Using Cooking Gas (LPG) for Refrigeration and Cooling
Presentation Outline

- Who is Asiko?
- Energy Transition
- LPG in Nigeria
- Cooling: A Means to Development
- Cooking Gas For Cooling
- Summary
Asiko Group Current Operations

- Benin (Future)
- Ijora Depot
- Coastal Terminal
- Oshogbo Depot
- Alagbole Depot
- 3x Ilorin Depot
- Abuja Depot
- Kano Depot
- Owerri Depot

- Third Party Coastal Terminal
- Gas Distribution Hubs / Depots
- Gas Producers / Suppliers
- Distribution / Bulk
- Retail (New)
Asiko Typical LPG Depot
Our Logistics
An LPG Power Plant
An LPG Fired Cold Room
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Energy Transition

- Energy Supply Pattern
  - LPG
  - Biomass
  - Coal/Oil
  - Electricity
  - Natural Gas
  - LPG

- Time and Degree of Economic Development

- Undeveloped
- Developing
- Developed

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Upcoming LPG Production in Nigeria
Comparative unit cost of power for Diesel cf. LPG — FUEL COST ONLY:

- Diesel = ₦77/kWh
- LPG = ₦47/kWh

LPG Costs 40% less than diesel.
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Cooling/Cold Chain As a Means To Development

- Allows industries maximize every part of the supply chain, and retains value at every stop until consumed. Applies to all industries.
- A robust cold chain aids improved health (blood banks, vaccines etc.)
- Reduced inter-communal clashes caused by grazing.
- Horticulture and other temperature sensitive luxury industries will thrive.
- Reduced food wastage; better food prices.
The Cooling Conundrum Cuts Across Diverse Industries and Professions

- Agriculture
- Health Care
- Information Technology
- Manufacturing

- Diary and Livestock
- Horticulture
- Restaurants and Leisure
- Logistics
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Asiko Approach to LPG Cooling

Vapor Absorption Refrigeration System

• An absorption refrigerator uses a heat source to provide the energy needed for the cooling process.

• VARS are often classified as heat-driven systems. They are used especially, when there is a source of inexpensive thermal energy at a temperature of 100 to 200°C.

• Cooking gas (LPG) can burns at over 300 °C, which makes it ideal for VARS.
An LPG Fired Cold Room (Made in Nigeria)

Enclosed Space  Solar Panels  Cooking Gas

Inverter System  VAR System  Indoor Unit
The VAR System Advantage

- **No CFC, hence environment friendly**
  - Uses water (R 712) as refrigerant instead of ozone depleting Chlorofluorocarbons

- **No noise**
  - No moving parts, therefore no dynamic load
  - No vibration, therefore silent operation

- **Negligible maintenance**

- **Negligible electric power**
  - 0.75kW for a 5RT Vs 5kW for an electrically powered compressor unit of same size
  - Power required for only small pumps

- **Modular Design**
  - Compact design; on skid Delivery
<table>
<thead>
<tr>
<th>Type</th>
<th>Location</th>
<th>Operating mode</th>
<th>Total Cooling Capacity</th>
<th>Fuel</th>
<th>Scope</th>
<th>Delivery</th>
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</thead>
<tbody>
<tr>
<td>Residencial Space</td>
<td>Lekki Lagos</td>
<td>Direct Fired</td>
<td>5RT/17.9kW</td>
<td>LPG</td>
<td>Engineered equipment delivery</td>
<td>In service 2015</td>
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<tr>
<td>Cooling</td>
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<tr>
<td>Medical Space</td>
<td>Banana Island</td>
<td>Direct Fired</td>
<td>10RT/35.8kW</td>
<td>LPG</td>
<td>Engineered Equipment Delivery and Installation</td>
<td>In service 2015</td>
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<tr>
<td>Cooling (FCC)</td>
<td>Ikoyi, Lagos</td>
<td>Direct Fired</td>
<td>15RT/53.7kW</td>
<td>LPG</td>
<td>Engineered Equipment Delivery and Installation</td>
<td>2016</td>
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</table>
Mall Development - OPTION 1
Diesel Power + Electric Cooling

Diesel 464 kg/hr

DIESEL POWER

Electricity

ELECTRIC COOLING

Cooling 3,000kW
Mall Development - OPTION 2
Gas Power + Electric Cooling

LP Gas 464 kg/hr

GAS POWER

Electricity

ELECTRIC COOLING

 Cooling 3,000kW

ṣ247m /Annum Savings!
Mall Development - OPTION 3
Gas CCHP

GAS POWER
LP Gas 139 kg/hr

GAS COOLING
Cooling 3,000kW

Electricity
Clean Waste Heat

₦381m /Annum Savings!
Payback (in Months)

Option 1: 3 x 1250 Diesel

Option 2: 3 x 1250 LPG

Option 3: 2 x 750 LPG

Payback on Incremental Costs - Months:
- Option 1: 17.4 months
- Option 2: 6.7 months
- Option 3: 0.0 months
<table>
<thead>
<tr>
<th></th>
<th>Power Demand (kWh)</th>
<th>Diesel Cost (N/kWh)</th>
<th>Gas Cost (N/kWh)</th>
<th>Cost Savings (N/kWh)</th>
<th>Annual Saving (N)</th>
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<tbody>
<tr>
<td><strong>Fuel Cost</strong></td>
<td>8,352,000</td>
<td>47.80</td>
<td>21.25</td>
<td>26.55</td>
<td>221,745,600</td>
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<tr>
<td><strong>Equipment Cost</strong></td>
<td>8,352,000</td>
<td>10.28</td>
<td>18.50*</td>
<td>(8.22)</td>
<td>(68,653,440)</td>
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<td><strong>Total</strong></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>8,352,000</td>
<td>58.08</td>
<td>39.75</td>
<td>18.33</td>
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</tbody>
</table>

* Capital cost amortized over 5 years

**Net Annual Savings** | 153,092,160
Power Supply – Mall Project Client
(Single 2,400 kW Gas cf. Diesel)

<table>
<thead>
<tr>
<th></th>
<th>Power Demand @ 75% Load (kWh)</th>
<th>Diesel Cost (N/kWh)</th>
<th>Gas Cost (N/kWh)</th>
<th>Cost Savings (N/kWh)</th>
<th>Annual Saving (N)</th>
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<tbody>
<tr>
<td>Fuel Cost</td>
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<td>Equipment Cost</td>
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<td>(124,286,400)</td>
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<tr>
<td>Total</td>
<td><strong>58.08</strong></td>
<td><strong>39.75</strong></td>
<td><strong>18.33</strong></td>
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</table>

* Capital cost amortized over 5 years

**Net Annual Savings** 277,149,600
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Summary

◆ Gas in the form of LPG is readily available in Nigeria and W. Africa

◆ LPG will increasingly become the preferred fuel of choice from a cost savings and environmental point of view.

◆ Asiko has the capacity, through an un-paralleled supply and logistics network, to deliver reliable, cost saving energy and cooling projects in Nigeria & W. Africa

◆ We are committed to delivering clean, cheap gas COOLING SOLUTIONS to our clients.
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