Avoiding Half Million Tonnes CO$_2$ per Year..... and Still Counting

Presented by:
Muhammad Ali
Montreal Protocol

(a)

(b)

Savings
Perhaps the single most successful international agreement to date has been the Montreal Protocol.

Kofi Annan
former United Nations Secretary General
2003
Per capita commercial energy consumption per year

1 toe = 11.63 megawatt-hour
The bad news is the ice cap is melting and it’s going to be almost impossible to catch seals.

The good news is if we keep moving south, there’s tons of fat animals called “humans” who can’t run very fast.
The six natural resources most drained by our 7 billion people

<table>
<thead>
<tr>
<th>Resource</th>
<th>Status and Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>WATER</td>
<td>• 1.4 billion km³</td>
</tr>
<tr>
<td></td>
<td>• fresh water ~ 2.5%</td>
</tr>
<tr>
<td></td>
<td>• 70% ~ ice &amp; permanent snow cover</td>
</tr>
<tr>
<td></td>
<td>• 200,000 km³ (less than 0.015%)</td>
</tr>
<tr>
<td></td>
<td>• 2025 → 1.8 billions, absolute water scarcity</td>
</tr>
<tr>
<td></td>
<td>*source UN-Water Organization</td>
</tr>
<tr>
<td>OIL</td>
<td>• 2010 ~ 188.8 million tonnes</td>
</tr>
<tr>
<td></td>
<td>• 46.2 years</td>
</tr>
<tr>
<td>PHOSPHOROUS</td>
<td>• 50 to 100 years</td>
</tr>
<tr>
<td>COAL</td>
<td>• 188 years</td>
</tr>
<tr>
<td>RARE EARTH</td>
<td>Exact reserves are not known</td>
</tr>
</tbody>
</table>

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Resource Efficiency

CREATE MORE with LESS

✓ Reduce input
✓ Optimize production process
✓ Minimize waste
✓ Improve resource stocks
✓ Improve logistics
✓ Change consumption patterns

we need to find “new ways” in all steps of the value chain.

we 80/20
Energy Efficiency

“Using less energy to provide same service”

Energy Conservation

“Using less of an energy service”
Energy Efficiency ≠ Energy Conservation

(energy efficiency: using less energy for a service) ≠ (energy conservation: using less of an energy service)

As an example from HVAC application;

1.7 kW/TR \rightarrow 0.9 kW/TR

3000 TR * 1.7 = 5100 kW
3000 TR * 0.9 = 2700 kW

2400 TR * 1.7 = 4080 kW
2400 TR * 0.9 = 2160 kW

If both ideas are combined, 2400 TR * 0.9 = 2160 kW

The message is “integration”
GCC challenge in coming decades....

Power

Experts say.....

Air-Conditioning accounts for,

- 50% of annual electricity consumption
- 70% of peak period electricity consumption
- 40-50% electricity savings by district cooling

300% Increase in cooling demand in GCC between now and 2030

856 TWh by 2020

100 GW in coming 10 years

50 b US$ investment

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Multiple production sites around the city connected to DC grid

- Four main plants: Total Market > 500,000 TR
DC Vs. BAU

- **2017**: 82 GWh/Annum
- **2022**: 585 GWh/Annum
- **2031**: 1280 GWh/Annum

- **2017**: 54,000 TR
- **2022**: 354,000 TR
- **2031**: 540,000 TR

DC Cooling: 2017 - 54,000 TR, 2022 - 354,000 TR, 2031 - 540,000 TR

BAU (GWh/annum)

International District Cooling & Heating Conference
24th - 25th October 2017 | Ritz-Carlton Hotel - Doha, Qatar

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CO₂ Savings

**CO₂ Savings (tonnes)**

- **2017**: 34,000 tonnes
- **2022**: 246,000 tonnes
- **2031**: 538,000 tonnes

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IDEA Carbon Champion Awards

2014

2016
GCC face a serious challenge in securing water resources, already diminishing due to droughts, low rainfall and the prevalent climate....
GCC face a serious challenge in securing water resources, already diminishing due to droughts, low rainfall and the prevalent climate.....

- 60% of world’s desalination water is produced in GCC
- 85% of water resources is consumed by GCC agriculture
- 140% rise in demand in GCC over past decade
- 1,000 m³ Per capita per year is water poverty threshold

**Significant water issues**
- Greater water subsidies
- Depletion of groundwater reservoirs
- Falling per capita water availability

*Source: Al Jazeera*
Prohibition of Potable Water Use for Cooling

It was May 2013.....

No Potable Water for Central Cooling Plants

15 major central cooling plant operators to replace potable water with TSE

Treated Sewage Effluent (TSE) water
Prohibition of Potable Water Use for Cooling

Kahramaa officials and representatives of stakeholders at the meeting.

Kahramaa discusses district cooling norms with stakeholders
## TSE for CT makeup

<table>
<thead>
<tr>
<th>Year</th>
<th>Cooling (TR)</th>
<th>Makeup</th>
<th>Blow down</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Potable water (m$^3$/day)</td>
<td>Raw TSE (m$^3$/day)</td>
</tr>
<tr>
<td>2017</td>
<td>47,500</td>
<td>8,926</td>
<td>11,300</td>
</tr>
<tr>
<td>......</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2027</td>
<td>357,725</td>
<td>57,151</td>
<td>72,544</td>
</tr>
</tbody>
</table>

**over 50,000 m$^3$/day**
Blow down Reuse

Raw TSE

Intends to re-use with raw TSE

Raw TSE RO Polishing Plant (in District Cooling Plant)

DCP

Evaporation from Cooling Towers

Blow down

Discharge to surface water network

Part of irrigation within DC plot

over 10,000 m³/day
Savings in Nutshell

**Greenhouse gas emissions from** 538,000 Metric Tons

- **115,203** Passenger vehicles driven for one year
- **1,318,627,451** Miles driven by an average passenger vehicle
- **187,456** Tons of waste recycled instead of landfilled
- **26,806** Garbage trucks of waste recycled instead of landfilled

[https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator](https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator)

**Water**

100,000 persons/day @ per capita 500 ltrs/day
3,333,333 m² agricultural land @15 ltrs/day/m²
✓ Reduce input
✓ Optimize production process
✓ Minimize waste
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✓ Improve logistics
✓ Change consumption patterns

Thank You

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