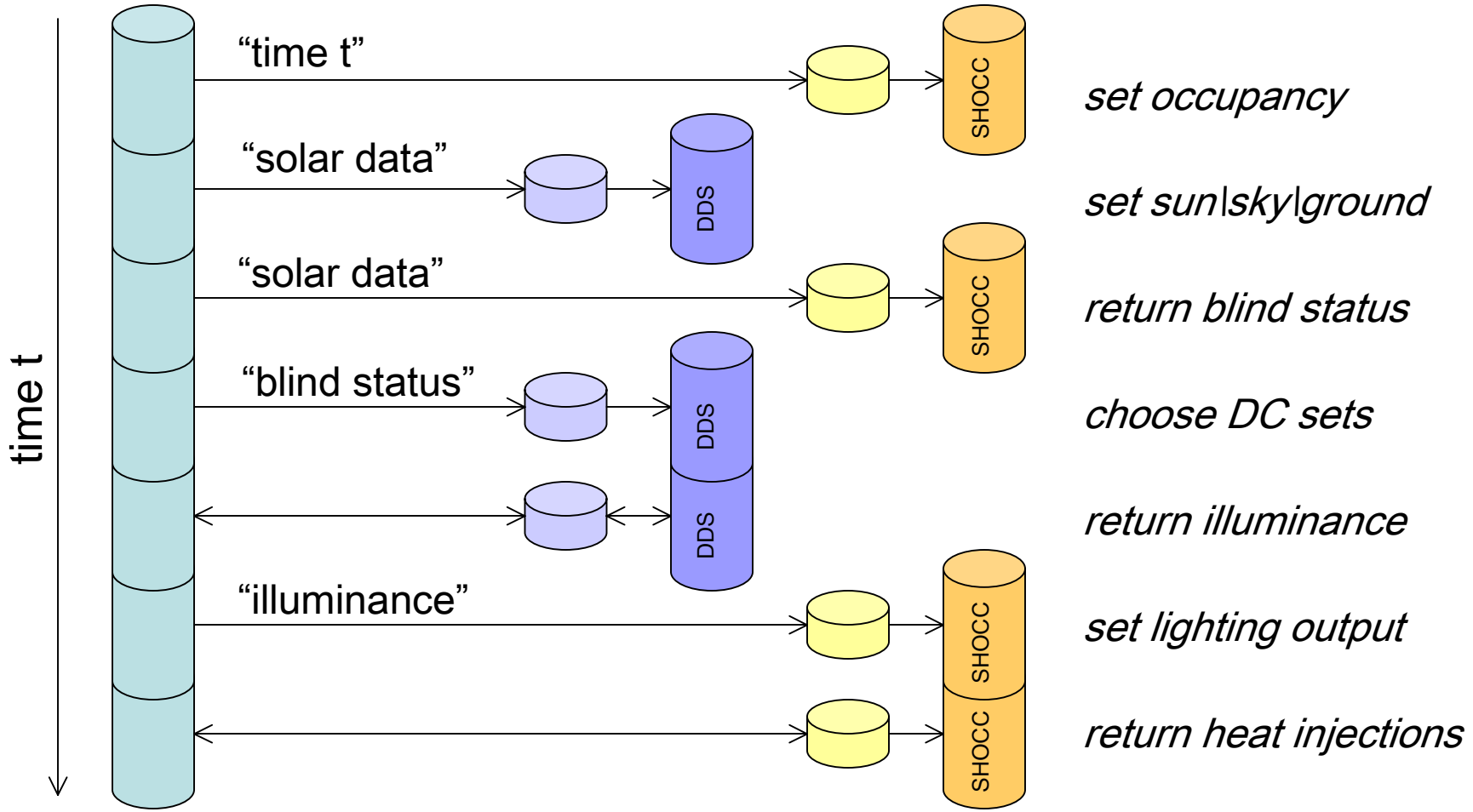
ESP-r \ SHOCC \ DDS



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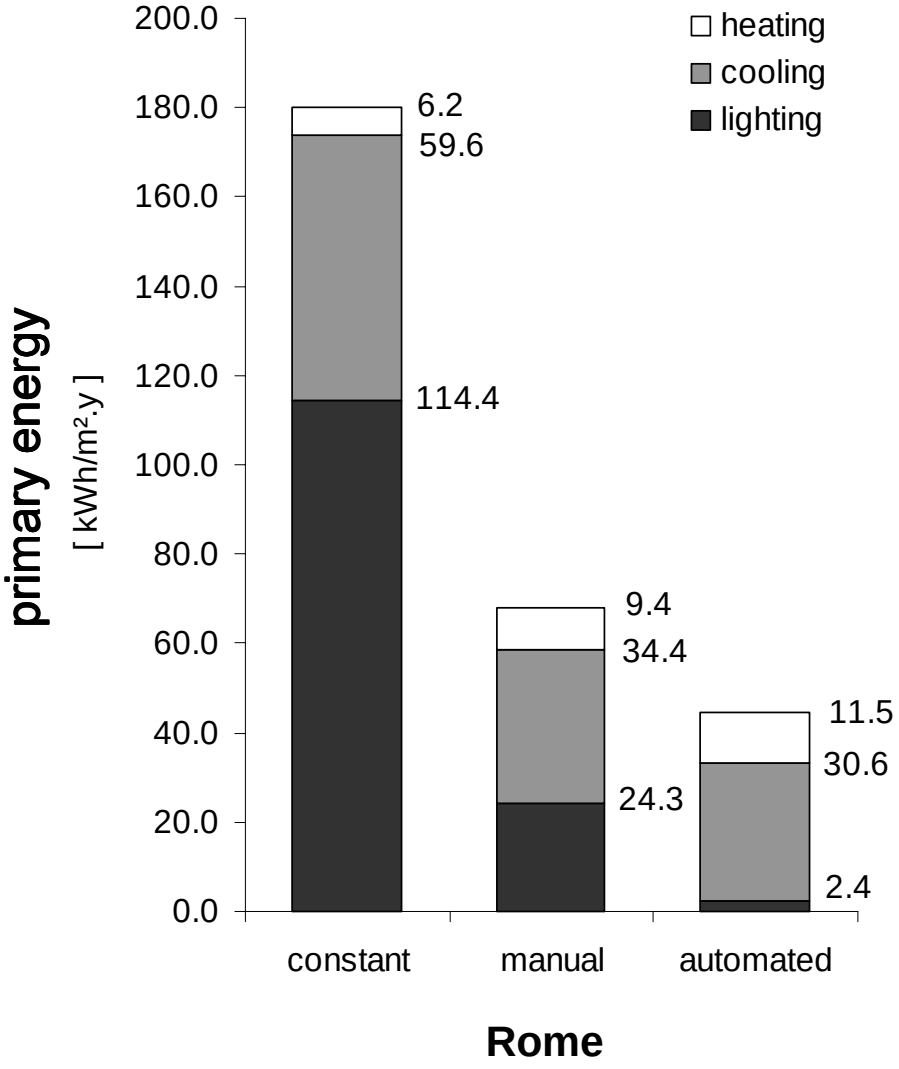

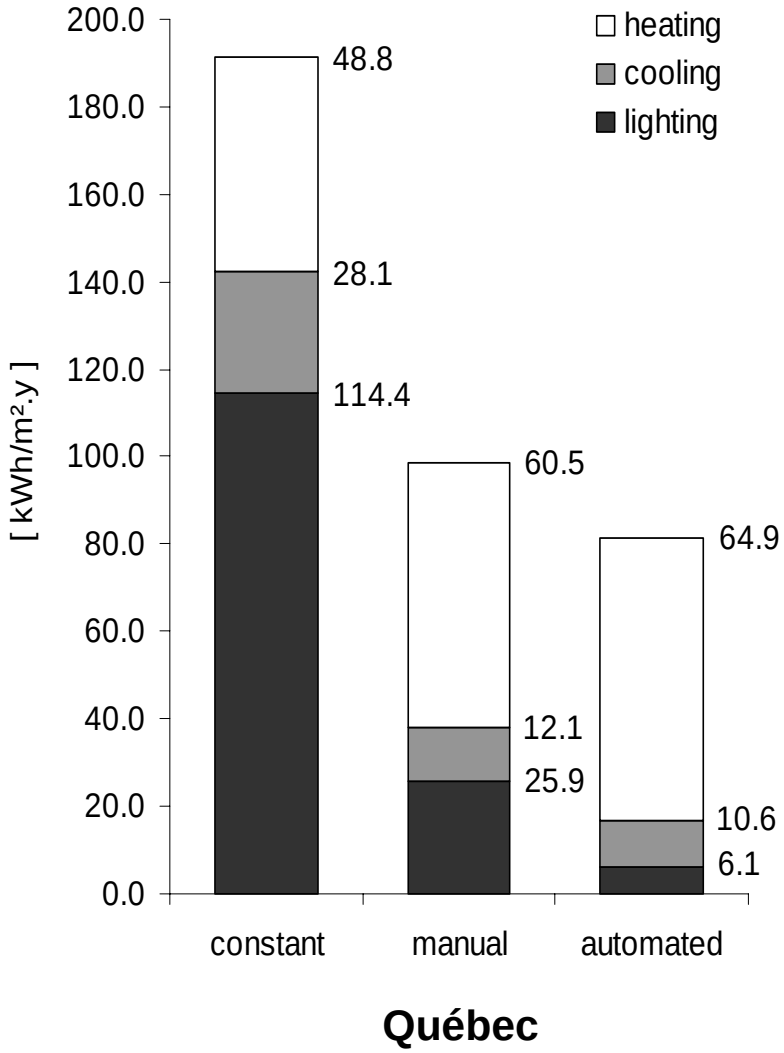

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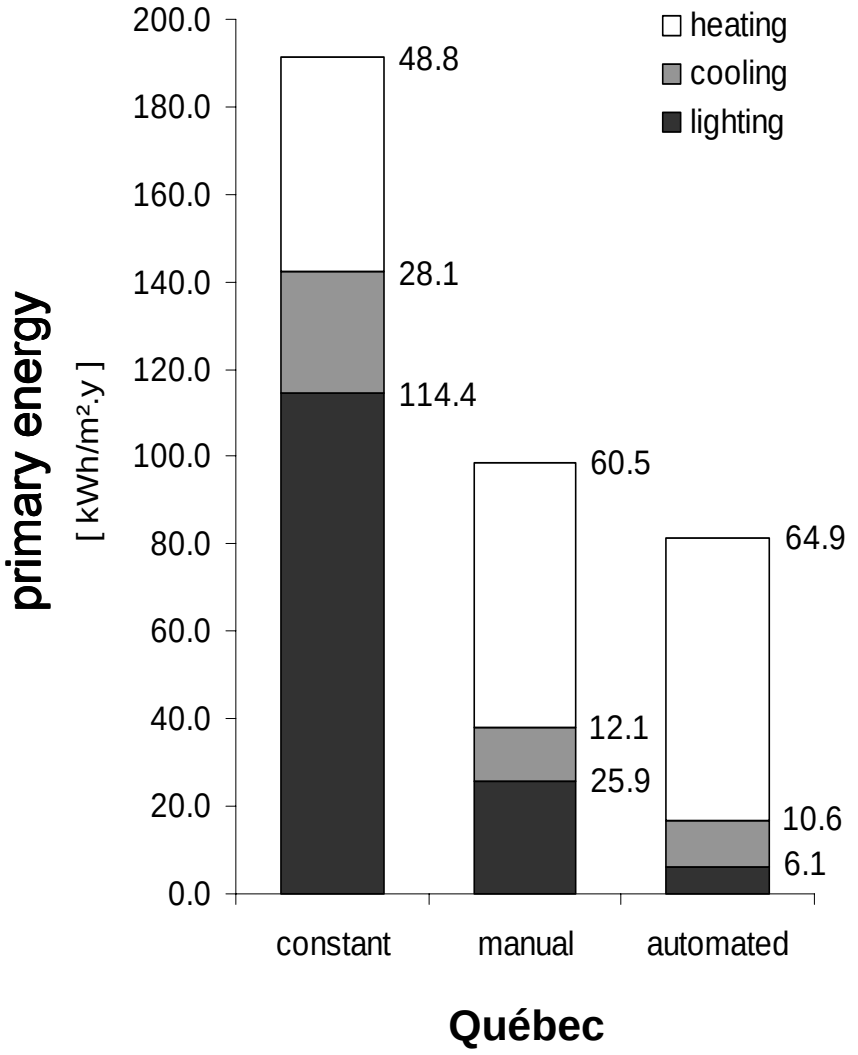
- illustrates significance of reference case choice for lighting use (ref: IESNA)
- anticipated reduction in indoor climate energy use linked to daylight is only found in cooling dominant climates



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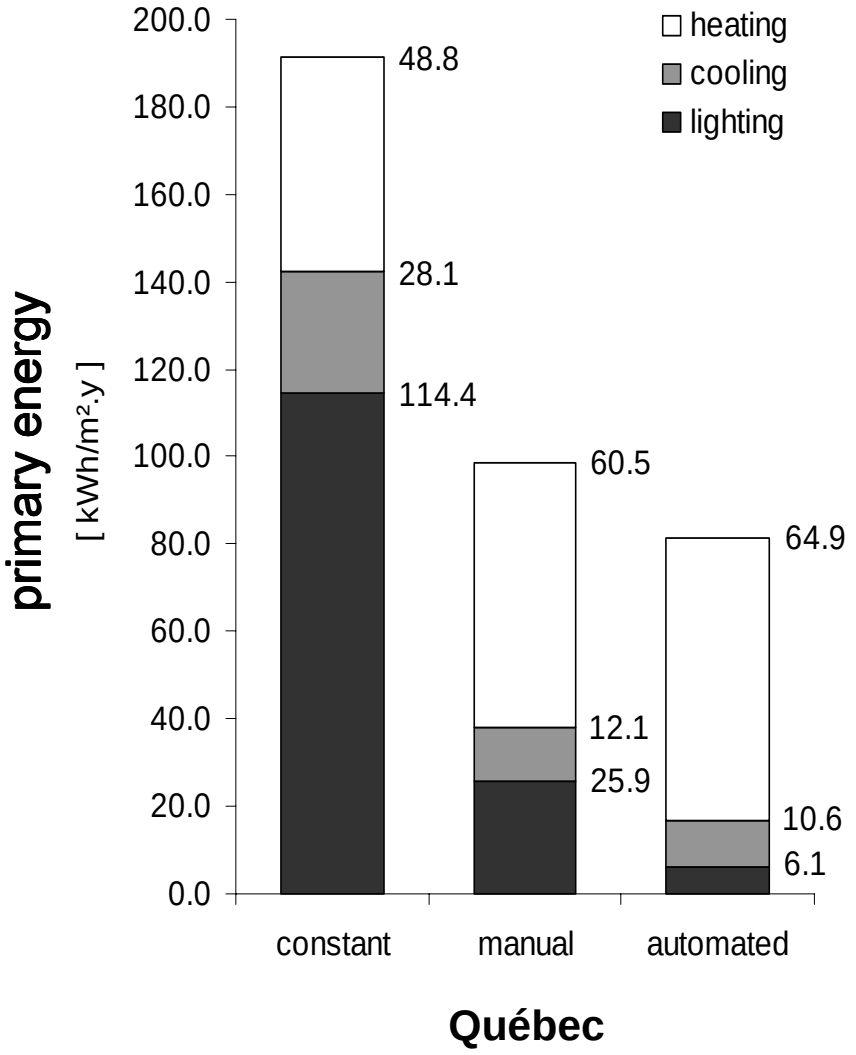
- reproducible method in forecasting the influence of human factors on energy use
- means of assessing the interdependency of personal control (lighting vs. cooling)
- provides designers (et al.) with an educated guess on what to expect in perimeter zones



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- DDS provides …
  - greater accuracy (based on .dds concept)
  - greater resolution (nb. of sensors)
  - greater complexity (nb. of windows)
  - greater efficiency (reduced nb. of computations)
  - simplifies .dds file handling


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- future?
  - expand scope of application (e.g. classrooms)
  - improved population predictors
  - additional behavioural models (e.g. clothing patterns)
  - detailed metabolic rate models
  - integration of thermal indicators
  - transient conditions (e.g. step changes)