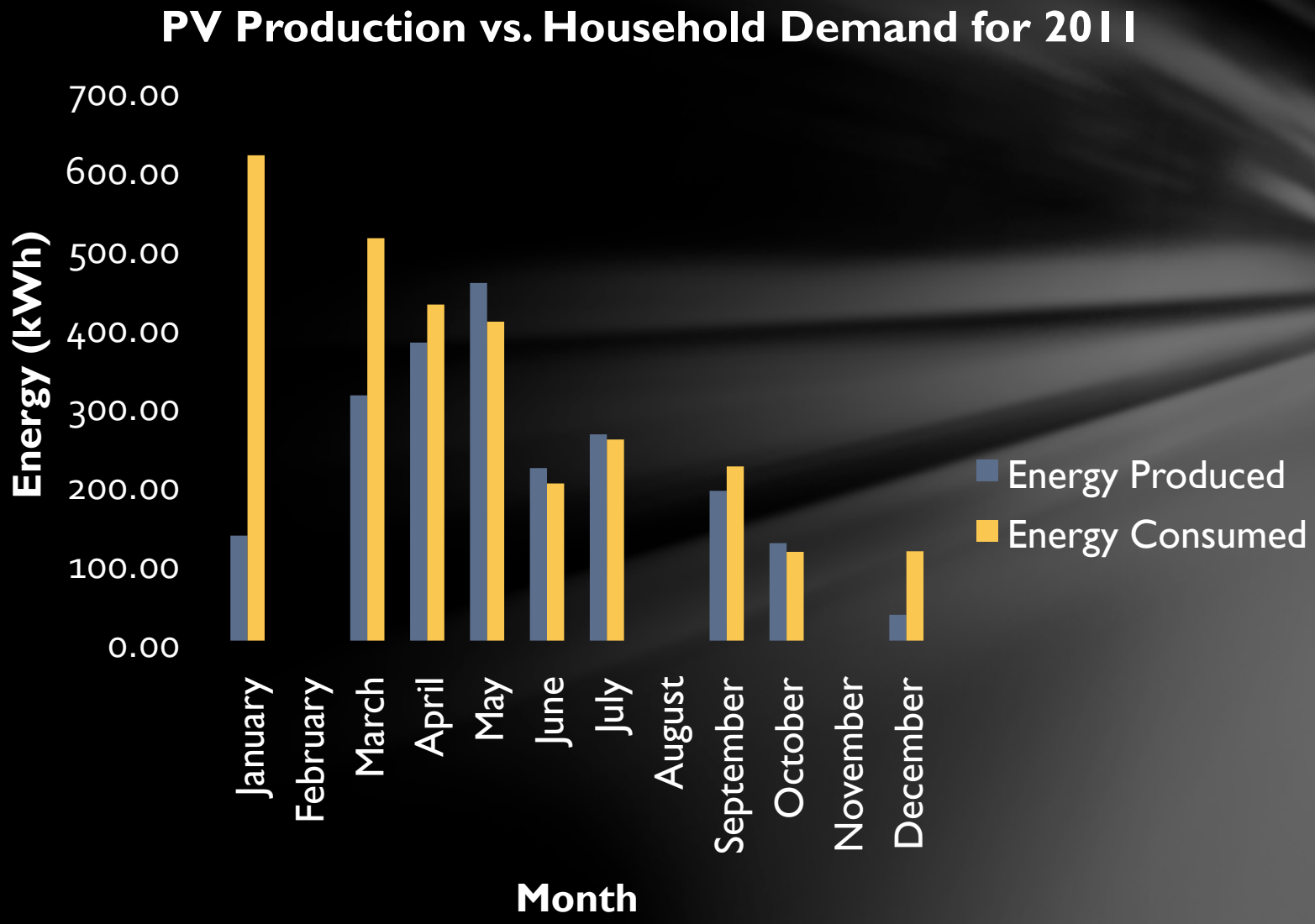
Photovoltaic Research at the University of Virginia: Research and Application

Helena Khazdozian
ecoMOD

University of Virginia
Co-advisors: Paxton Marshall & Tatiana Globus

Impact of Residential PV: ecoMOD4



Impact of Residential PV: Charlottesville, VA

ecoMOD4

Every month an average of:

- 395 kWh produced
- $35 saved in electricity
- 790 lbs. carbon emissions offset

ecoREMOD

Every month an average of:

- 601 kWh produced
- $54 saved in electricity
- 1200 lbs. carbon emissions offset

- System cost is high
- Unaffordable to middle class citizens
- Payback period ranges from 20 – 30 years

Thin Film PV: A Lead Selenide Absorbing Layer

PVs are not cost-competitive with fossil-fuels

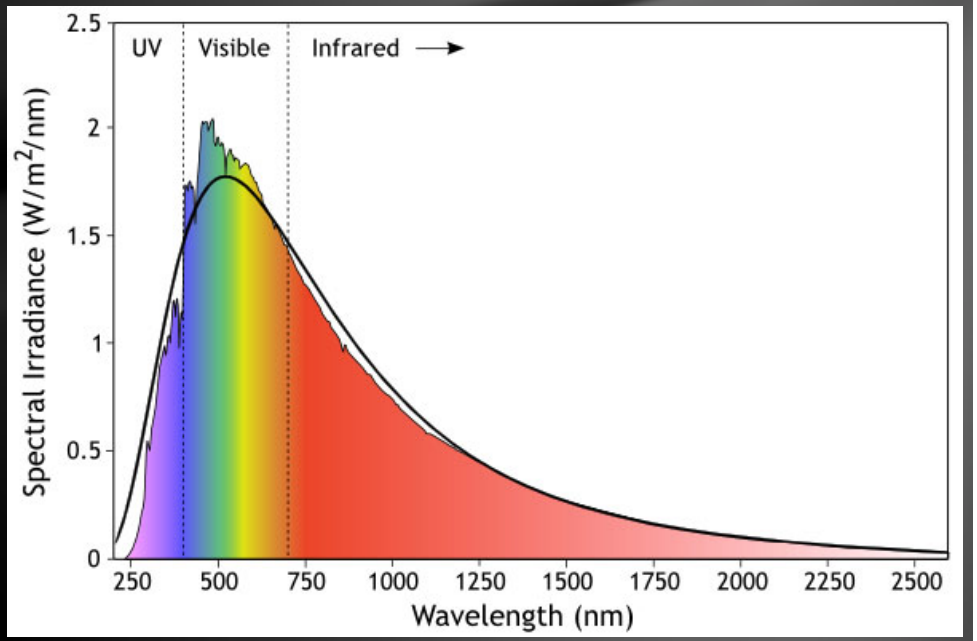
- High material and manufacturing costs
- Relatively low conversion efficiency

Why lead selenide (PbSe)?

- Reduced manufacturing costs by chemical bath deposition
- Reduced material costs through the use of thin films
- Potential to increase conversion efficiency through full spectrum absorption and carrier multiplication

Research at UVA

- Determine if a PbSe – Si heterojunction is viable for commercial PV
- Criteria for success:
  - Hole density = (1-2)x10^{17} cm^{-3}
  - Photoconductive
  - Successful junction e.g. effective charge carrier separation



Current Results & Future Work

Results:

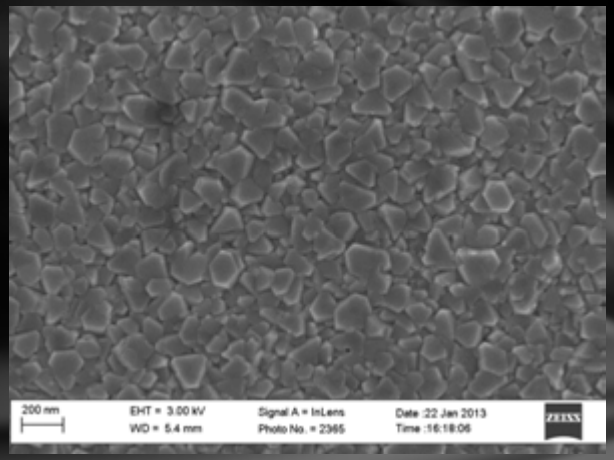
- Thin film p-type PbSe successfully deposited on glass and microcrystalline Si
- Average hole density of PbSe = 4.93×10^{17} cm^{-3}
- Consistency in PbSe nanocrystals on glass and microcrystalline Si

Challenges:

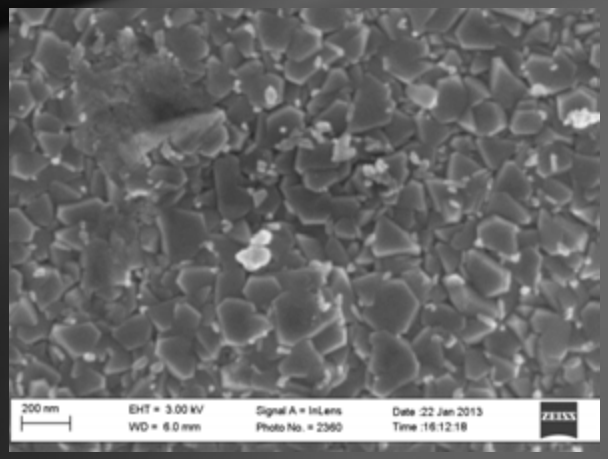
- Wide distribution of properties due to chemical bath deposition
- Reduction of hole density to achieve photoconductivity

Future Work:

- Characterization of PbSe – Si heterojunction
- Doping of PbSe to reduce hole density



Scanning electron micrograph of PbSe nanocrystals on glass



Scanning electron micrograph of PbSe nanocrystals on n-type Si