The influence of Swedish households' everyday activities and electricity-use patterns on the utilization of small-scale photovoltaic systems

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Distributed domestic photovoltaics

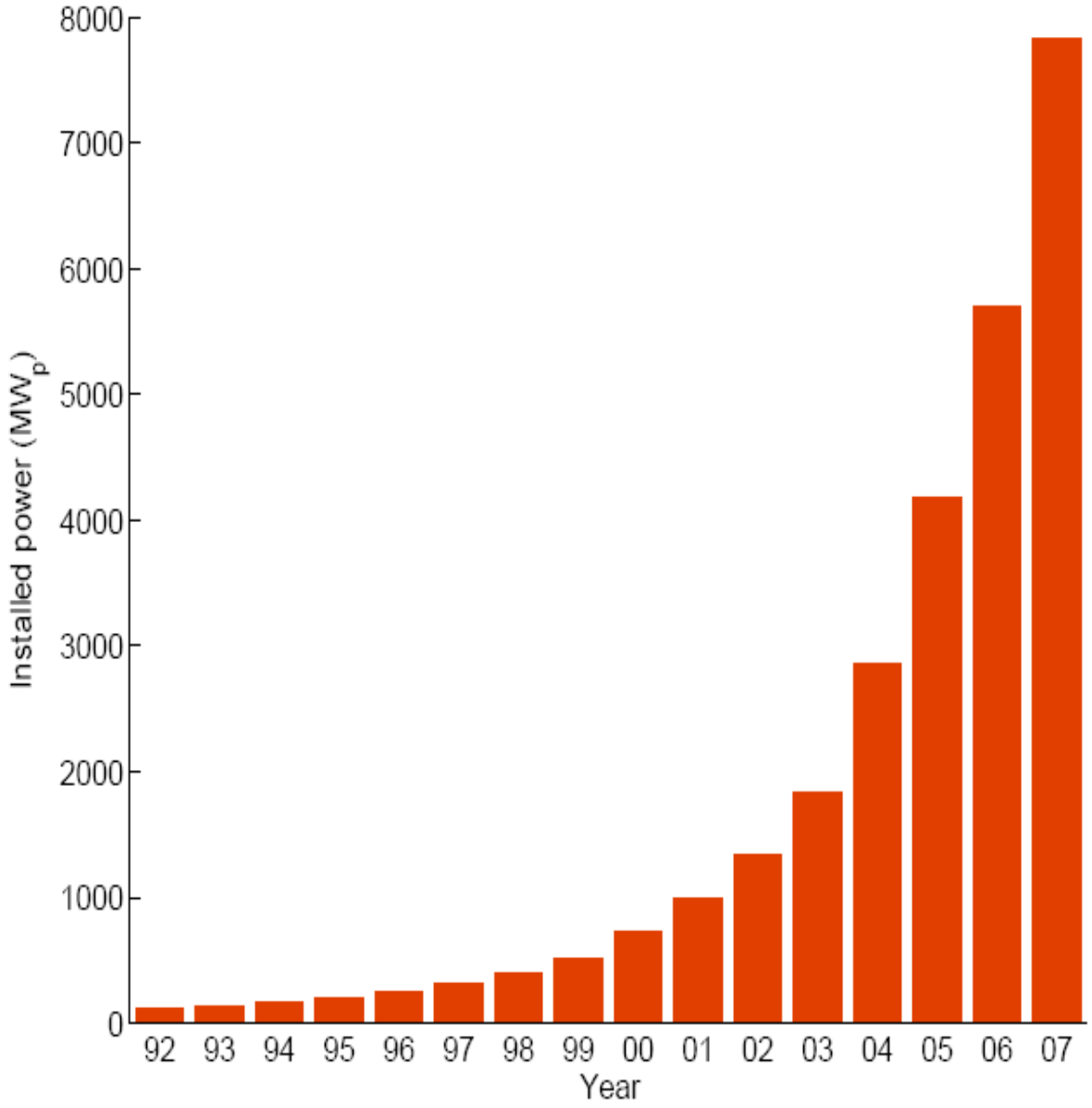
Pitrus / Mattenbies / Kalmoes / Lisdodde houses, 1 MW project, Amersfoort, The Netherlands [Copyright: SenterNovem]

Background

Increasing photovoltaic application around the world.

Eight-fold increase of grid-connected power in the IEA-PVPS countries.

Extensive subsidy schemes in many countries.



Background

Increased interest in Sweden:

- Support to installations on public buildings

- Inquiry into facilitation of grid connection

- Future support to PV installations

- Private initiatives

Load matching capability of PV

Increases the value of PV.

Decreases end-user interaction with the electricity distribution grid:

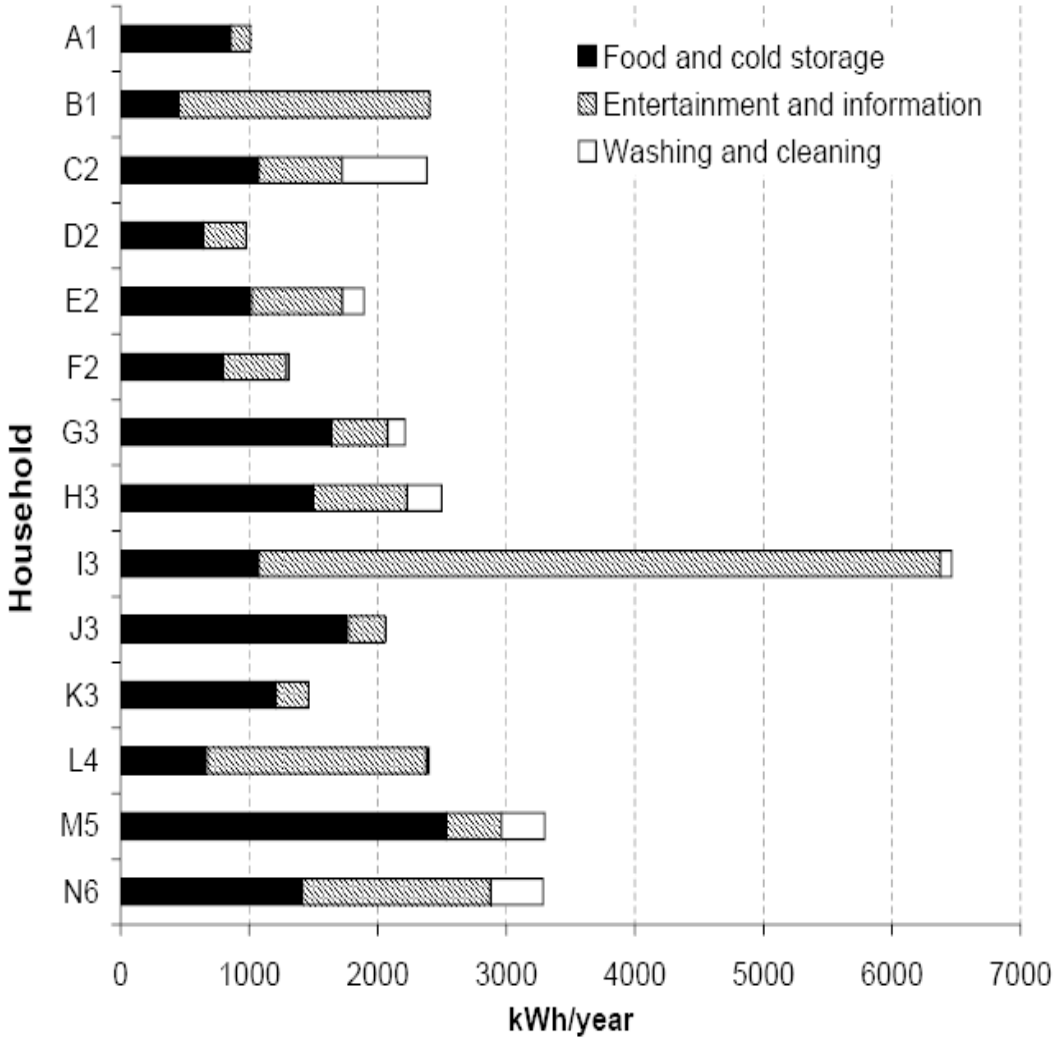
- Increased on-site demand coverage

- Reduced voltage drops to customers

- Decreased network losses

Previous findings on residential demand

Large differences between individual households:



Previous findings on residential demand

Energy use depends on habits and activity patterns of household members in which there is great variability.

Conjecture:

This also affects individual households' load curves and the load-matching capability of PV in individual households.

Aims of the study

How does utilisation of a PV system differ between individual households?

What determines the electricity-use patterns of households?

Interdisciplinarity:

Qualitative AND quantitative analysis

Methods

Simulation of PV system output.

Determination of load matching to measured end-use-specific demand.

Studies of daily allocation of end uses.

Interviews with households.

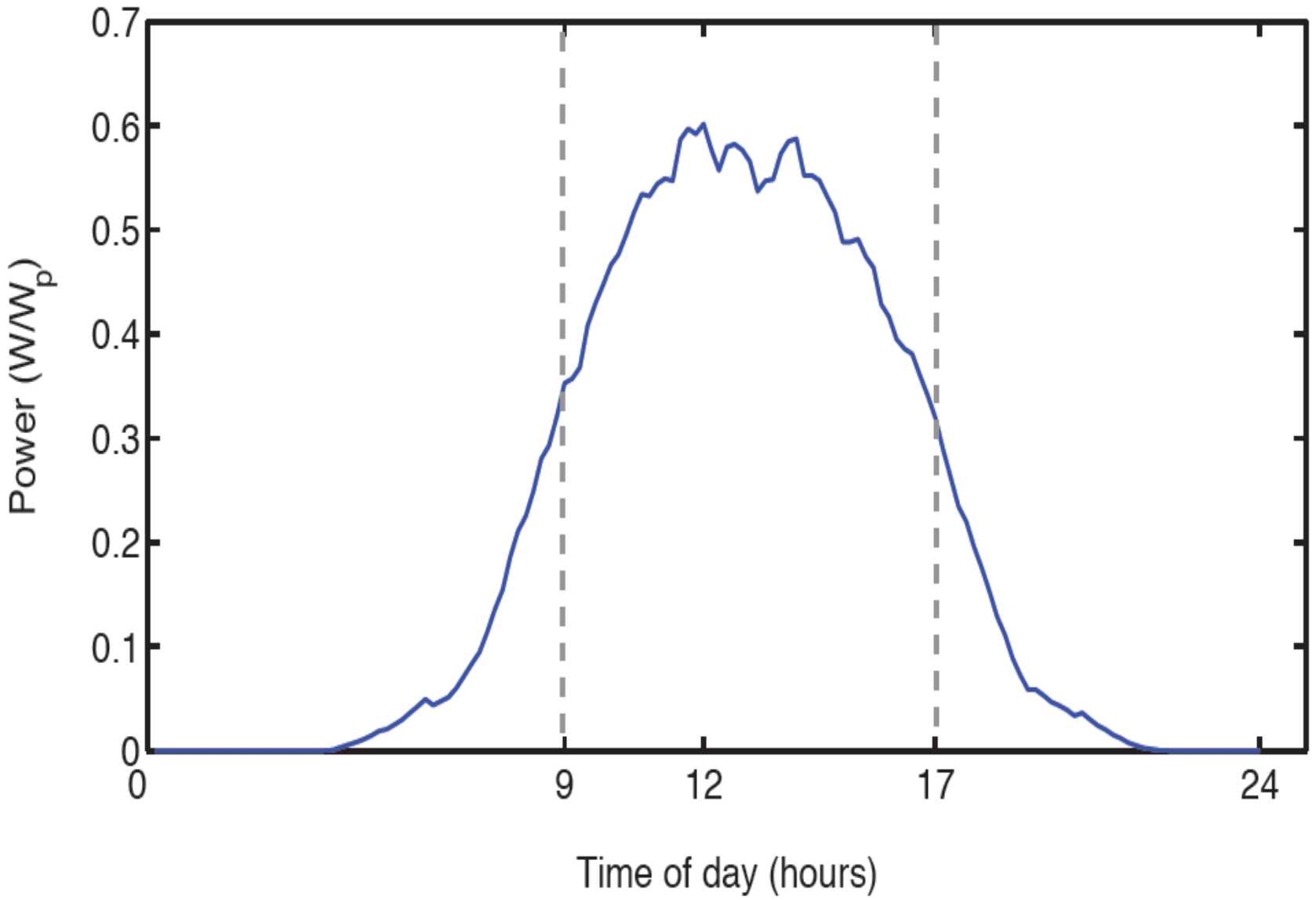
Material

Data from the Swedish Energy Agency's monitoring survey:

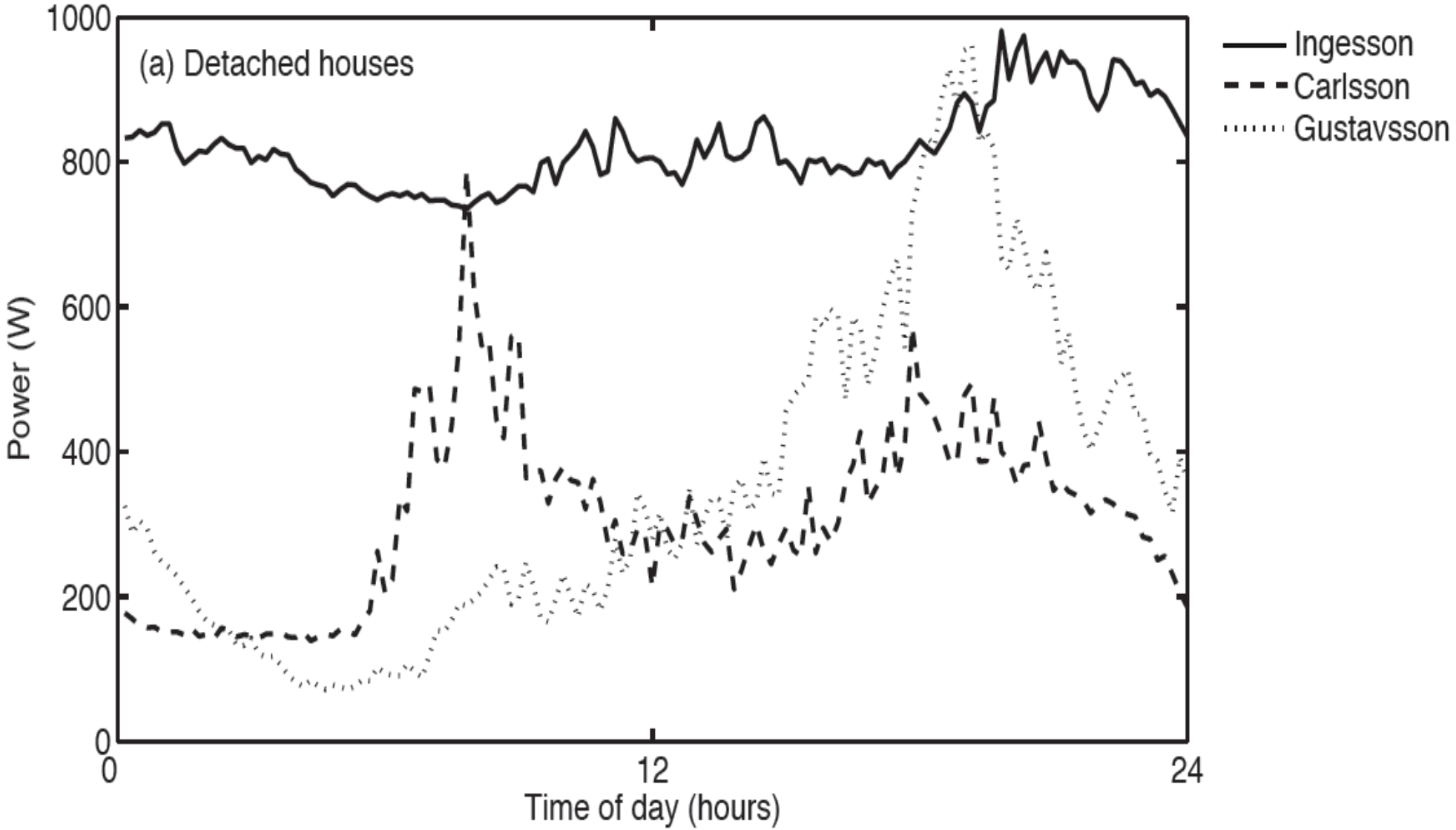
10-minutely electricity demand data for individual appliances in seven annually measured households.

Interviews with the seven households about energy-related habits.

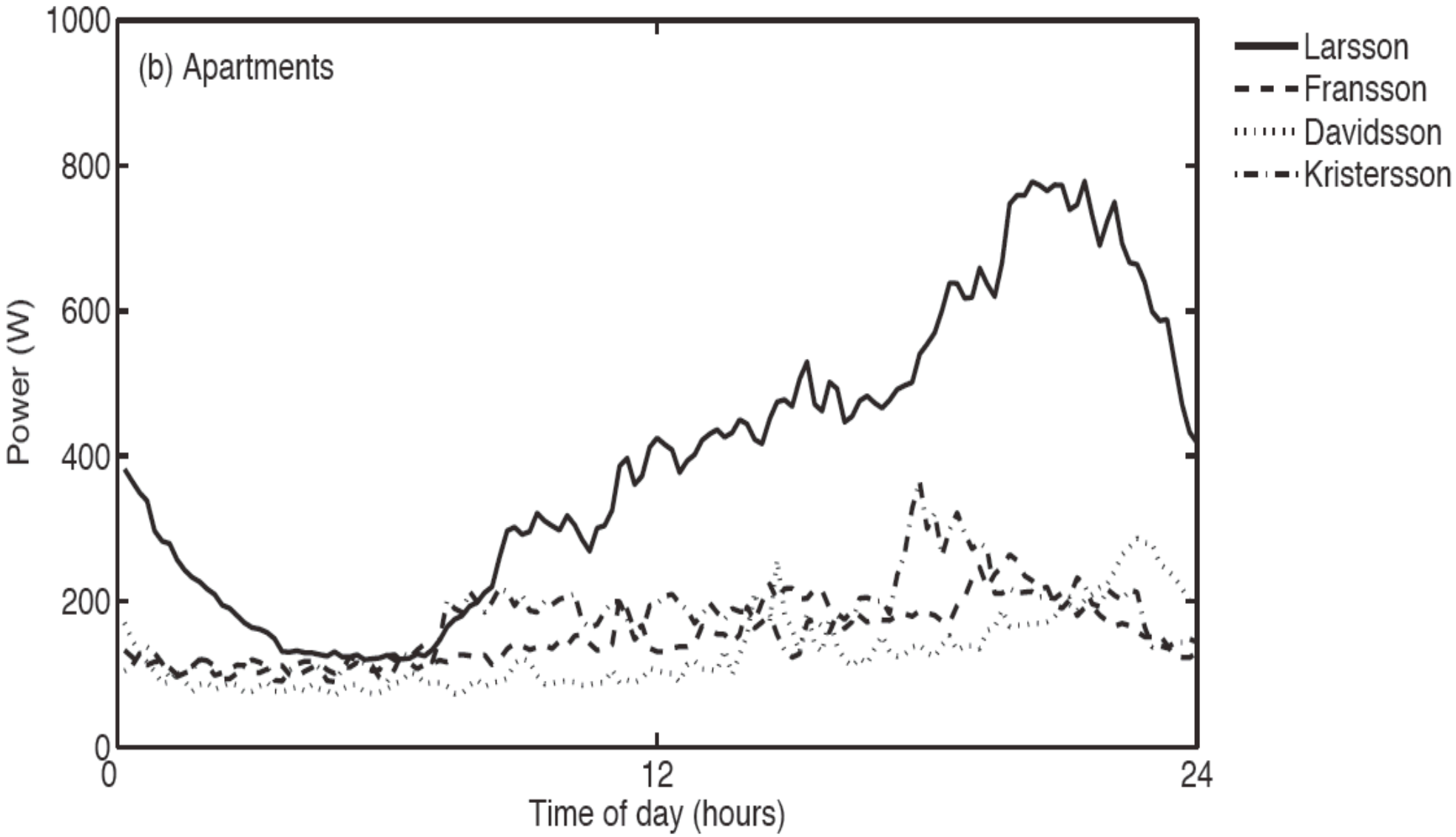
Results



Results


(a) Detached houses
Power (W)
1000
800
600
400
200
0
0
12
24
Time of day (hours)
Ingesson
Carlsson
Gustavsson

Results


(b) Apartments
Power (W)
1000
800
600
400
200
0
0
12
24
Time of day (hours)
Larsson
Fransson
Davidsson
Kristersson

Results

Table 5.1: *PV system sizes for 90 % internal utilisation of system output determined in Paper VII.* [a)]

Household [b)]	Peak power [W]	Total generation [kWh]	Total load [kWh]
Apartments:			
Larsson	450	126	1046
Fransson	340	95	441
Davidsson	200	56	326
Kristersson	200	56	454
Detached houses:			
Ingesson	1450	660	2105
Carlsson	850	387	2396
Gustavsson	430	196	1183

a) Calculations are based on the period May through July.
b) All households are given assumed names.

Results

Low-demand households

Morning and evening peaks

Daytime demand

Conclusions

Degree of load matching and internal utilisation of PV is highly variable.

Main factor that affects internal utilisation: daytime occupancy and activity.

Reasons for demand patterns can be obtained through the interdisciplinary approach.

Further reading:

Licentiate thesis
June 2009

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