SEAD | SUPER-EFFICIENT EQUIPMENT AND APPLIANCE DEPLOYMENT INITIATIVE

Governments Working Together to Save Energy.

ACs: Cooling Growth in Energy Demand

Stephane de la Rue du Can, LBNL

September 2015

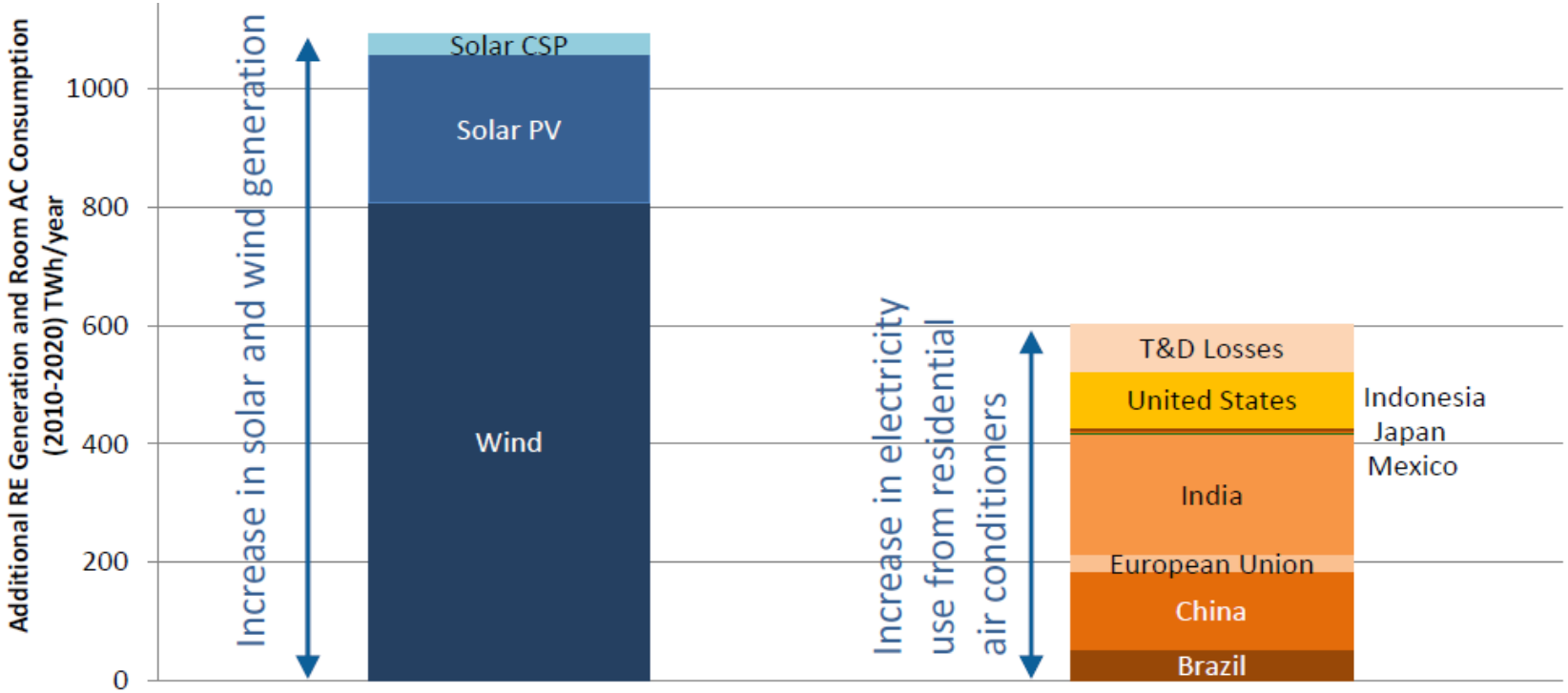
www.superefficient.org

CLEAN ENERGY MINISTERIAL
Accelerating Transition to Clean Energy Technologies

ipeec International Partnership for Energy Efficiency Cooperation

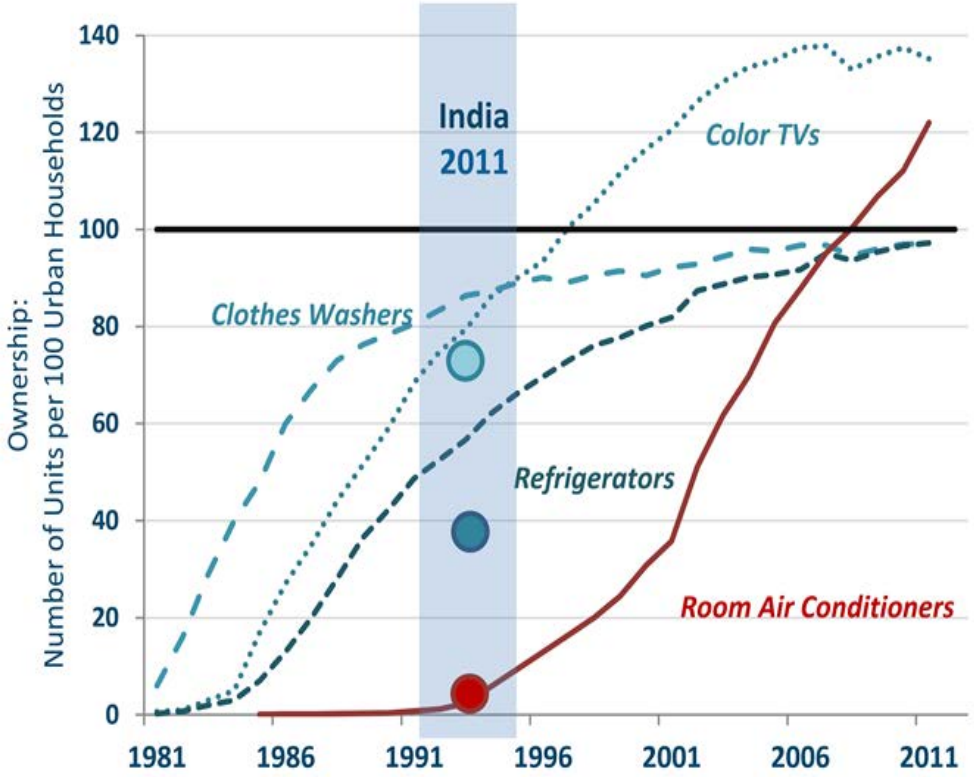
Energy Demand Forecast

Electricity demand to power residential air conditioners purchased during 2010-2020 could consume more than half of all solar and wind generation projected to be added globally over the same period.



Source: Renewable energy generation: IEA World Energy Outlook 2012 (Current Policies scenario). Residential air conditioning consumption: LBNL's BUENAS model (McNeil et al., 2012)

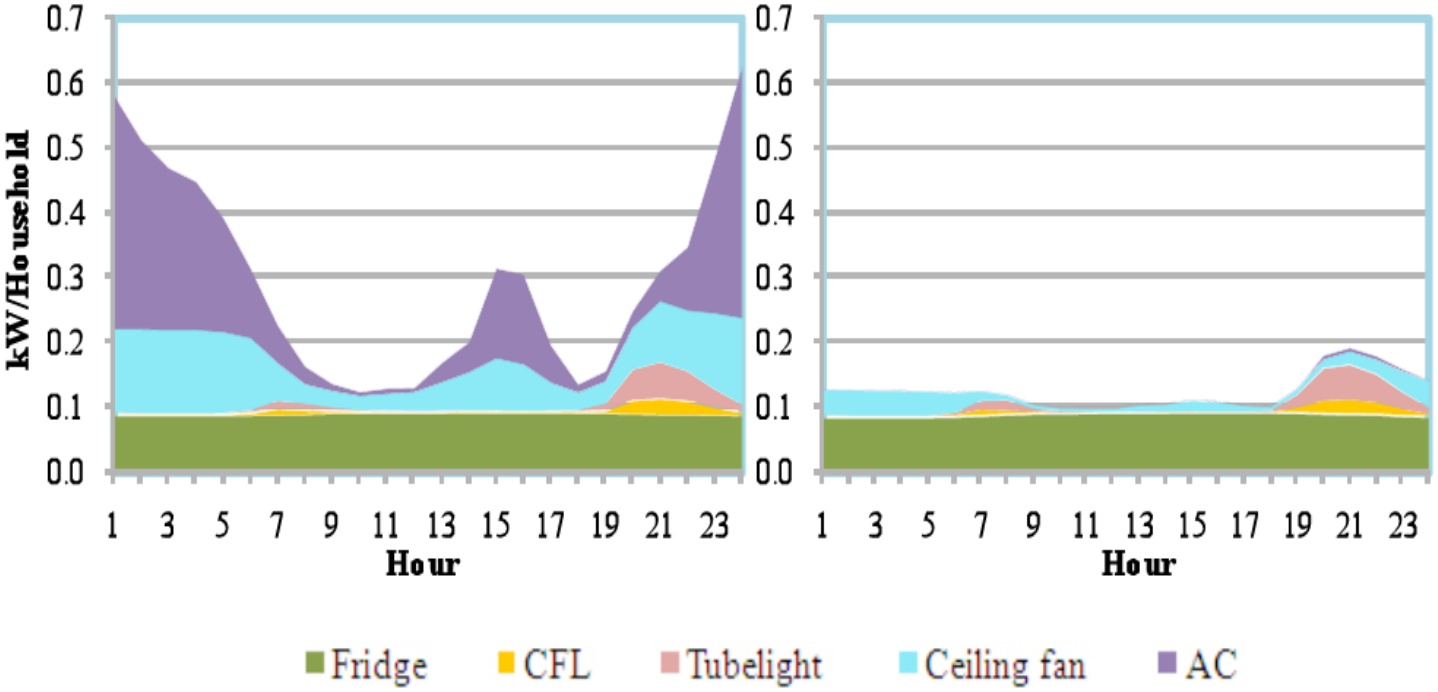
Relative Rates of Appliance Ownership in Urban China and India



AC sales are driven by rising income levels and increasing urbanization, particularly in countries with warm climates.

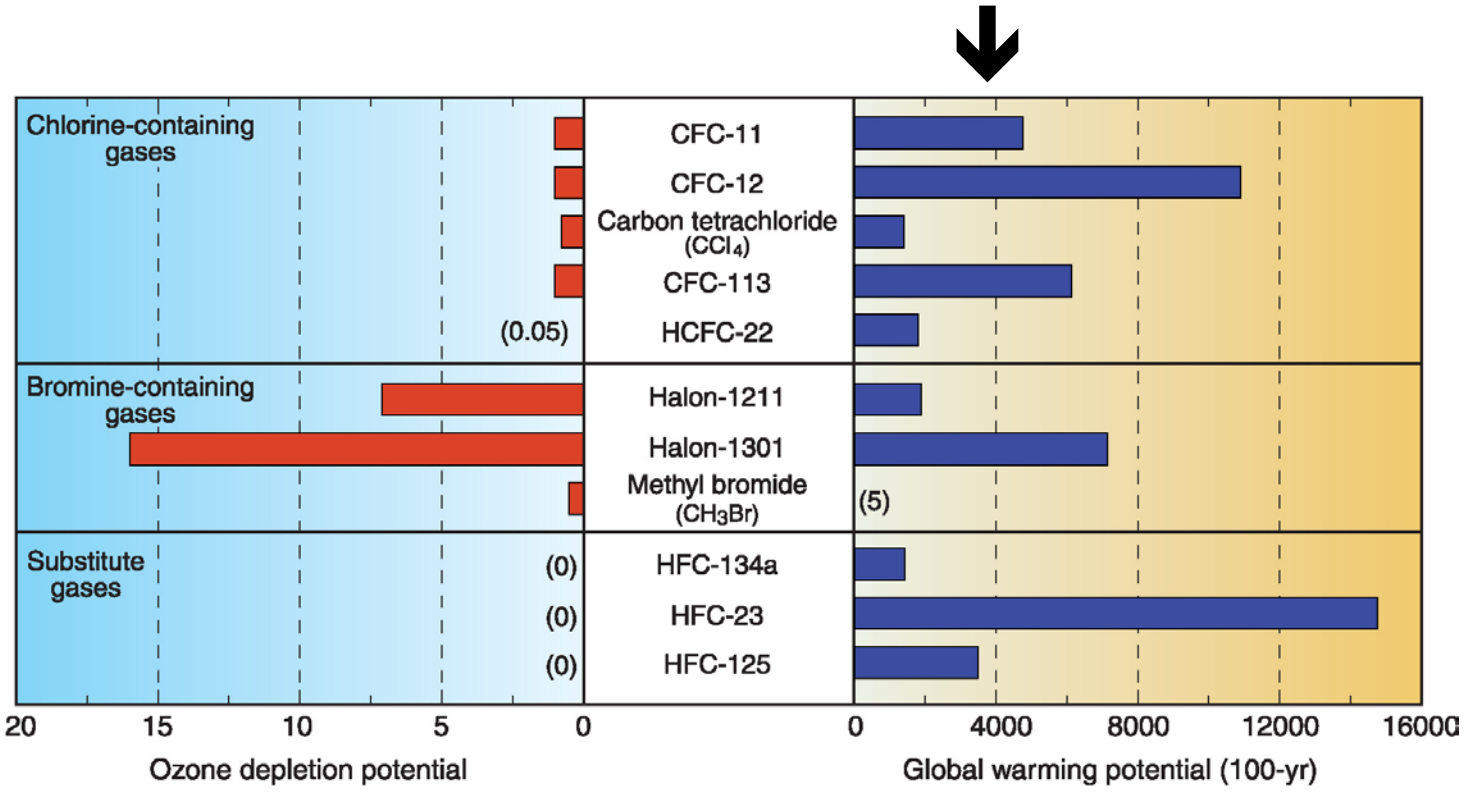
Peak Power Demand

Gujarat Appliance Load Curve in “Summer” and “Winter”



Greenhouse gas Emissions

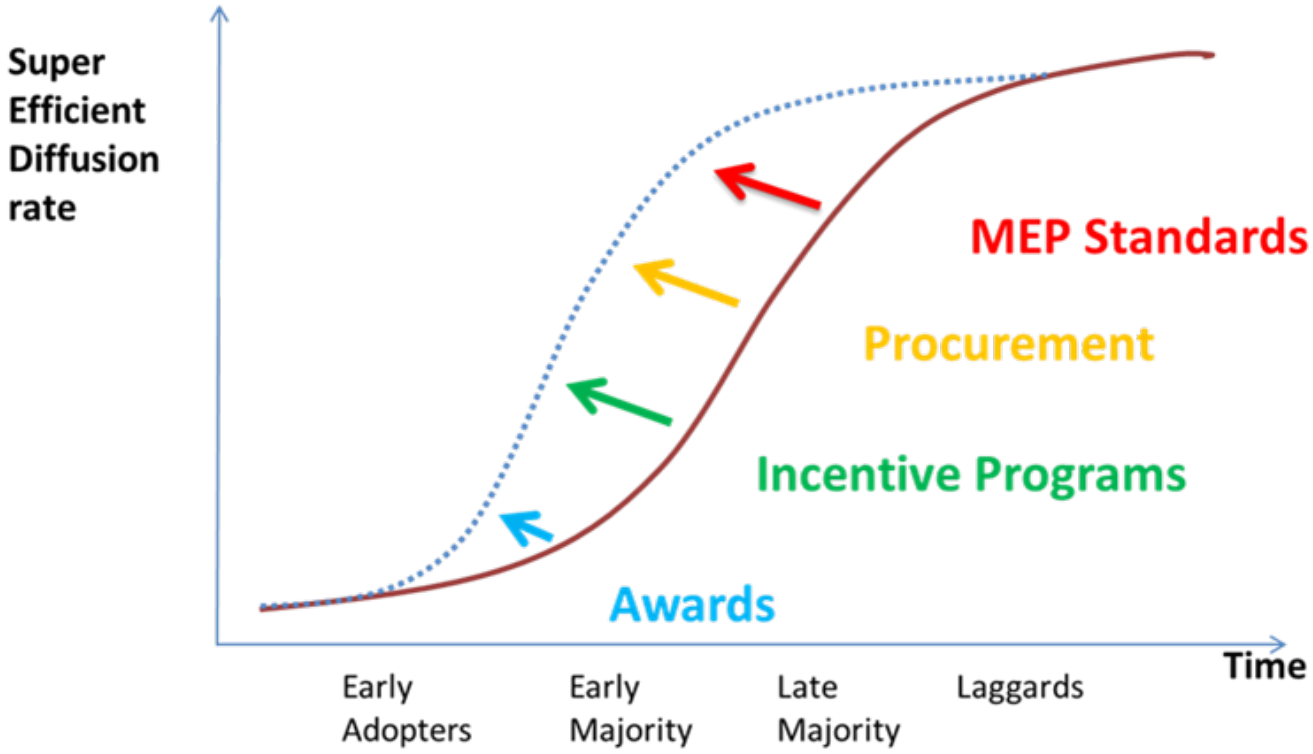
Ozone depleting substances are also potent global warming gases



Problem Statement

- What are the implications?
  - Power Supply Reliability
  - GHG Emission Growth
  - Energy Security
  - Energy Access
- What can be done to slow down the Power Demand growth?
- Can programs and policies be designed to contribute to cooling this growth?

Accelerating Super-Efficient (SE) rate of diffusion



A number of policy interventions can transform the market towards higher efficiency for specific end-use equipment such as ACs.

Case Studies

Scope:

- What kinds of AC Incentive programs are deployed across countries?
- How are they implemented and what are their main goals?
- Are they evaluated? What are the main findings?
- What are the lessons learned?

Program Type	Main goals	Case Studies
Downstream and Replacement Programs	Encourage consumer uptake of more efficient models and reduce stock of old, inefficient ACs	• Programa Nacional para la Sustitución de Equipos Electrodomésticos, MEXICO • ConEd Residential Appliance Replacement Program, New York, USA
Upstream Programs	Promote production of more efficient ACs in the market	• Promoting Energy-Efficient Products For The Benefit Of The People, CHINA • Reliance Infrastructure Ltd. Five Star Split AC Pilot Program, Mumbai, INDIA
Refrigerant Conversion	Transition from HCFCs to non-ODS, low-GWP and energy efficient alternatives	• Promoting Energy Efficiency For Non-HCFC Refrigeration and Air Conditioning, INDONESIA
Demand Response Programs	Incentivize decreased electricity consumption during peak demand hours	• Indiana Power & Light CoolCents Demand Response Program

SEAD | SUPER-EFFICIENT EQUIPMENT AND APPLIANCE DEPLOYMENT INITIATIVE

Promoting Energy-Efficient Products for the Benefit of the People, China

- **Budget**: US$1.85 billion (1st round)
- **Goals**: Boost the economy and transform the market to more efficient products
- **Program**: Upstream
- **Administrator**: government
- **Area served**: National
- **Time Frame**: 2009-2011 (1st round- 18 months) 2012-2013 (2nd round)

- Largest program studied - 34 million units targeted
- Market transformation, from 5% (tier 1 or 2) units in March 2009 to 70% at the end of 2010
- MEPS were revised in 2011 and tier 3, 4 and 5 units were removed from the market

Evaluation: Incentive should have only be offered for variable AC technology which is the most efficient technology

Trust Fund for Energy Savings (FIDE), **Mexico**

- **Budget**: $60 million, loan from the World Bank
- **Goals**: Economic development, poverty reduction and energy savings
- **Program**: Downstream rebate through financing
- **Administrator**: FIDE, Mexican Development Bank (Nafinsa)
- **Area served**: Mexico, entire country
- **Time Frame:** 2009-2014

- Has replaced and recycled >150Kunits since 2009
- Allows participants to finance new ACs on their utility bills
- Transportation, storage and recycling costs included in the subsidy

Evaluation: High rebound rates according to Davis, et al (2012)

Reliance Infrastructure (RI), **Mumbai, India**

- **Budget**: ~$330,000, from utility bill-payer funds
- **Goals**: Decrease load, add service value for customers
- **Program**: Downstream rebate
- **Administrator**: Investor-Owned Utility and program contractor
- **Area served**: RI service area in Mumbai
- **Time Frame**: 2014-2016

- Pilot program begun in February for commercial customers to **replace** old window units with **5-Star** split units
- Through bid process, worked with manufacturers to minimize pre-rebate unit price
- Negotiated per unit price that includes transportation, recycling & installation costs
- RI adds rebates of ~$70-$80 per unit

Promoting Energy Efficiency for Non-HCFC Refrigeration and AC (PENHRA), **Indonesia**

- **Budget**: $5 million, from Global Environment Fund
- **Goals**: Improve the energy efficiency of refrigeration and air conditioning equipment manufactured and used in Indonesia
- **Program**: Upstream grants to manufacturers
- **Administrator**: Ministry of Environment and UNDP
- **Time Frame**: 2015-2017

- Leverage HCFCs Phase-out Management Plan under the Montreal Protocol's Multilateral Fund (MLF) to support manufacturers to simultaneously upgrade their facilities to produce more efficient products
- The PENHRA program seeks to increase AC efficiency while decreasing AC refrigerant GWP

Consolidated Edison (ConEd), **New York, US**

- **Budget**: $1.1 million, from utility bill payer funds
- **Goals**: Meet regulator efficiency targets, add customer value
- **Program**: Consumer rebate
- **Administrator**: Investor-Owned Utility and program contractor
- **Time Frame**: 2010-at least 2015 (ongoing program)

- Offers $25 rebate for ENERY STAR-rated window ACs
- Impacted nearly 60K units in 2010-2011
- Program designed to meet regulator cost-effectiveness test
- Has experienced high free-ridership and lower-than-expected peak coincidence, diminishing results

Coolcents Demand Response Program, **Indianapolis , USA**

- **Budget**: $1.3 million in 2013 from utility bill payer funds
- **Goals**: Peak demand savings
- **Program**: Downstream through utility customers bill credit
- **Administrator**: Indianapolis Power & Light Utility
- **Time Frame**: 2002 to the present

- Financial incentive of $5 per month (Jun. to Sept.)
- DR events are based on economic criteria: if wholesale costs rise above $0.10 per kWh
- The average program cost per kWh saved is $0.069

Evaluation: The program had saved 28 MW of demand, about 1% of IPL total Capacity

Conclusion

- Incentive programs have a significant role to play in transforming the market to more efficient ACs
- Programs are very diverse, and there is no single model that is universally applicable.
- A program has yet to be designed that combines multiple objectives of
  - refrigerant transition,
  - efficiency improvement,
  - and demand-response participation.

Thank You

Contact at sadelarueducan@lbl.gov

See SEAD's new website at: www.superefficient.org

SEAD | SUPER-EFFICIENT EQUIPMENT AND APPLIANCE DEPLOYMENT INITIATIVE