

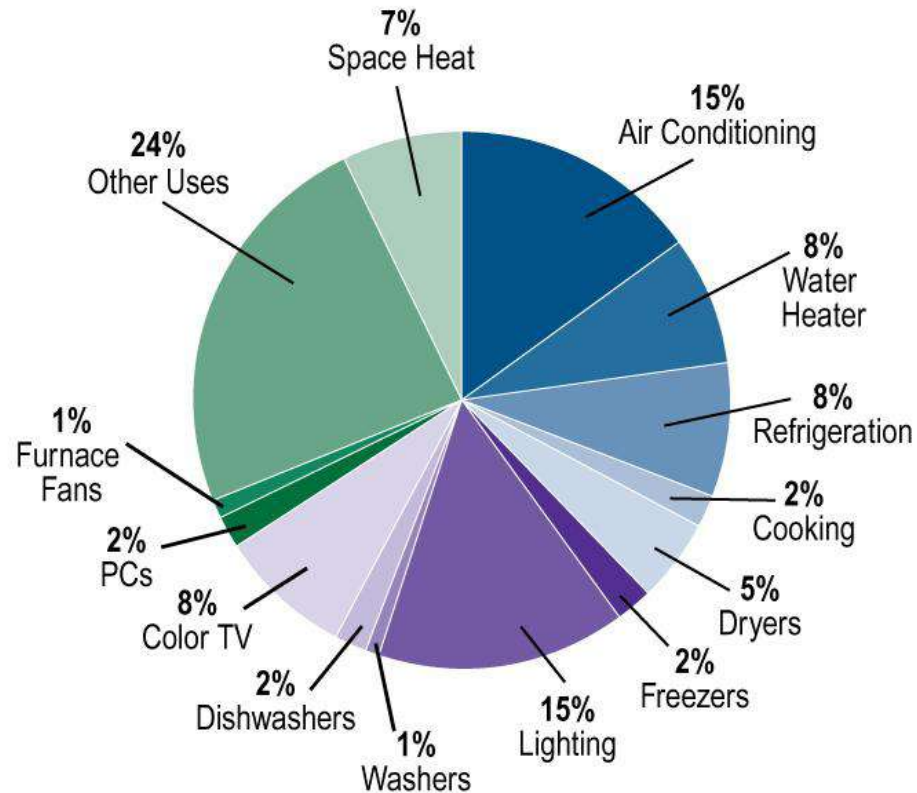
SOLAR POWERED CHARGING STATIONS

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2012 Dialog on Sustainability

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Residential Consumption of Electricity

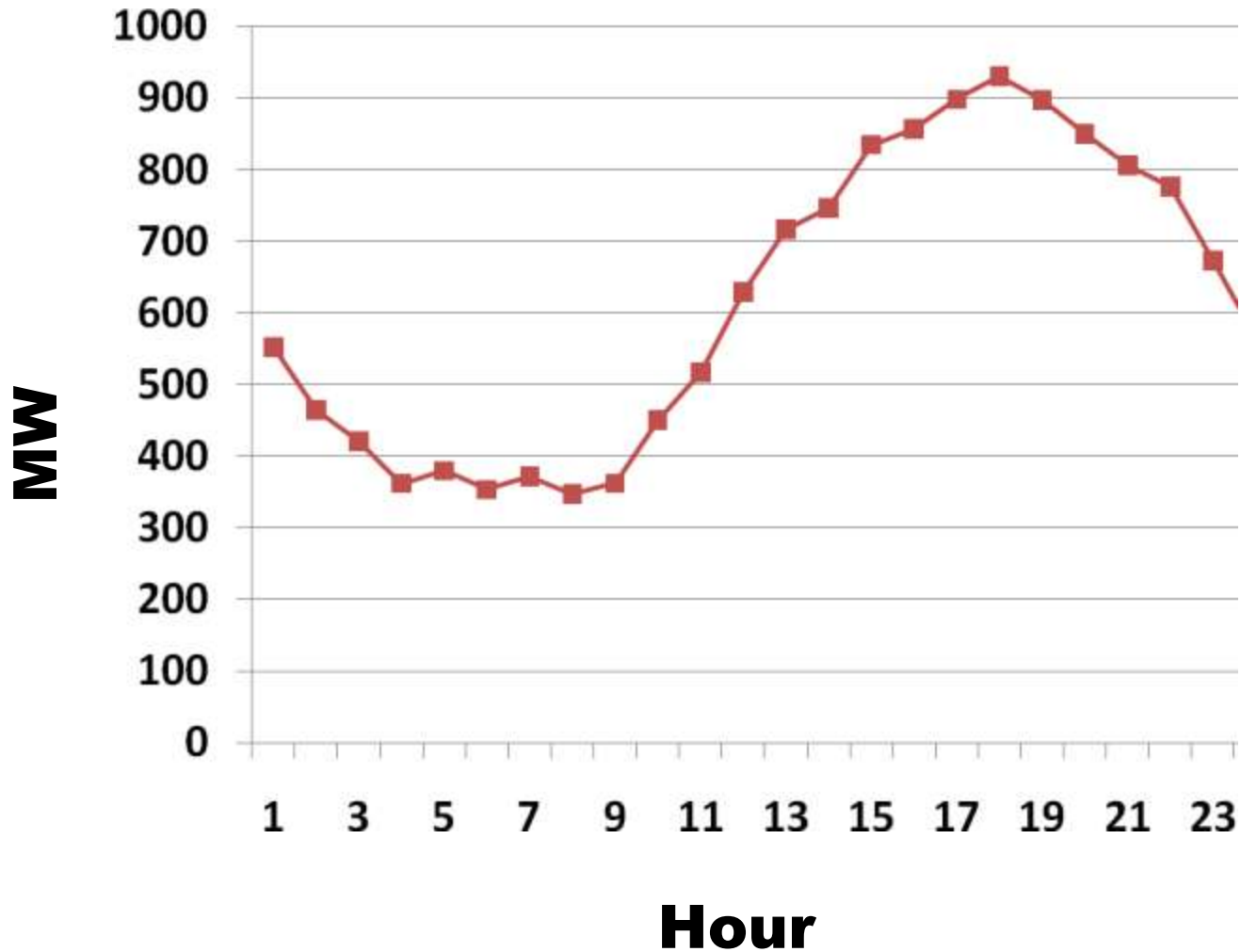


Source: U.S. Department of Energy, Energy Information Administration (EIA), 2008.

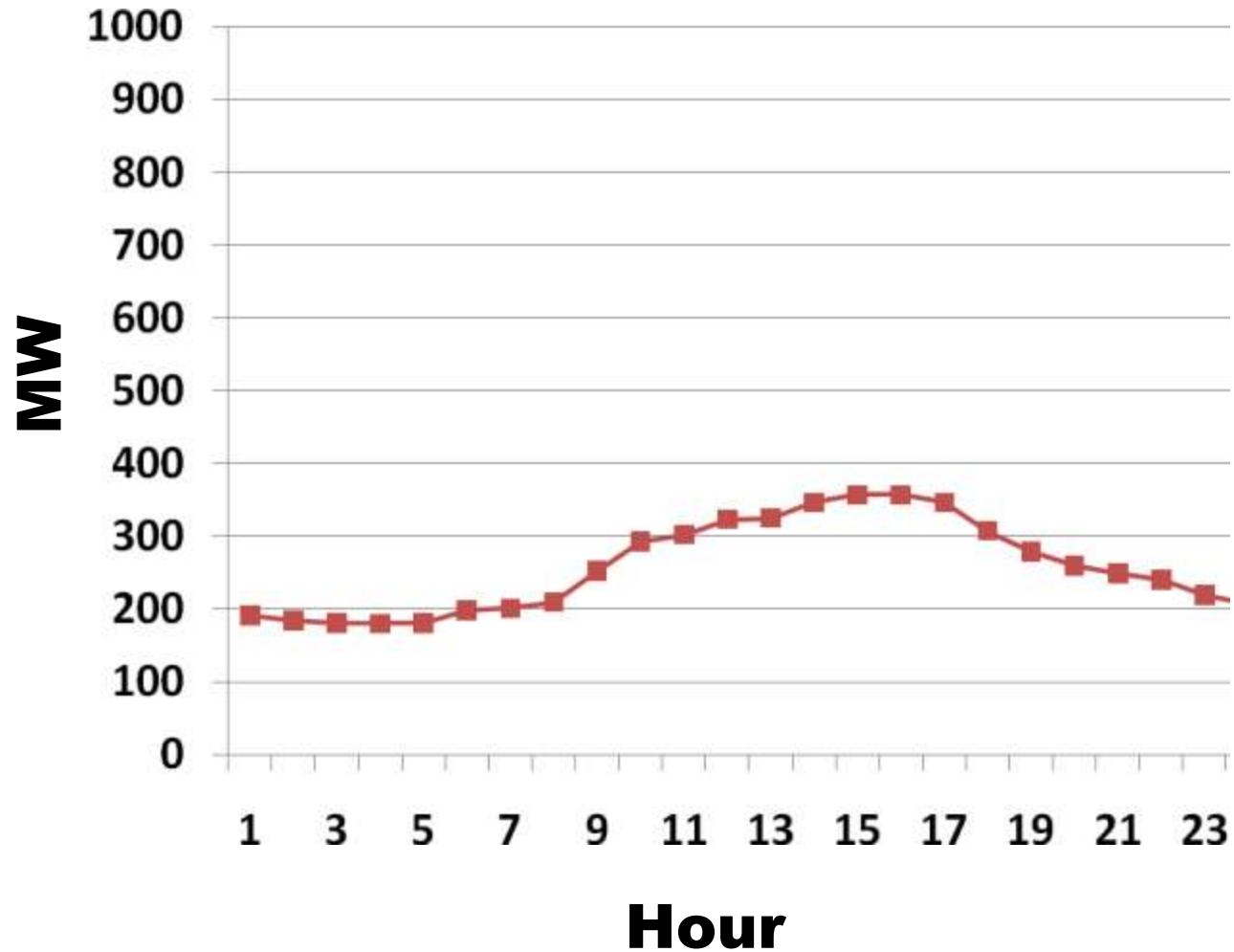
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<http://www.eei.org/Pages/ResidentialConsumers.aspx>

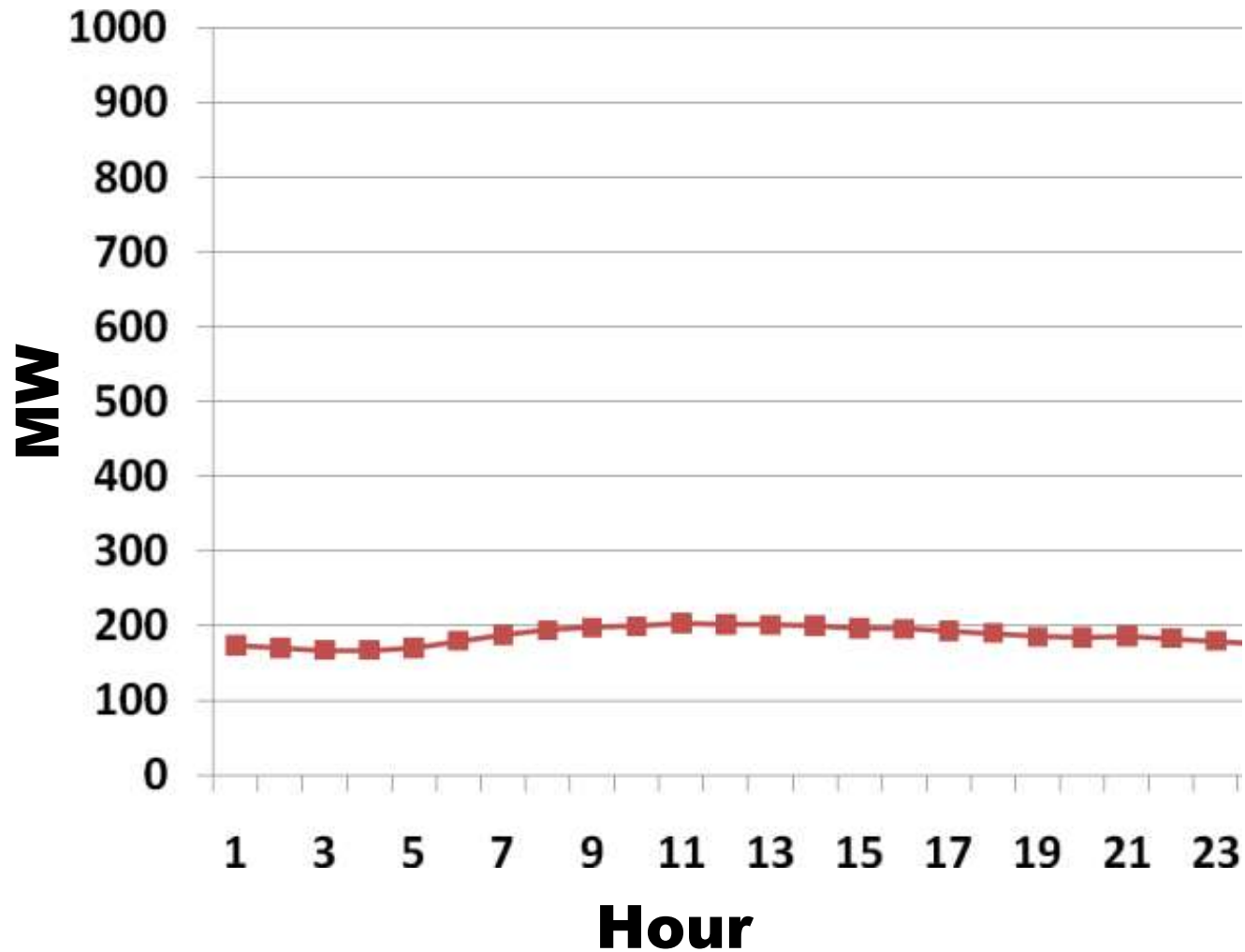
RESIDENTIAL LOAD ON A SUMMER DAY



COMMERCIAL LOAD ON A SUMMER DAY



INDUSTRIAL LOAD ON A SUMMER DAY



OBSERVATIONS

- ⦿ Residential load is significantly higher than the commercial and industrial loads.
- ⦿ Residential load sees large fluctuation in load from night to day.
- ⦿ Utilities have to adjust generation up and down to meet the load at any given time.
- ⦿ Very expensive to meet the afternoon load because it requires operating expensive peaking units or purchasing power in the market.

ELECTRIC VEHICLE LOAD

- New load on the system
- Best time to charge the vehicles
 - Night - because system load is low and available capacity can be utilized very effectively
 - Charging of vehicles must be staggered to prevent creating a new peak in the night
 - Preferred time by utilities: 12 am to 7 am
- Current distribution systems are not designed to handle the extra load of electric vehicles

CHARGE THE VEHICLES DURING DAY

- ⦿ Allows increasing (doubling) the range of electric vehicles for commuters in certain situations
- ⦿ Consumers may be able to avoid upgrades in their homes for electric vehicles



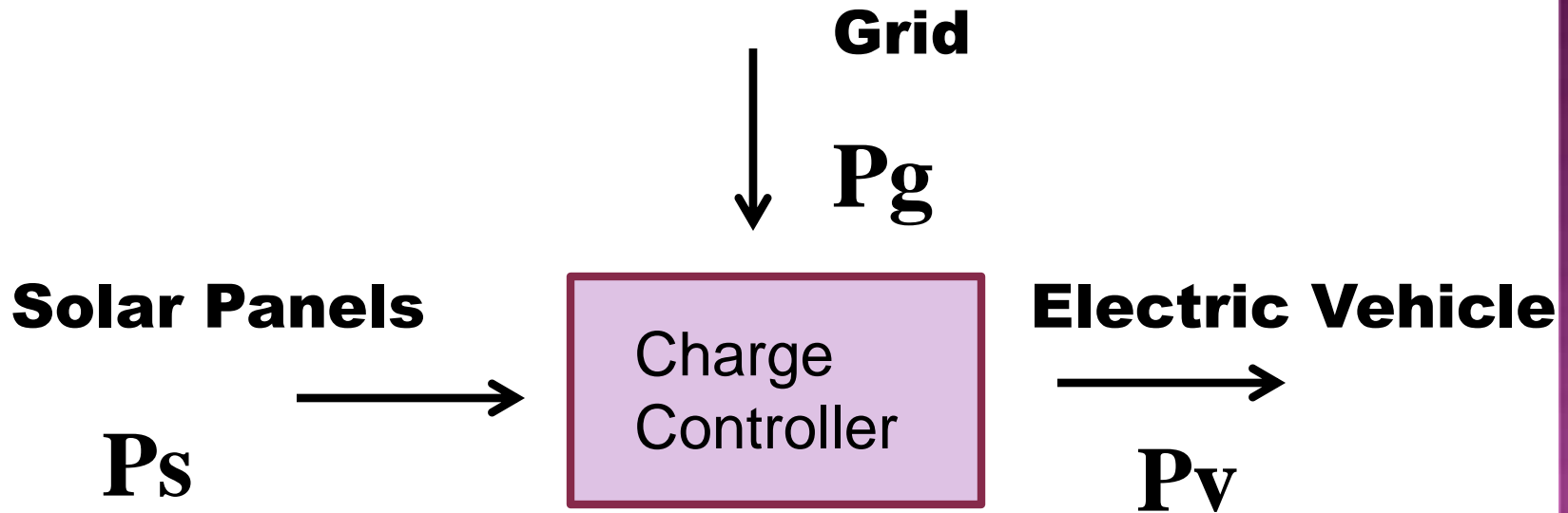
Find Electric Car Charging Stations

CHARGING DURING THE DAY

- ⦿ Not a suitable option for utilities on peak days
- ⦿ Since the sun shines in the day, harnessing its energy to charge electric vehicles could be a possibility

<http://www.ecofriend.com/entry/11-charging-stations-designed-to-refuel-evs-with-renewable-energy/>

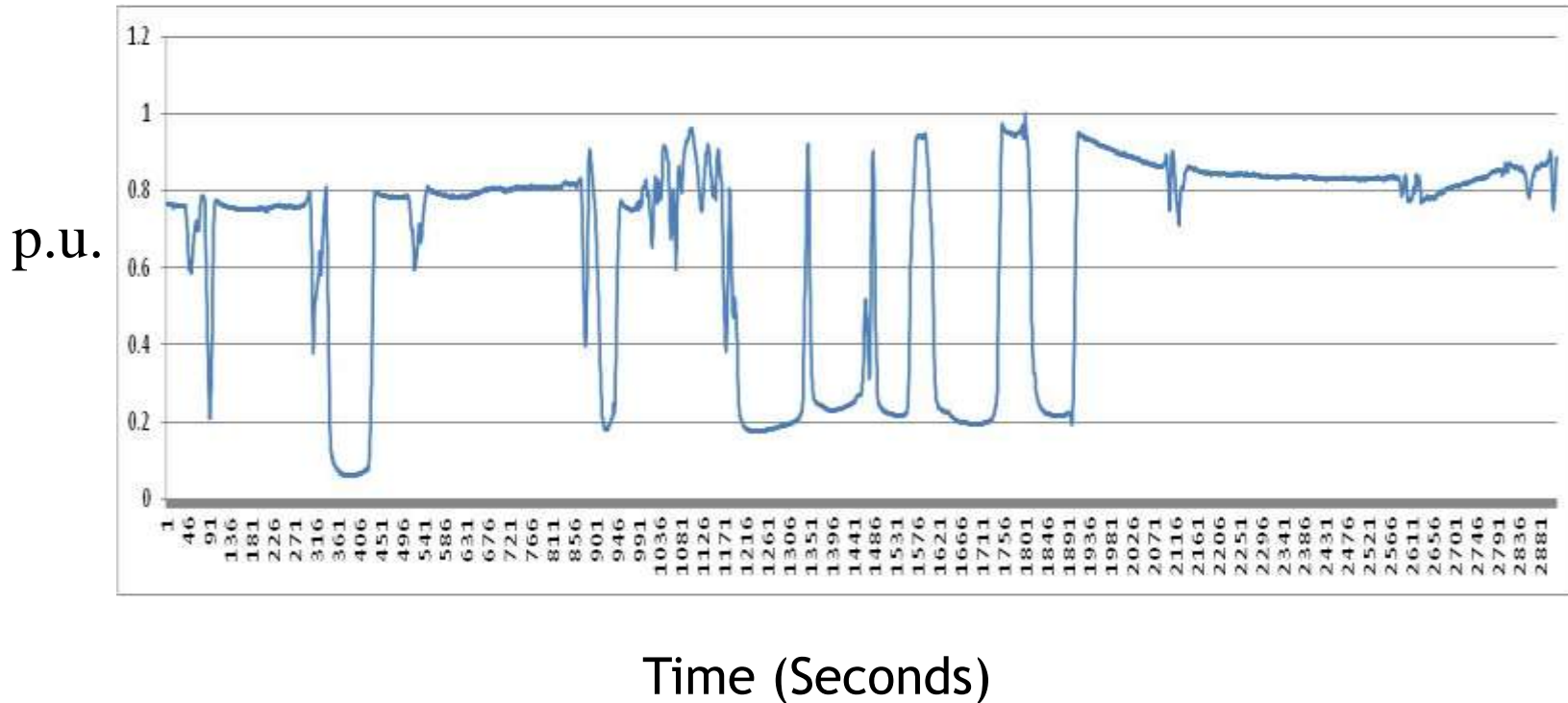
SHADED PARKING LOT WITH SOLAR PANELS



$$P_v = P_s + P_g$$

Ideally: $P_v = P_s$ with $P_g = 0$

POWER OUTPUT OF PV



Fluctuations due to cloud movement

CHALLENGES

- Design a controller which can sense changes in power flow from PV to make adjustments
 - Suspend charging
 - Could be detrimental to car batteries
 - Use auxiliary batteries to compensate for loss of production from PV
 - Expensive because additional batteries are needed
 - Use supercapacitors or other short-term storage devices to smooth out fluctuations

