Opportunities in Energy Efficiency: Green Building and the Industrial Sector

USAID's Energy Efficiency for Clean Development Program (EECDP)

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Opportunities in Energy Efficiency

Industrial Energy Efficiency *Setting the Context*

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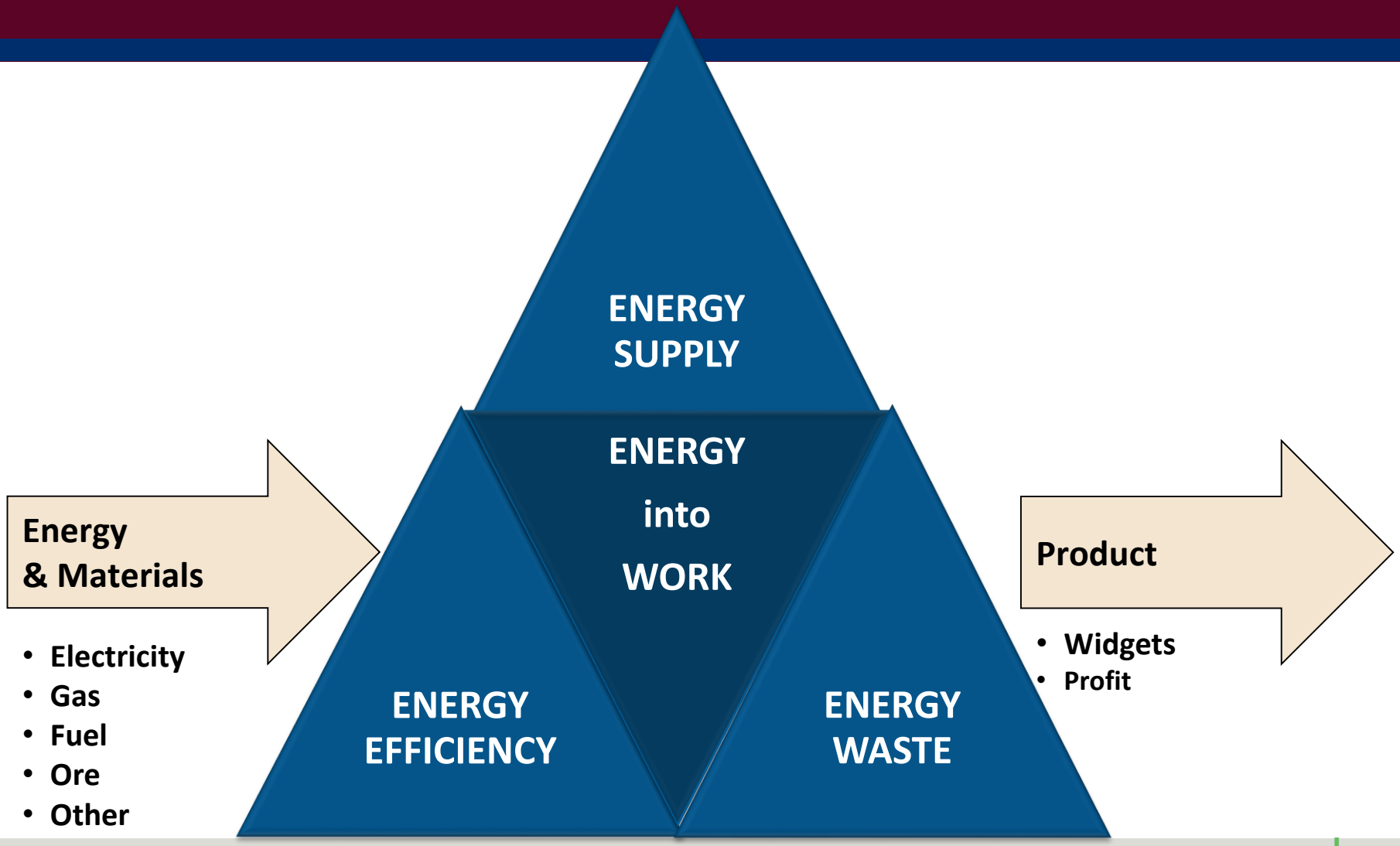
Overview

Introduction of Industrial EE concepts

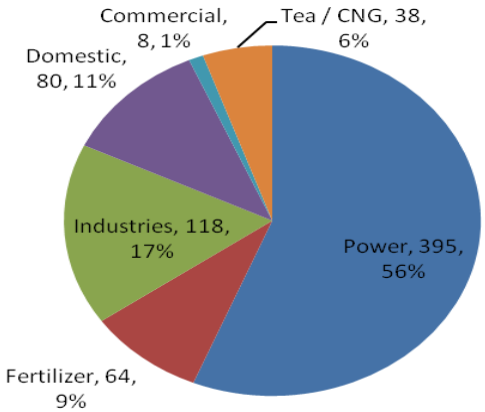
1. Industrial Energy Management
2. Case Study – Bangladesh
    1. National Energy Consumption Overview
    2. Energy Consumption Equivalents
3. Energy Efficiency Retrofit
4. Energy Management – Non Sophisticated
5. Energy Management – Sophisticated
6. Energy Supply Management – Fuel Switching
7. Energy Demand Management
8. Electric Demand Response
9. New Plant Design & Commissioning
10. Energy Efficiency Program Types by Sector
11. Industrial Energy Efficiency - Benefit Matrix

Industrial Energy Management Concept



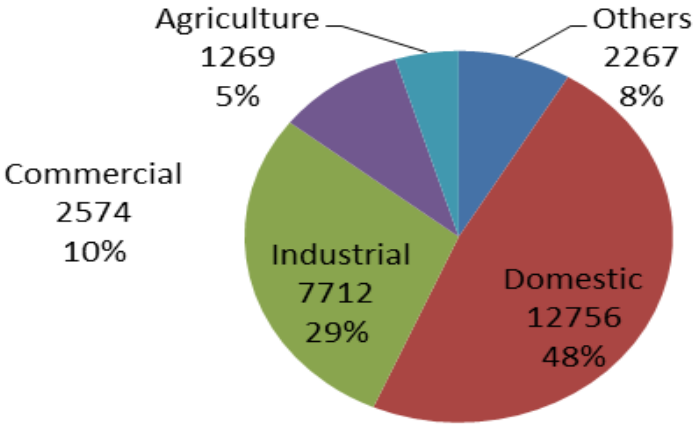
Case Study – Bangladesh
Industrial Plant Operating Environment

Case Study – Bangladesh
National Energy Consumption Overview

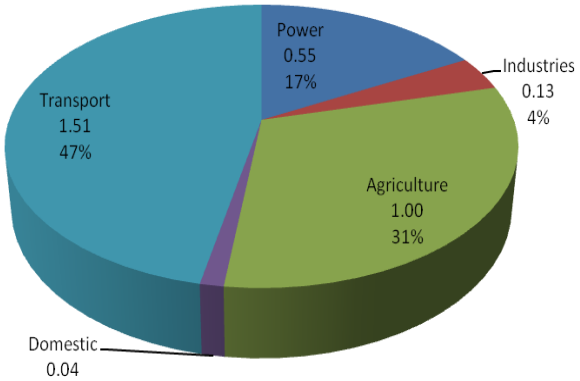


Natural Gas FY 2010, Billion Ft3

ICF Project File – USAID *Bangladesh Industrial Energy Efficiency Opportunities Assessment, 2012*



Electricity Consumption FY 2011, KWh



Petroleum Consumption FY 2011, million tons

Case Study – Bangladesh
Energy Consumption Equivalents

12,000 USA homes' energy use for one year

30,000 Passenger vehicles

500,000 Central African homes' energy use for one year

=

1 Bangladesh 'large' Steel Mill

See Speaker notes for list of references, ICF/USAID, ICF/EPA, IEA

Energy Efficiency Retrofit

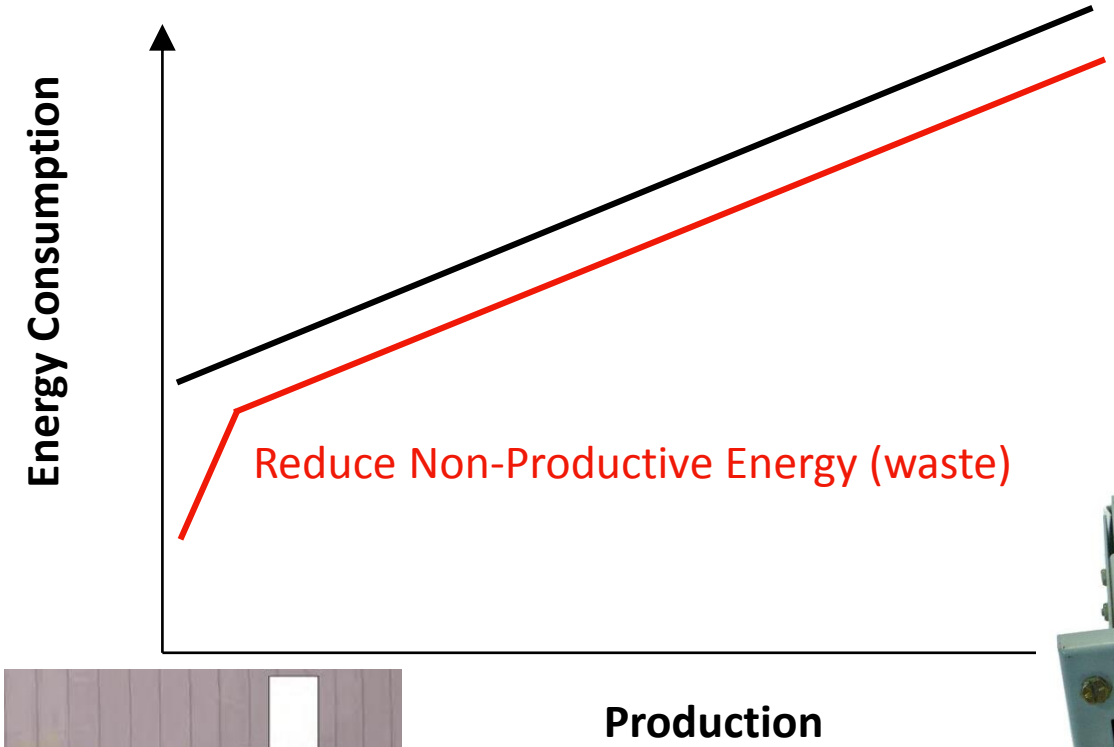
- Industrial Lighting
- Technology Upgrade
- Retrofit old technology with new
- Large % of industrial EE retrofits are not as simple and require engineering

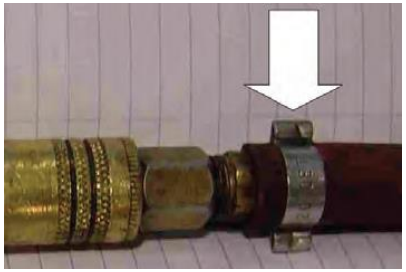
1000 Watt Metal Halide

150 Watt LED High Bay

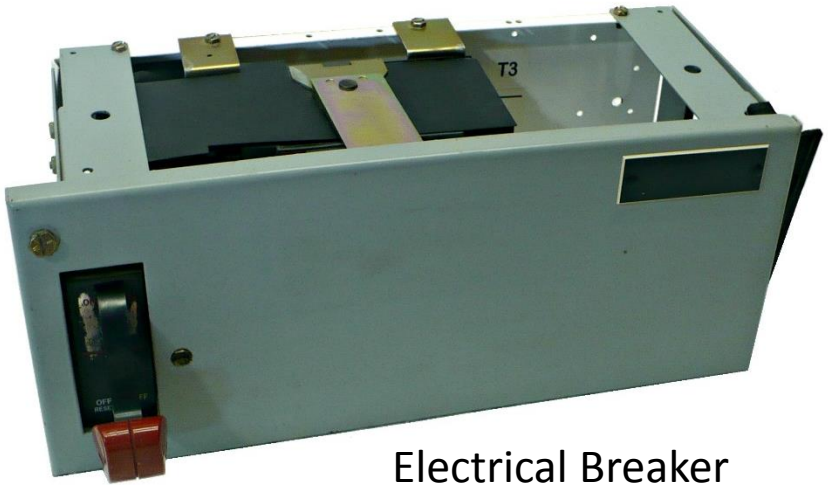
<u>Related EE definitions defined in Day 2:</u>
Resource Acquisition
Market Transformation
Prescriptive Incentives

Energy Management – Non Sophisticated



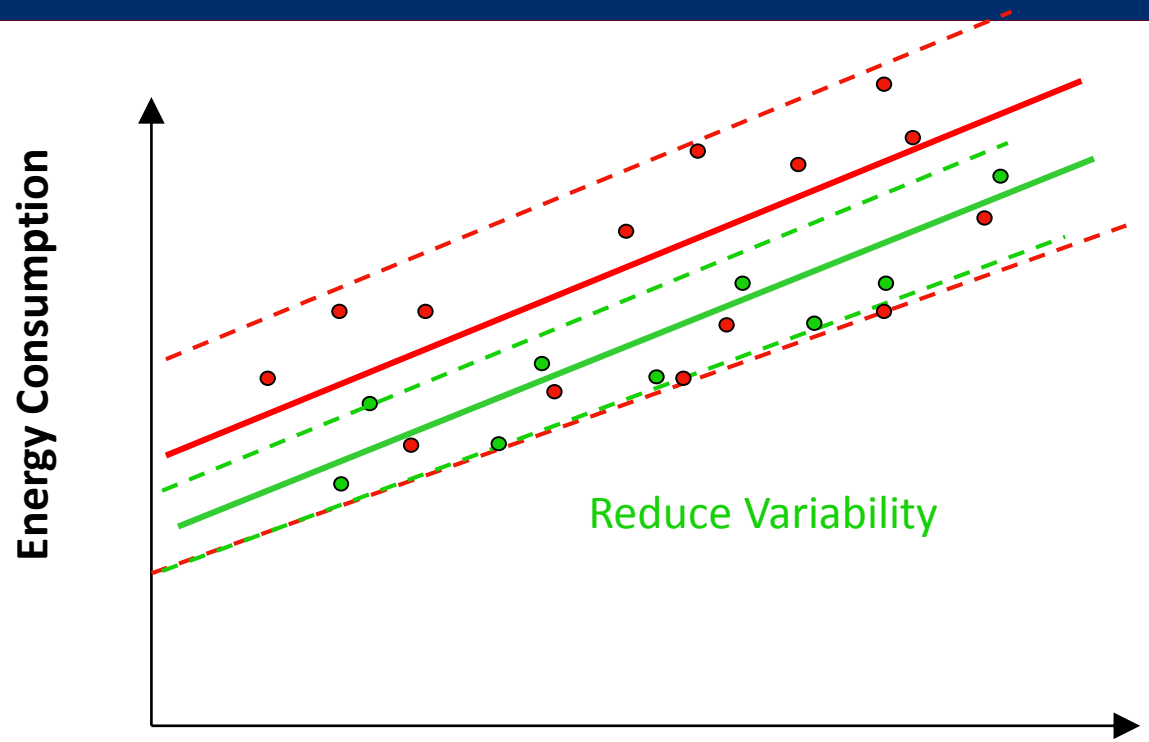


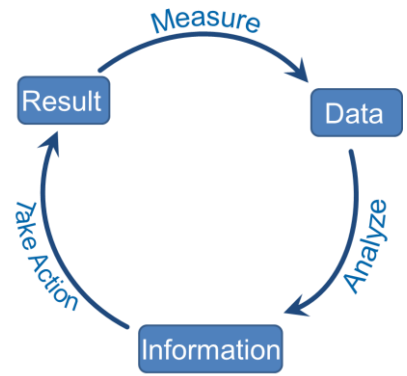
Compressed Air Leak



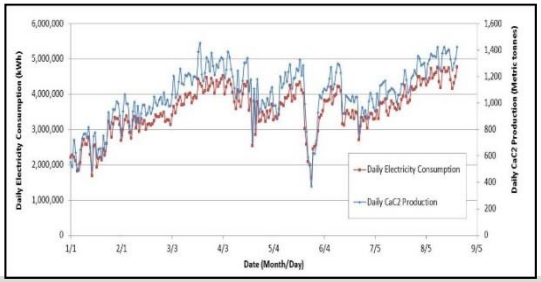
Electrical Breaker

Energy Management – Sophisticated





Management Methodology



Measured Energy Performance

Natural Gas

	Gas (m3)	Mean Temp (C)	Pkg Wt. (kg)		
Consumption	12800	7.6	35000		
	Value	Mean	LCL	UCL	In Control?
Index	1.10	1.00	0.95	1.05	NO

Index = Actual Gas/Predicted Gas = Gas(m3)/(9859-151*Mean Temp+0.0455*Pkg Wt)

Electricity

	Electricity (kWh)	Mean Temp (C)	Pkg Wt. (kg)		
Consumption	68000	7.6	35000		
	Value	Mean	LCL	UCL	In Control?
Index	1.01	1.00	0.93	1.07	YES

Index = Actual Elec./Predicted Elec = Electricity(kWh)/(56058+200*Mean Temp+1.52*Mean Temp^2+0.107*Pkg Wt)

Real-Time Energy Performance

Energy Supply Management – Fuel Switching

Electrical Generator

- **Backup Generation**
- **Self (Full Time) Generation**
- **Biomass**

Engine**

- **Combined Heat and Power**
- **District (micro) Grid**
- **Coal/Oil/Dung**

DIY Solar Thermal Concentrator*

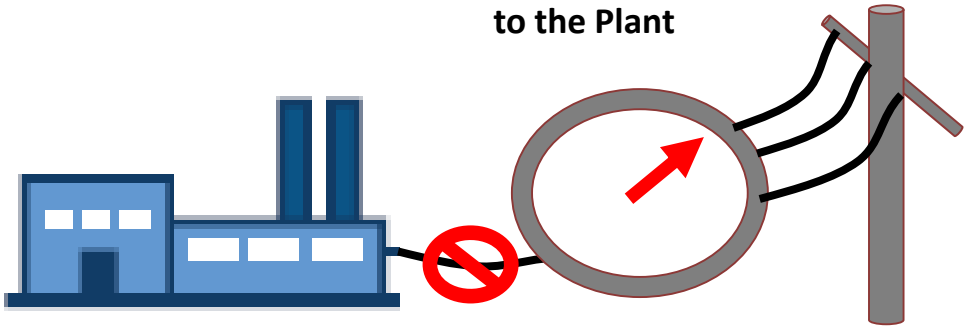
Solar Thermal Concentrator*

*Courtesy of Life Prometheus **ICF Project File

Energy Demand Management

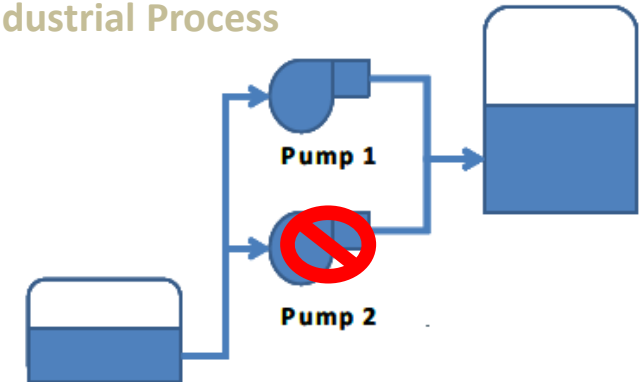
Since Industrial electrical loads are relatively large, with some flexibility, Plants can manage their own Demand for financial gain, or safety.

Electrical <u>Demand</u> reaching 'billed' monthly peak or a line constraint to the Plant



Industrial Plant

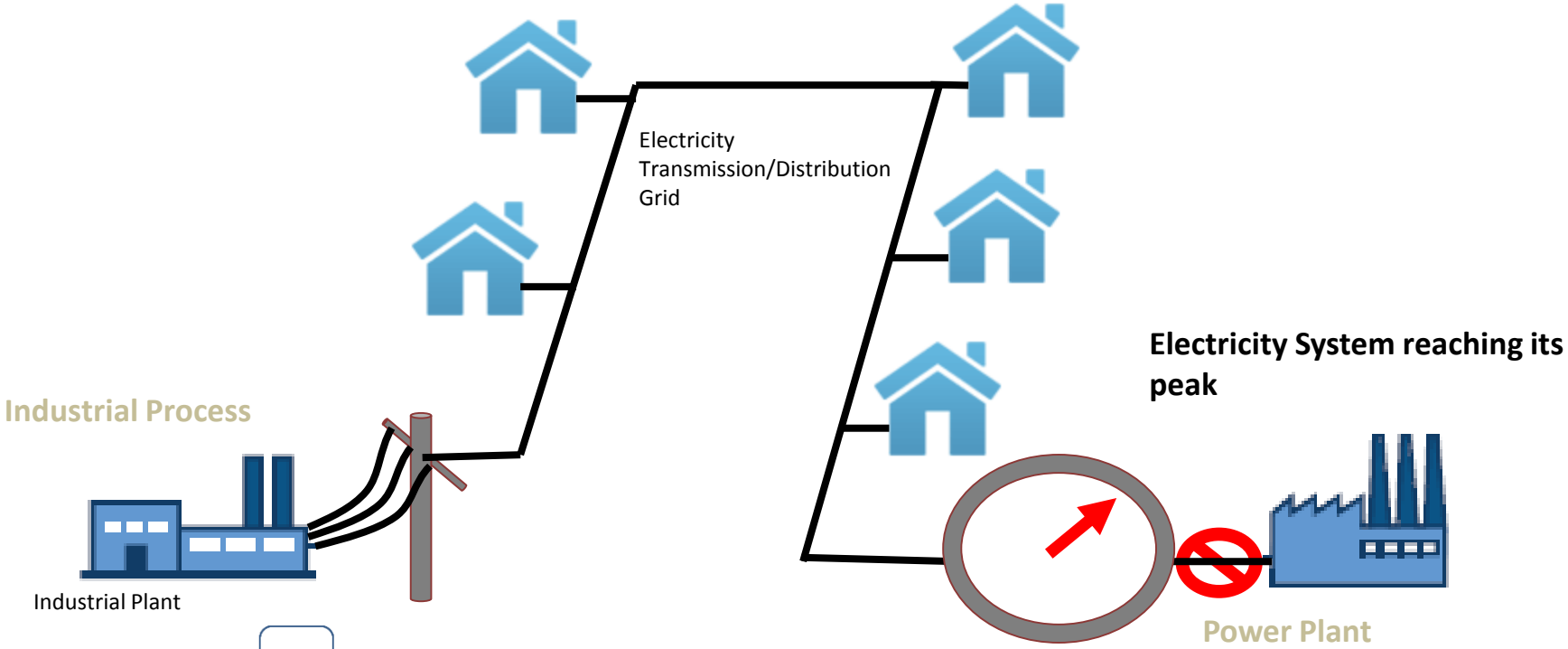
Industrial Process

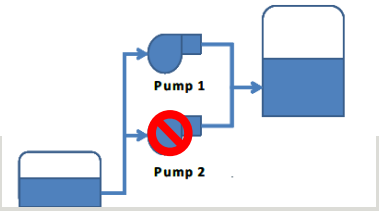


Resulting Action is to shed load, in priority sequence

Electric Demand Response

Electricity system planning can identify opportunities for Grid reliability through Demand Response. Industrial plants are compensated. Reduces Black/Brownouts.





Resulting Action is to shed load, in priority sequence

New Plant Design & Commissioning

Existing Scenario

- Industrial Plants are designed by discrete trades/engineer resulting in a sub optimized industrial processes
- Capital is tight resulting in a low cost design, potentially second hand components

Intervention 1 – Desktop energy efficiency review of design

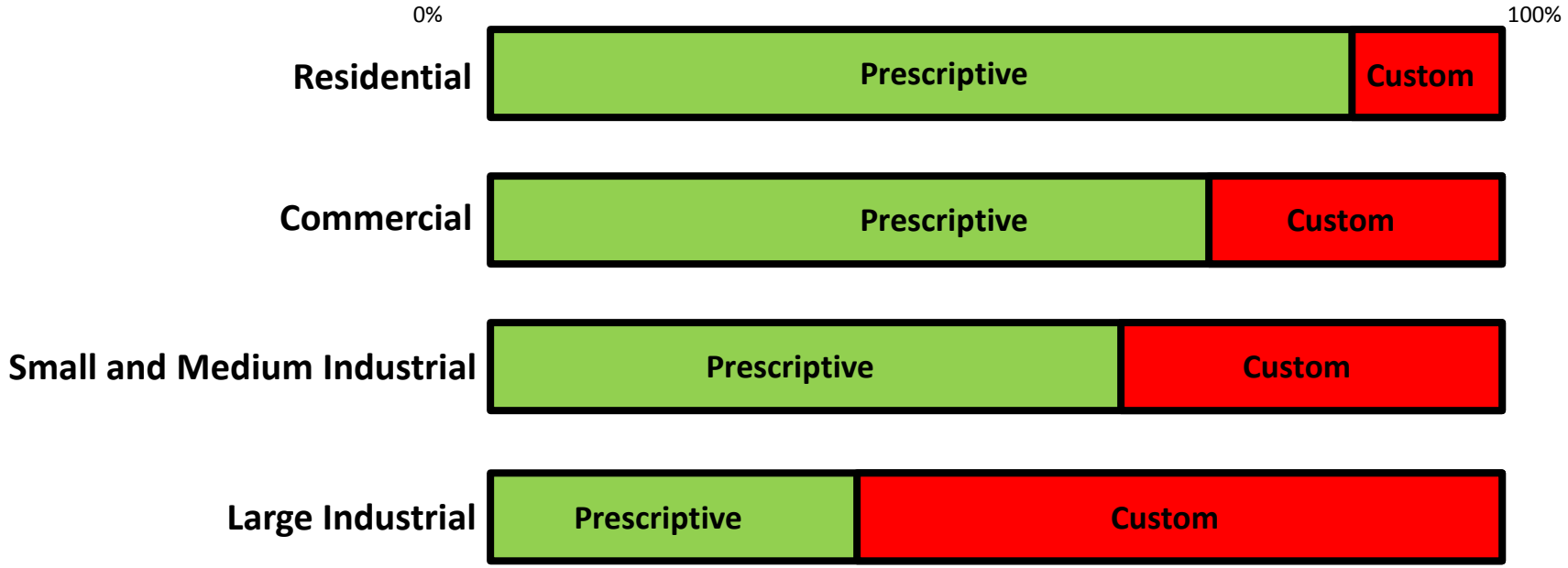
Intervention 2 – Energy performance is imbedded into plant commissioning

Resulting Scenario

- EE opportunities identified for Industry and business cases of incremental cost/savings for the Financing Agencies
- Asset Lifecycle cost improved, less energy consumed

Energy Efficiency Program Types by Sector

Programs are market interventions that differ by the market sector. Application of Training and Marketing is common across sectors.



Prescriptive = Program designed for high # of transactions, for popular technologies. X$ per unit of retrofit. i.e. $5 for a LED light bulb.

Custom = Program designed for large projects, engineered solutions, business cases for investment. i.e. X% cost for a business case, X% of project cost.

Industrial Energy Efficiency - Benefit Matrix

Market Actors and their motivations are important to characterize. Channel partnerships, funding arrangements, program administration, policy changes are all possible, and unique in each jurisdiction.

Society	Utility	Financier	Industry
• GHG Reduction • Grid Reliability • Electrification • Industrialization • Poverty Reduction • Export Taxes • Trade Jobs • Manufacturing Jobs • Knowledge Jobs	• Customer Satisfaction • Grid Reliability • Lowest Cost Generation • Policy Contingent – Profit • Policy Contingent – Compliance	• Green Investment Portfolio • Stable Economy • High ROI • Scalable • Trusted Business Cases	• Lower Operating Cost • Lower Variable Cost Risk • Asset Renewal • Debottleneck • Safety • Quality • Green Supply Chain • Policy Contingent – Faster Depreciation • Policy Contingent – GHG Obligations