



SEAD

SUPER-EFFICIENT EQUIPMENT AND  
APPLIANCE DEPLOYMENT INITIATIVE

Governments Working Together to Save Energy.

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# ACs: Cooling Growth in Energy Demand

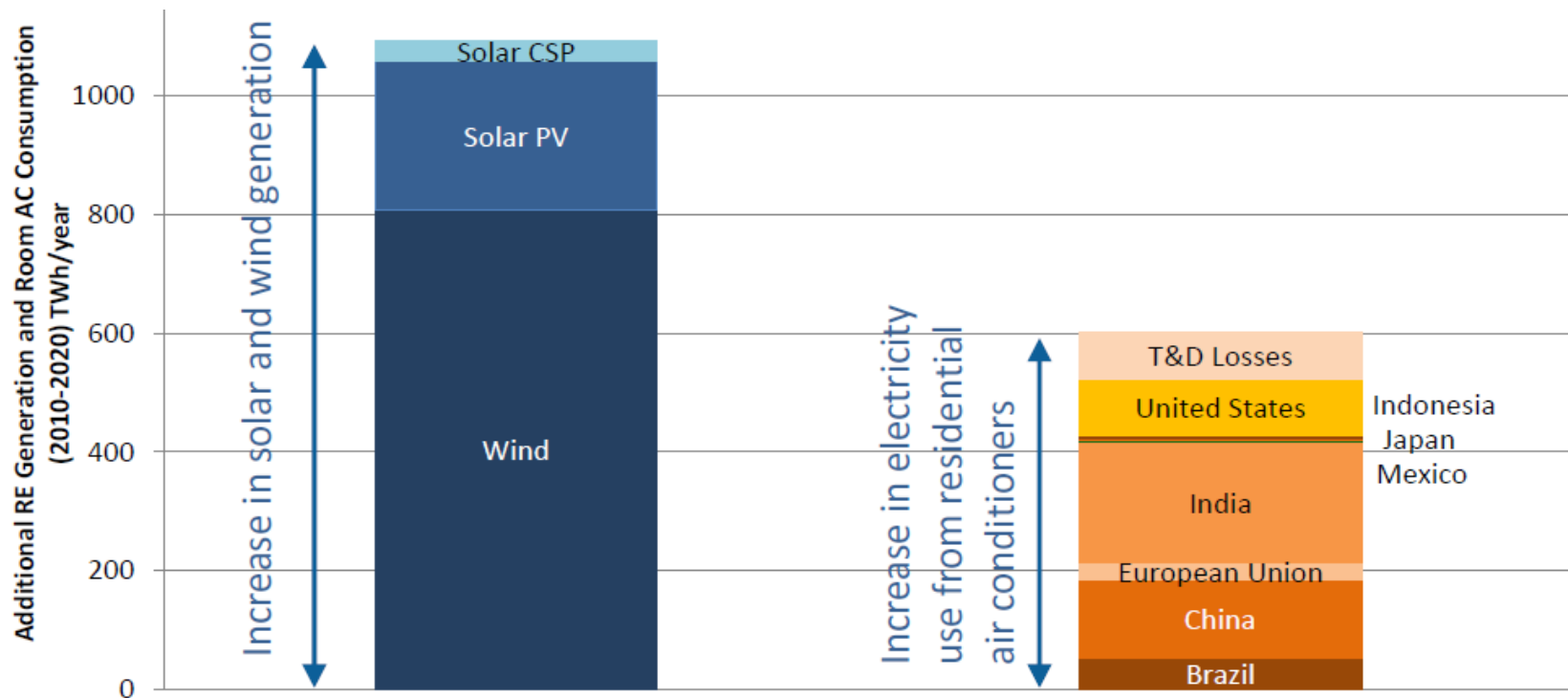
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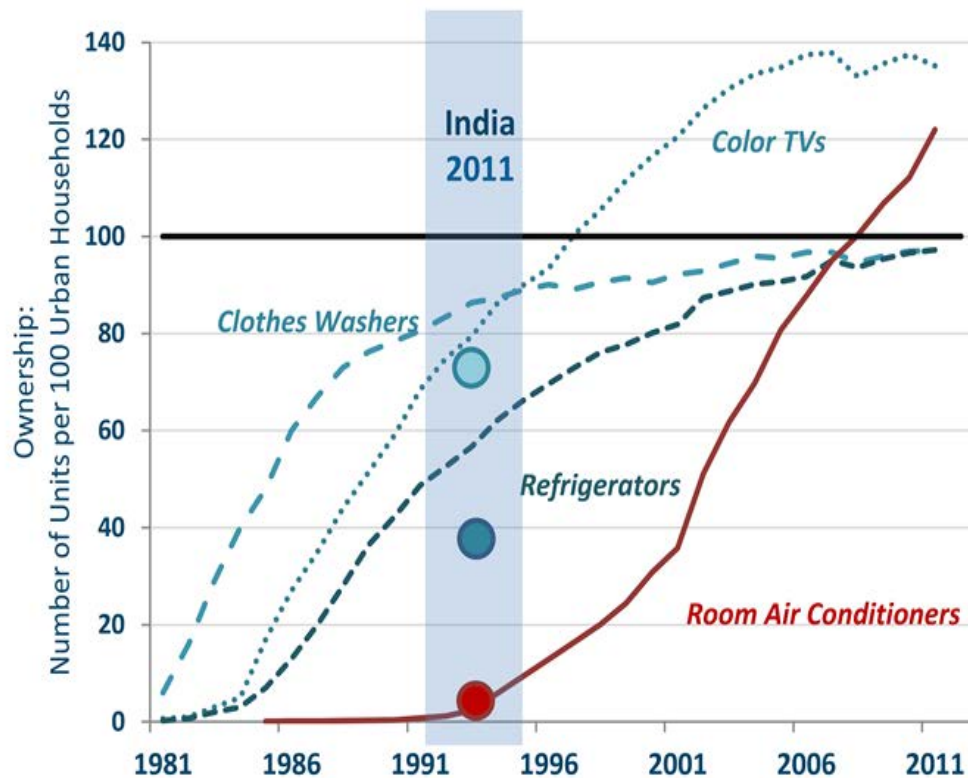
# Energy Demand Forecast

***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)

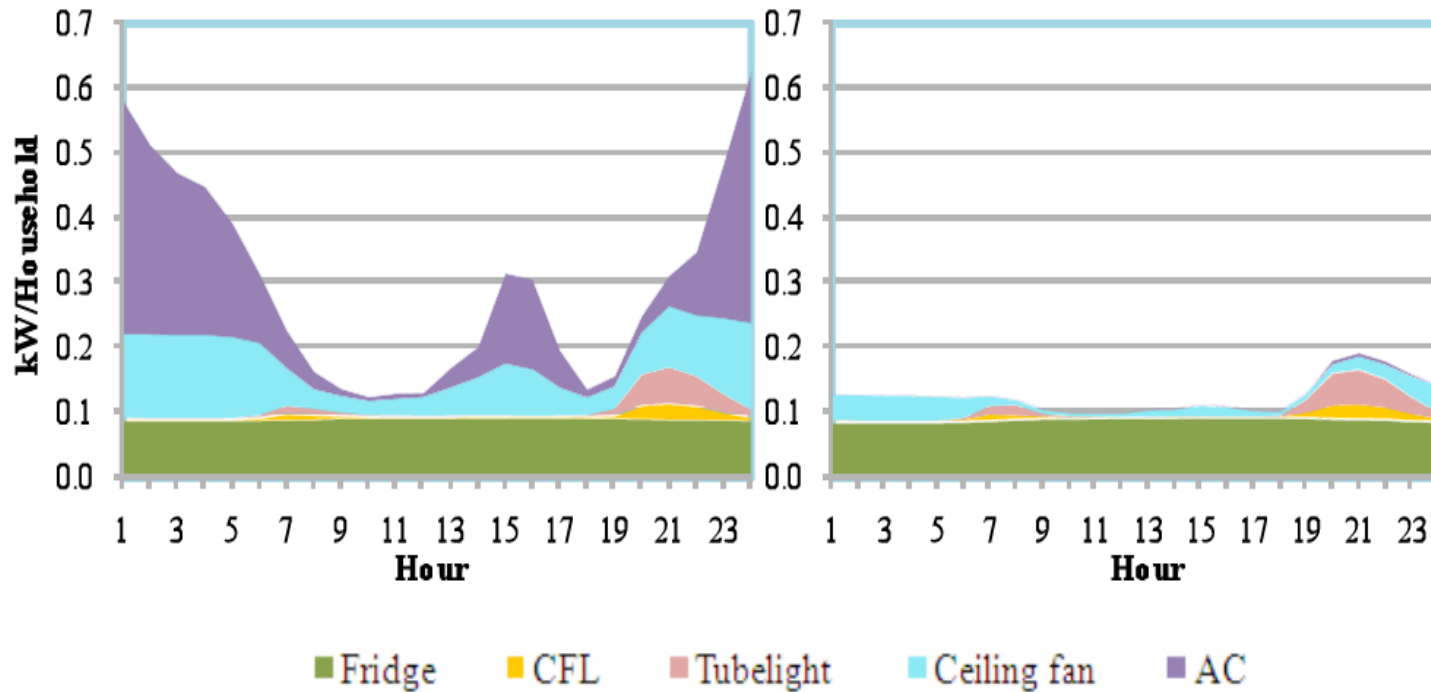
# Relative Rates of Appliance Ownership in Urban China and India



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

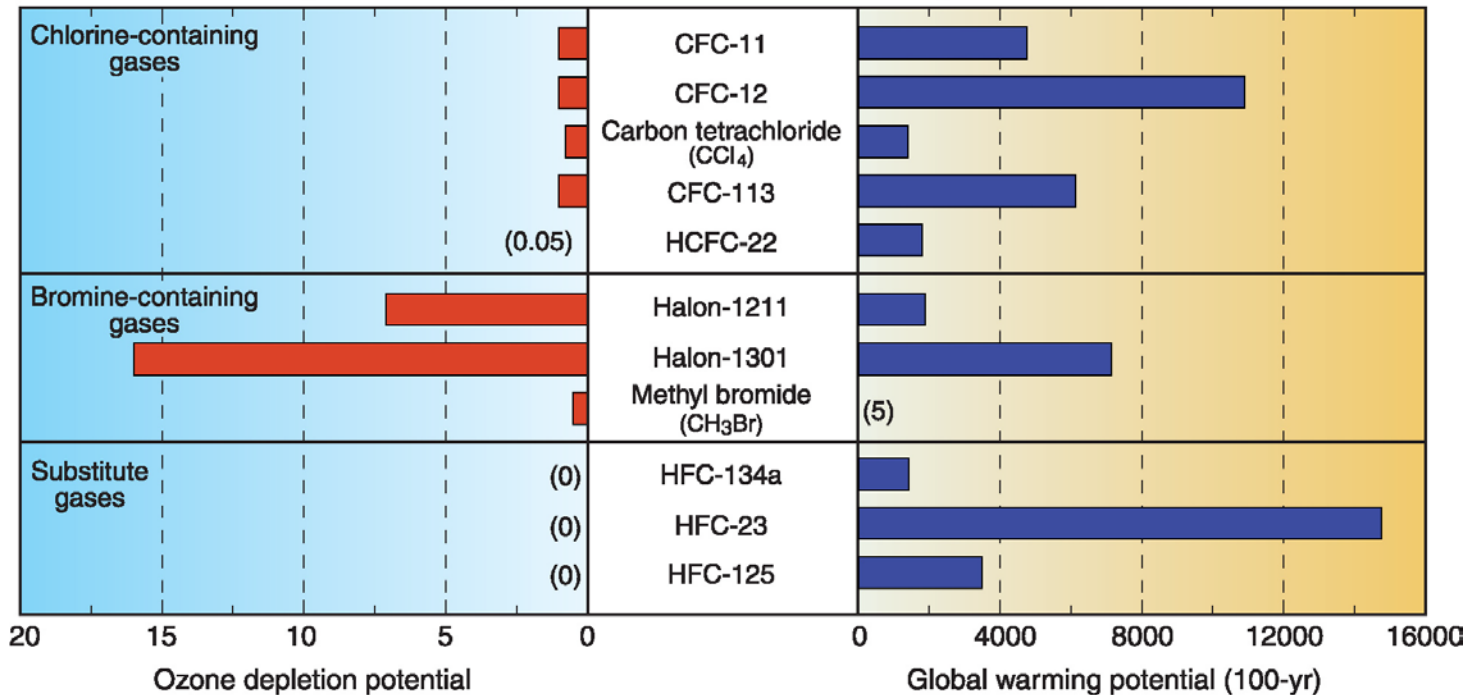
# Peak Power Demand

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



# Greenhouse gas Emissions

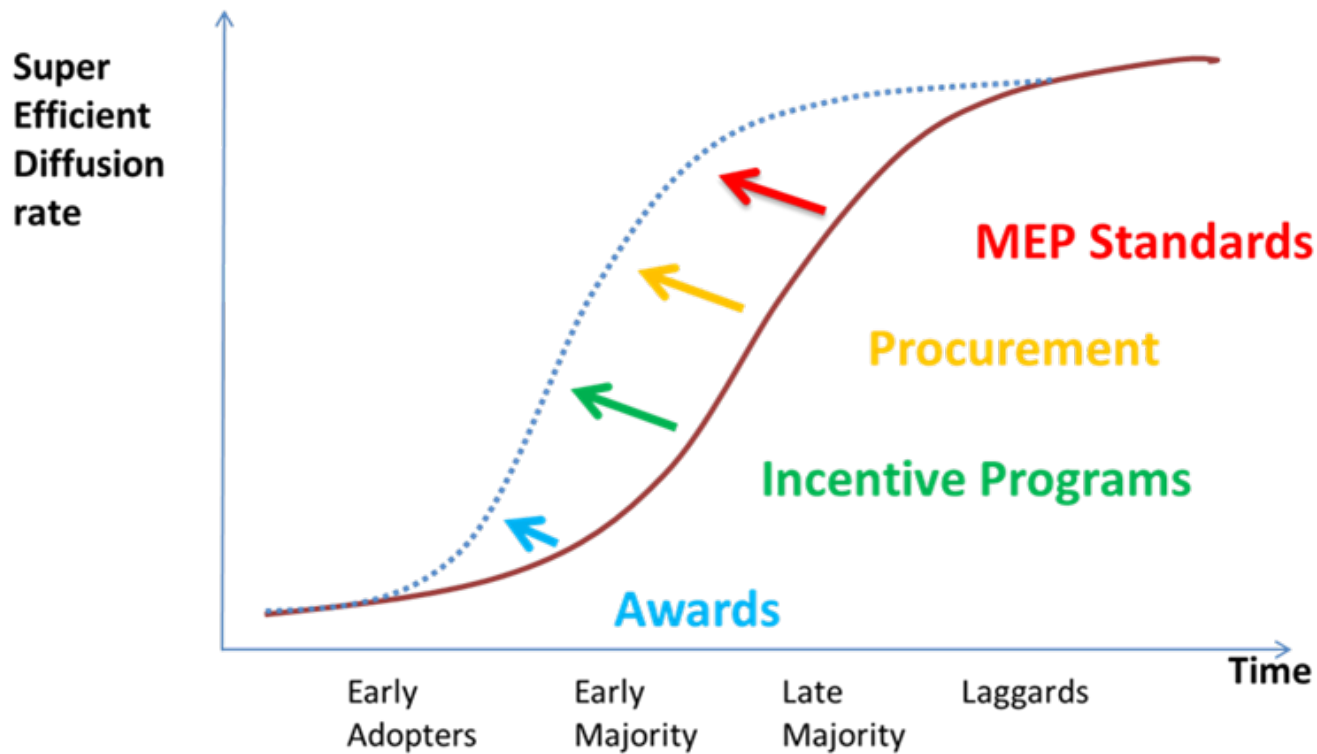
Ozone depleting substances are also potent global warming gases



# 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
<b>Downstream and Replacement Programs</b>	Encourage consumer uptake of more efficient models and reduce stock of old, inefficient ACs	<ul style="list-style-type: none"> <li>• Programa Nacional para la Sustitución de Equipos Electrodomésticos, MEXICO</li> <li>• ConEd Residential Appliance Replacement Program, New York, USA</li> </ul>
<b>Upstream Programs</b>	Promote production of more efficient ACs in the market	<ul style="list-style-type: none"> <li>• Promoting Energy-Efficient Products For The Benefit Of The People, CHINA</li> <li>• Reliance Infrastructure Ltd. Five Star Split AC Pilot Program, Mumbai, INDIA</li> </ul>
<b>Refrigerant Conversion</b>	Transition from HCFCs to non-ODS, low-GWP and energy efficient alternatives	<ul style="list-style-type: none"> <li>• Promoting Energy Efficiency For Non-HCFC Refrigeration and Air Conditioning, INDONESIA</li> </ul>
<b>Demand Response Programs</b>	Incentivize decreased electricity consumption during peak demand hours	<ul style="list-style-type: none"> <li>• Indiana Power &amp; Light CoolCents Demand Response Program</li> </ul>



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

- **Budget:** US\$1.85 billion (1<sup>st</sup> round)
  - **Goals:** Boost the economy and transform the market to more efficient products
  - **Program:** Upstream
  - **Administrator:** government
  - **Area served:** National
  - **Time Frame:** 2009-2011 (1<sup>st</sup> round- 18 months) 2012-2013 (2<sup>nd</sup> 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 >150K units 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
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- 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
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- 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)
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- Offers \$25 rebate for ENERGYSTAR-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.

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# Thank You

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Contact at [sadelarueducan@lbl.gov](mailto:sadelarueducan@lbl.gov)

See SEAD's new website at: [www.superefficient.org](http://www.superefficient.org)

