BSc – Engineering - Uop, MEng – Energy Technology , UoM

Charted Engineer, Cooperate Member IESL

Accredited Energy Auditor

Past President – Sri Lanka Energy managers Association

Past Board Member – Sri Lanka Sustainable Energy Authority

Board Member – National Cleaner Production Centre

Boar Member – Sri Lanka Energy Managers Association

Industrial energy efficiency, challenges and opportunities

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What are the challenges (Energy)?

Industry(user)

Higher Energy Cost

- Increased production cost
- Market competitiveness
- Curtail employees welfare

Country (Government)

Limited Resources

- Not sufficient energy to all
- Foreign exchange draining
- Depleting resources
- Energy for future generation

Environmental Issues

- Local and Global
- Global warming
- Climate change
- Acid rains

Result

- Industry want "Their factory" to use less energy/Green Energy
- Government wants "Industry" to use less energy/Green Energy
- Society wants "Industry" to use less Energy/Green Energy

Implement an Energy Management System

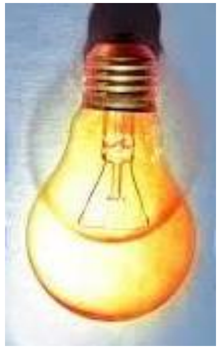
What Do We Need ? (Do We Need Energy?)

Energy Services

- Illuminating a room
- Air conditioning a space
- Typing and printing a letter
- Ventilating a room
- Boiling water

Crude Oil → 2.9 → Refinery → 2.75 → Power Plant

NW >>> MW

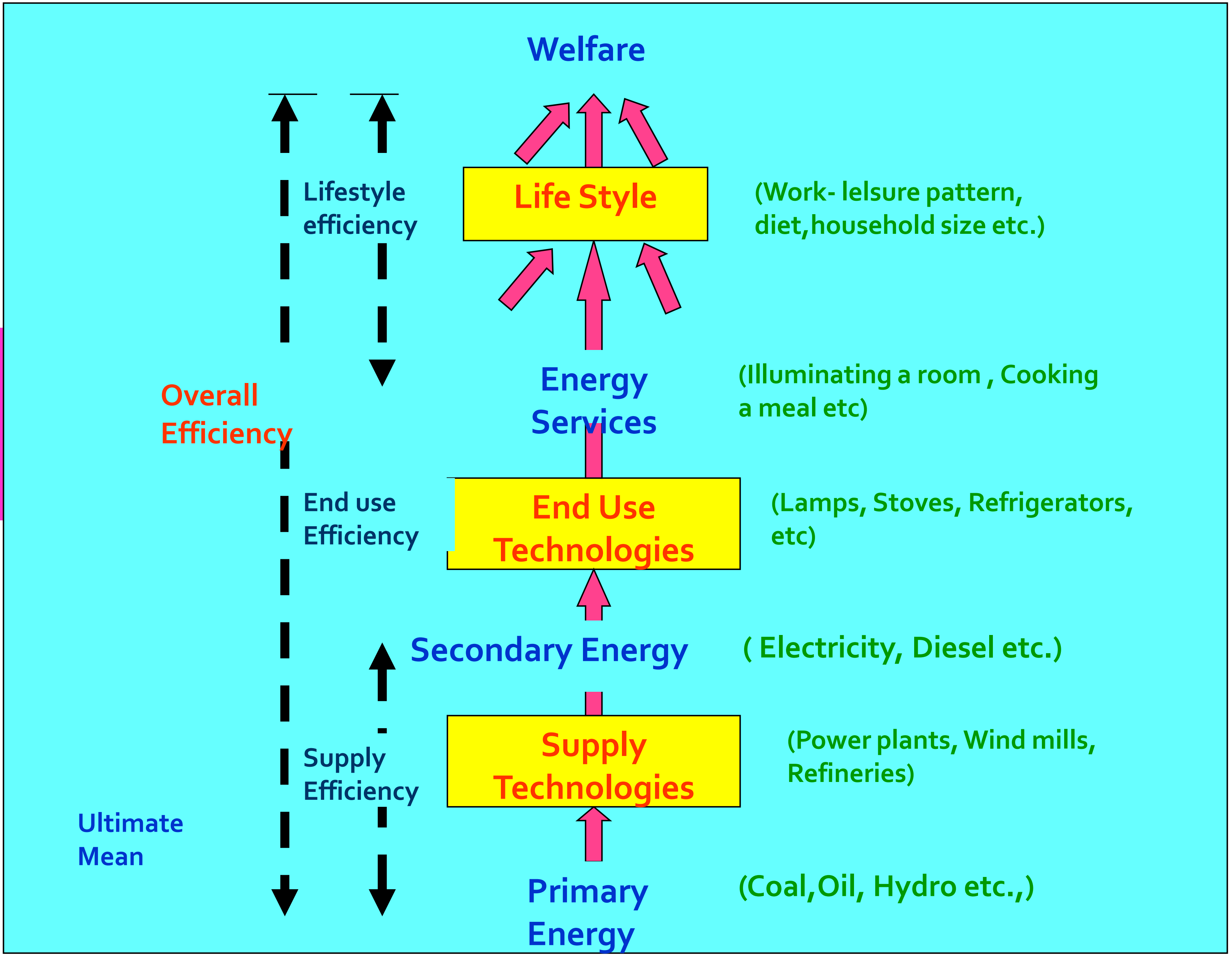


1.10 → 1 → Illuminance → 0.1 → Use → 0.05

1.7 %

3.4 %

Energy Chain

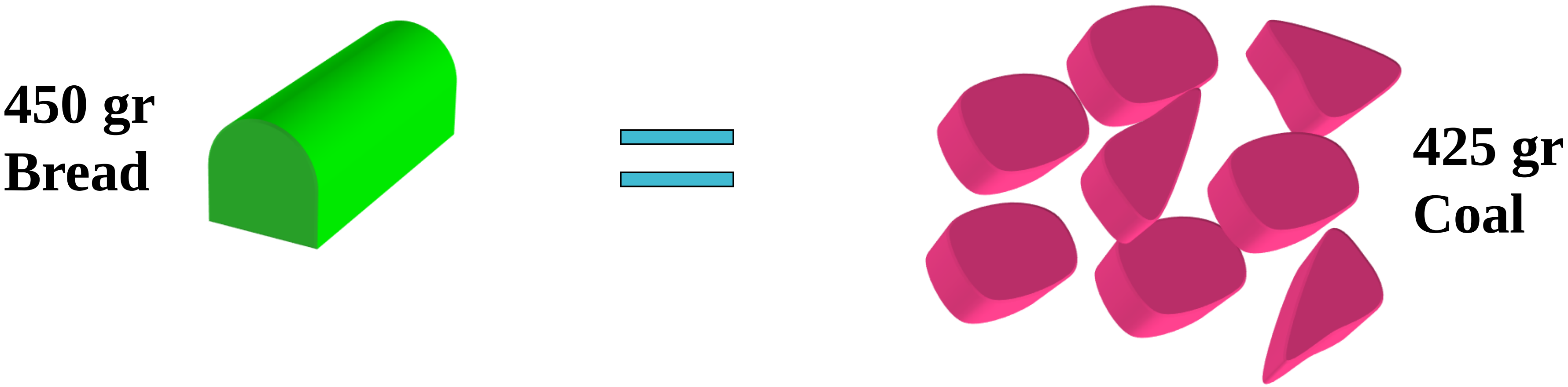


Energy Consumption and Saving potential

Industry	% Energy Share		% Saving Potential	
	Thermal	Electrical	Thermal	Electrical
Tea	87	13	25-40	25-40
Textile	78	22	10-45	10-15
Rubber	43	57	15-25	10-15
Garment (with Finishing)	52	48	15-40	25-40
Hotel	42	58	15-25	10-20
Garment (only Electrical)				10-32
Office Building				10 -38

What Happened to the Energy?

- Services
- Embodied in Materials & Products



Ultimate objective: Providing energy services to meet social welfare

Understand and Analyze What Happened to the Energy

Energy → Energy Service → Welfare (Life Style)

kWh | Pumping Water | Have a bath

Economical / Un Economical

Avoidable / Un Avoidable

Eg : Water Pumping

- **To transfer Water to a higher elevation from a lower elevation**
- **Useful Energy = HQρg**
- **Actual Energy = Useful Energy + Losses**
- **Useful Energy = Actual requirement + additional requirement**

Demand Side Management

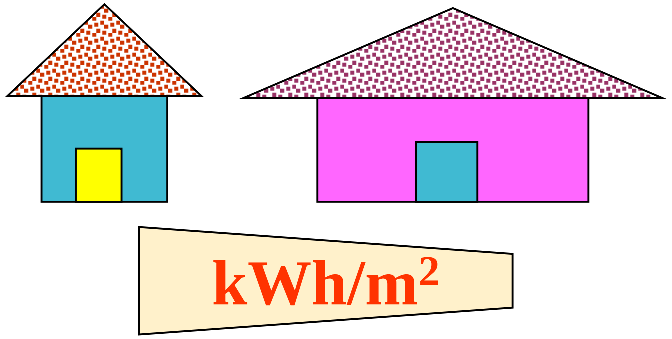
- Much more complex
- Integrated approach : Contribution from various actors

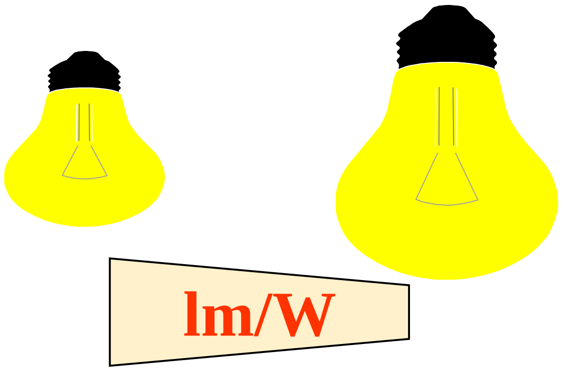
Improvement Of

- End use technical efficiency
- End use utilization efficiency
- Life style efficiency

End Use technical Efficiency

- More or less technical
- Starting point – procurement (costly)
- Be Careful
  - Economy of Scale : One can become a more energy efficient man by consuming more energy





- Good Knowledge :- eg: Use of energy efficient motors for pumps and blowers

Concept of 'Economy of Scale' - Bigger things are more energy efficient

- ***Positive Side → Practice***

Replace many small things with a large thing

  - *Small Compressors Vs Central Compressor*
  - *Individual AC units Vs Central Air Conditioner*

- ***Negative Side → Avoid***

Over Sizing

  - *You can become a more energy efficient man by consuming more energy*

Why oversizing

- Low price difference
- Room for future expansion
- Over estimation of the requirement
- Uncertainties in Engineering calculation
- Replacement with bigger one at break down

End Use Utilization Efficiency

- How best some one use energy efficient equipment

Is it sufficient to use Energy Efficient plant, equipment and process ?

NO , Not enough

Energy Efficient plant, equipment and process should be used efficiently.

Energy Efficient plant, equipment and process should be Located Correctly

Use Efficiently

Efficient Operation of Boilers

Maintain correct level of Excess Air

- Oil – 20%, Gas – 10%,
  Solid – 40 % - 60 %
- Room for efficiency improvement
– Up to by 10%

Correct Atomization

Recommended size 20 – 40 Microns

- Larger – unburnt C,➔ Black smoke
- Smaller – unburnt oil ➔ White smoke

Correct Blowdown level – 3500 ppm

End Use Utilization Efficiency

Locate Correctly

- Avoid installation of plant far away from the user points – Boilers, Compressors, Pumping Stations

- Avoid installation of compressors at HOT, Moist and Dirty Ambient,

- Avoid installation of compressors in series so that ; exhaust from one intakes to the other

Reduction of each 4 °C of inlet air temperature will result 1% ENERGY SAVING

- Install Fresh Air inlets of AHUs away from cooling towers, Hot chimneys

End Use Utilization Efficiency

- Technical
- Non Technical
- Managerial

- Boilers
  - Automatic Blow down
  - Flash Steam recovery
  - Pressure Reducing valves
  - Condensate Pumping
  - Online flue gas monitoring and burner tuning
  - On line steam trap monitoring

Select only matching Options for your requirement

End Use Utilization Efficiency

- Do Quickly
- Avoid over processing
- Minimize reworking
- Operate at full capacity
- Good Plant layout
- Avoid Idling Operation
- Reduce material/product waste
- Maintain Correct Process Parameter

Process parameters

- Maintain at correct values
- Calibration of Gauges

Cooling Chilled Water - Use highest possible temperature, improves COP

Fuel oil Preheating

- higher temperature
  – excess atomization, more unburnt oil.
  - More energy consumption
- lower temperature
  - Poor atomization, more un-burnt C

Compressed Air 1 Bar Reduction results 8 -15 % Reduction in Energy

End Use Utilization Efficiency – Housekeeping

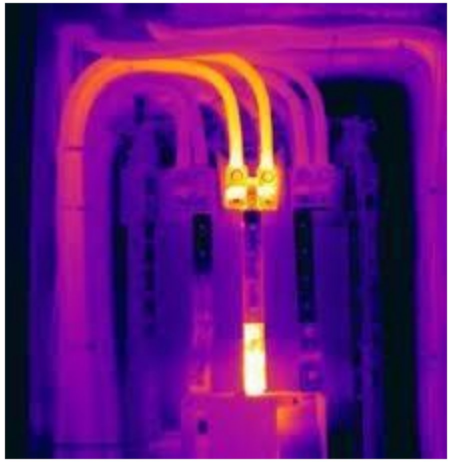
Use of Compressed air for cleaning (at 100 Psi)

- **9 mm tube – 225 cfm**
- **Gun with Nozzle – 15 cfm**

93% Saving

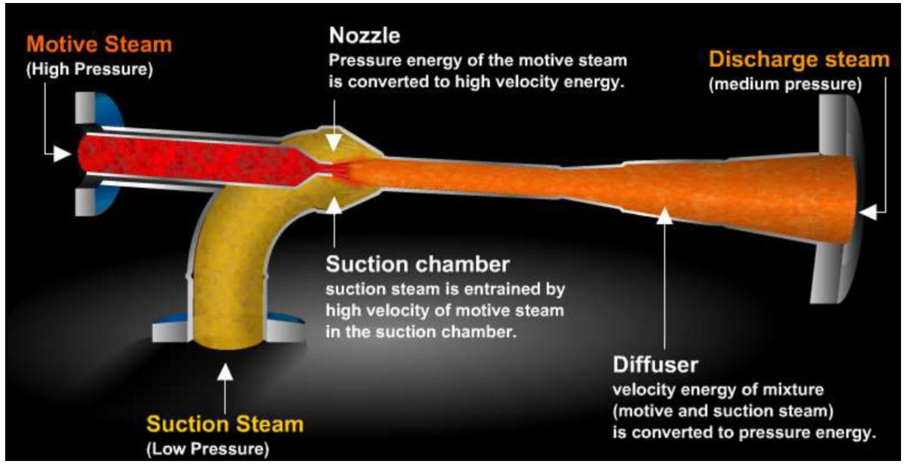
End Use Utilization Efficiency – Maintenance

- Belt Slip
- Bearings
- Loosen terminals
- Dusty Inter coolers in Compressors
- Clogged Condensers in AC Plants
- Blocked filters
- Repair – Make it Complete



End Use Utilization Efficiency – Waste Heat Recovery

Source	Waste Heat (as a % of input Energy
IC Engine	55%
Air Conditioning	350%
Air Compressors	60%
Boilers (Oil)	15%
Boilers (bio mass)	20%



WHR Limitations

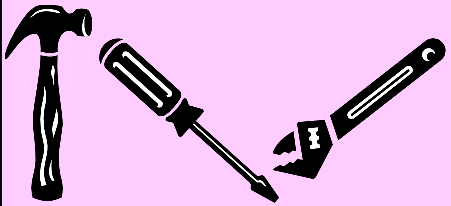
- **Temperature – No uses for low temperature**
- **Quality of media**
- **Occurrence**
  - **Matching user and source**
  - **Location**
  - **Time of occurrence**

- **Temperature Upgrading**
  - **Heat Pumps**
  - **Thermo Compressors**
- **Good Layout**
- **Industry Cascading**

Demand Side Management – Options and Actions

Need to address

- **Attitudes & Commitments**
- **Social &Cultural values**
- **Knowledge &Educational Level**



1 Incentives
2 Policies & Regulations
3 Information

Unattended Annual Energy Cost
12 h per day, 300 days per annum

- Un-lagged steam pipe (10 barg, 2 in, 1 m) 175 lit , 15750 LKR
- Un-lagged steam valve ((10 barg, 2 in,) 175 lit , 15750 LKR
- Steam leaks through 3 mm Hole (10 bar) 3850 lit, 346500 LKR
- Steam leaks through ½ inch trap (10 bar) 7715 lit, 694350 LKR
- Compressed air leak through 3 mm hole (7 bar) 4800 kWh, 52000 LKR
- Furnace oil leak 1drop per 3 Second - 1050 lit, 94500 LKR
- Diesel leak 1 drop per 3 Second - 1050 lit, 120750 LKR

International Conference on Resource Efficiency and Circular Economy

Thank You...!