**WHAT IS DRIVING ADOPTION?**

- **Rising electricity tariffs**
- **Rising urbanization driving demand for cooling and heating solutions**
- **Climate change mitigation**
- **Growing demand for energy efficiency and energy management practices**

**WHAT ARE THE BENEFITS?**

- Manage peak summer electrical demand loads
- Reduce intensity of energy use for cooling purposes
- Reduce operational expenditure associated with cooling and heating of enclosed spaces

**DESCRIPTION OF THE TECHNOLOGY**

The earth is a poor heat conductor. Throughout the world, the temperature underground is much more stable and constant than at the surface. This source of heat can be used to meet the cooling and heating requirements of enclosed spaces during summer and cold winter periods.

**Geothermal Cooling**:

Use of shallow geothermal heat pumps offers an opportunity to preserve cooling efficiency with a well-proven technology, thus utilizing the earth as a renewable resource.

**Geothermal Heating**:

Geothermal heating systems employ the same type of systems used for cooling and can be employed for hot water supply and space heating during the winter months.

**WHAT ARE THE BENEFITS?**

- Manage peak summer electrical demand loads
- Reduce intensity of energy use for cooling purposes
- Reduce operational expenditure associated with cooling and heating of enclosed spaces

**PATENT AND INNOVATION TRENDS – KEY AREAS OF RESEARCH**

Some of the important areas of patent filing include:

1. Flow control of liquid refrigerant in heat pumps
2. State change of refrigerants for compression type refrigeration systems
3. Hot water central heating systems using heat pumps for domestic and space heating

**PROMINENT COUNTRIES/TECHNOLOGY PROVIDERS**

- **Japan**
- **USA**
- **China**

**OPPORTUNITIES FOR KSA LOCALIZATION**

- Manufacturing of the following technology components:
  - Heat Exchangers
  - Piping, spiral tubes and coil
  - Storage Tanks
  - Heat Pumps
  - Valves, flanges and fittings
  - Pumps and pumping systems

**CHALLENGES TO SCALING IN KSA**

- High Initial CAPEX investment associated with infrastructure
- Completion from traditional air conditioners which incur a lower investment
- Subsidized electricity tariffs affect financial viability of renewable energy technologies like shallow geothermal cooling
- Limited assessment of existing geothermal potential in the Kingdom
- Absence of financial incentives and subsidies to improve payback periods and ROI