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AIR CONDITIONING

LEADING INNOVATION FOR GREENER TOMORROW

Jan 2013

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Climate Change - Some basic facts

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- Human activities are directly increasing the level of greenhouse gases (GHG) into the atmosphere
- Climate change is a global issue: 1 ton CO2 emitted in India = 1 ton CO2 emitted in Qatar
- Rising levels of greenhouse gases are already changing the global climate and the face of the planet, including severe droughts in Africa and flooding in Northern Europe.
- Climate models predict the global temperature will rise by about 1.4 to 5.8 degrees by 2100
- Climate change is likely to have a significant impact on the global environment, economy and society.

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What is global warming

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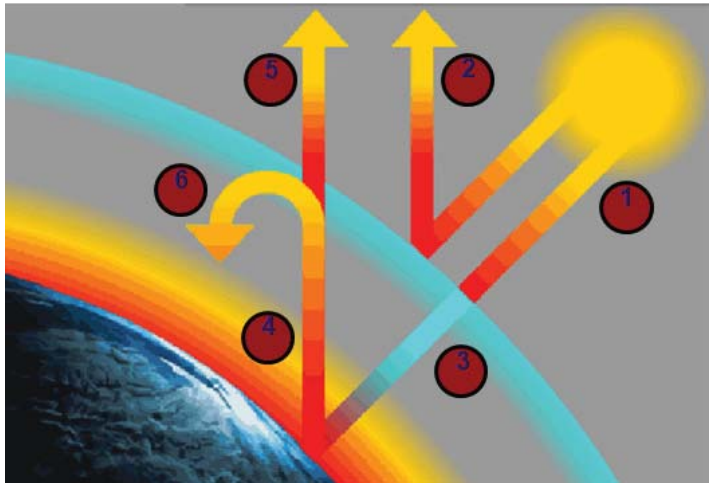
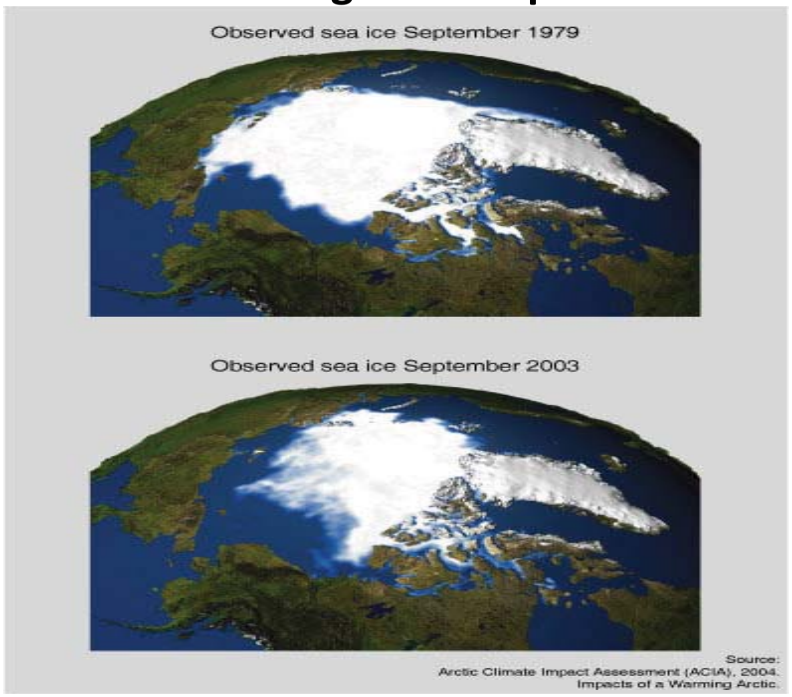
- **Global warming** is the rise in the average temperature of Earth's atmosphere and oceans since the late 19th century and its projected continuation.
- **The "greenhouse effect"** is the warming that happens when certain gases in Earth's atmosphere trap heat. These gases let in light but keep heat from escaping, like the glass walls of a greenhouse.

"Greenhouse" Effect



1) Solar radiation
2) Reflected back to space
3) Absorbed by atmosphere
4) Infra-red radiations emitted from Earth
5) Some of the IR passes through the atmosphere
6) Some is absorbed and re-emitted by greenhouse gas molecules

Melting Polar Caps



The effect is increasing temperatures on Earth

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What are the causes of global warming

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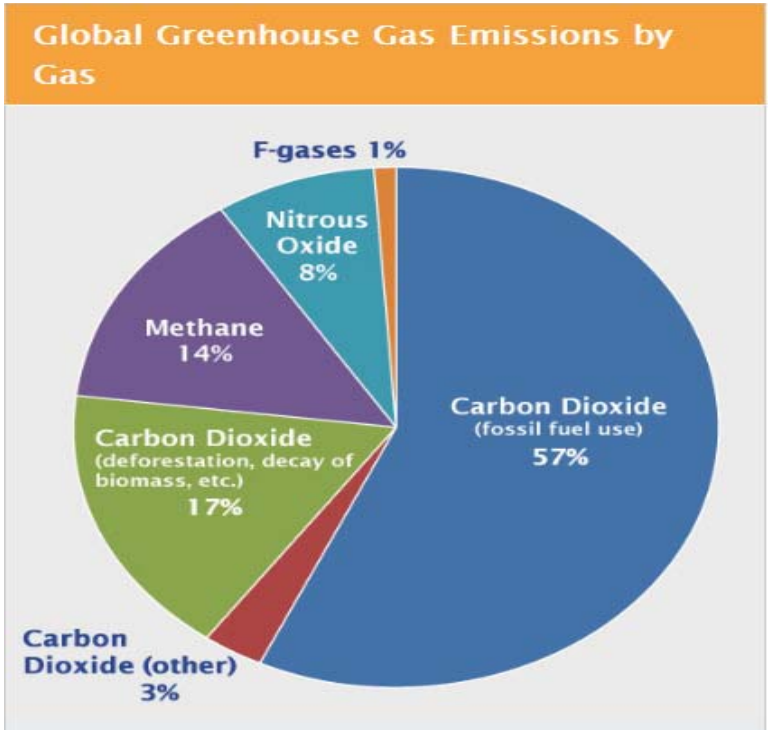
- Carbon dioxide emissions from fossil fuel burning power plants
- Carbon dioxide emissions from burning gasoline for transportation
- Methane emissions from animals, agriculture such as rice paddies and from the Arctic
- Deforestation, especially tropical forests for wood, pulp and farmland
- Increase in usage of chemical fertilizers on croplands

- **CO2 is biggest contributor of global warming**
- **77 % CO2 is produced in total green house Gases**
- **57 % by fossil fuel used in producing electricity**



Source: IPCC (2007)

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What are the consequences of climate change

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The Effects

1. Temperature increase
2. Sea level rise
3. Increased flooding
4. Increased droughts

The Results

Agriculture and food security

Crop yields, irrigation demands...

Water resources

Water supply, water quality...

Coastal areas

Erosion, inundation, cost of prevention...

Species and natural areas

Biodiversity, modification of ecosystems...

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What are the direct Global Warming effects on the GCC Regions

(Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and United Arab Emirates)

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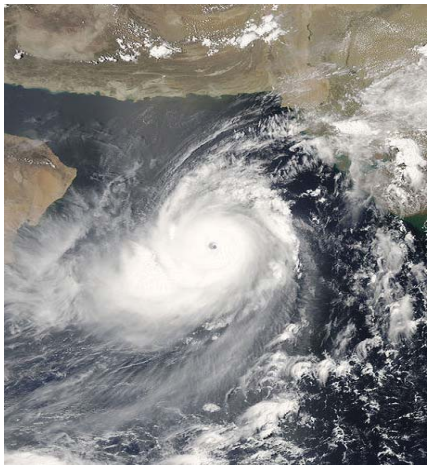
- 50 Million people in the Arab world have been affected by climate change in last 30 years.
- $30tr in damages due to the possible displacement of 1.5 million people if sea levels were to rise by 0.5 meters
- The average annual temperature of Kuwait was 52.6°C - the hottest in the Arab world in 2010.
- $50b tourism industry and agriculture could be severely affected by extreme weather events.
- 40% of jobs in the Arab world are derived from agriculture.

Gonu in Oman, 2007

Flood in Saudi Arabia,2009



Gulf News:29 Dec,2012

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Energy Use within the Middle East Regions

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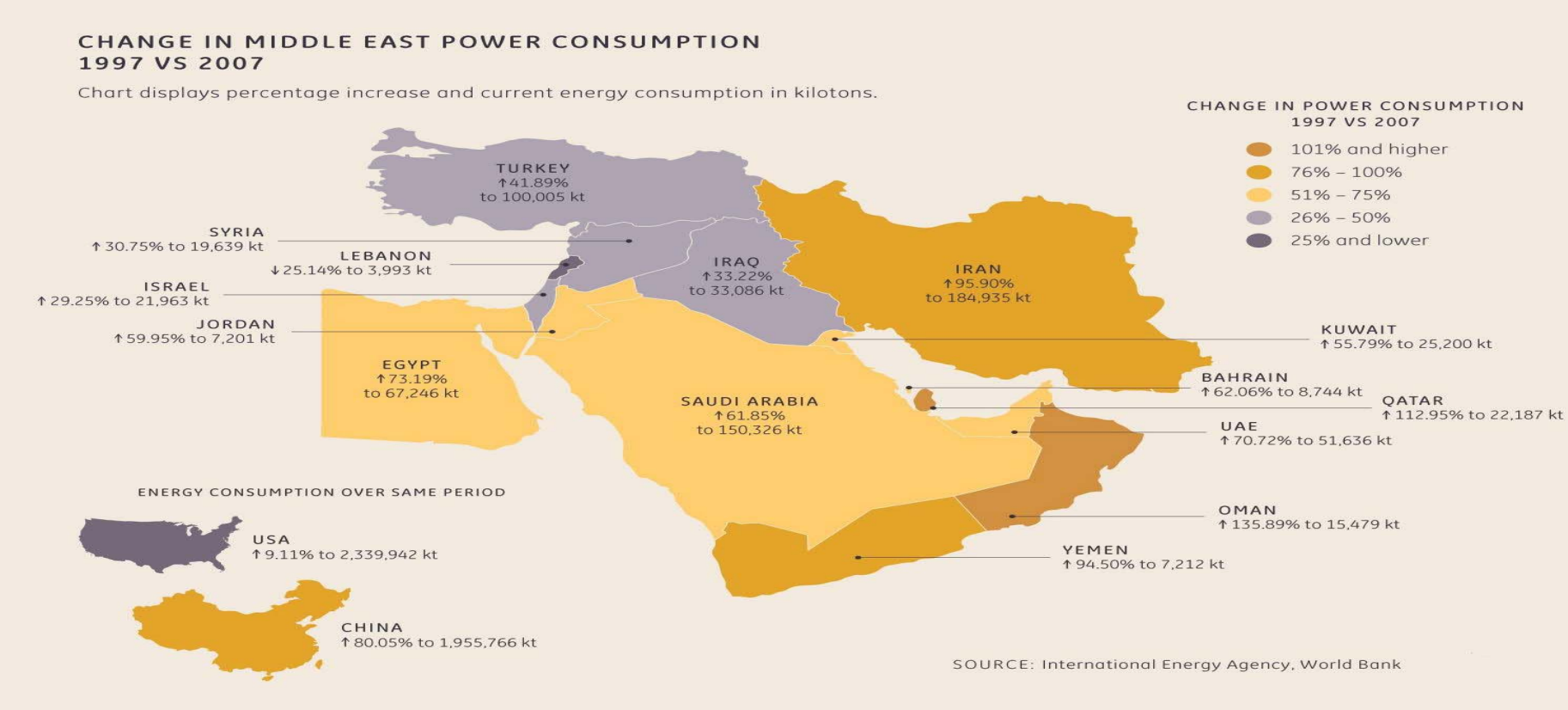
Rapid expansion in the consumption of Energy throughout the Middle East area.

The demand for energy within the Middle East regions has grown significantly over the past decade, with the percentage growth of energy consumption surpassing both that of China and the U.S.

The International Energy Agency and the World Bank Growth figures comparing 1997 to 2007 show:

Oman, up 135.9%	Qatar, up 112.9%	Iran, up 95.9%
Yemen, up 94.5%	Egypt, up 73.2%	Saudi Arabia, up 61.8%

That's compared to an 80% growth in China and a 9.1% growth in the U.S.



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Energy Use within the GCC

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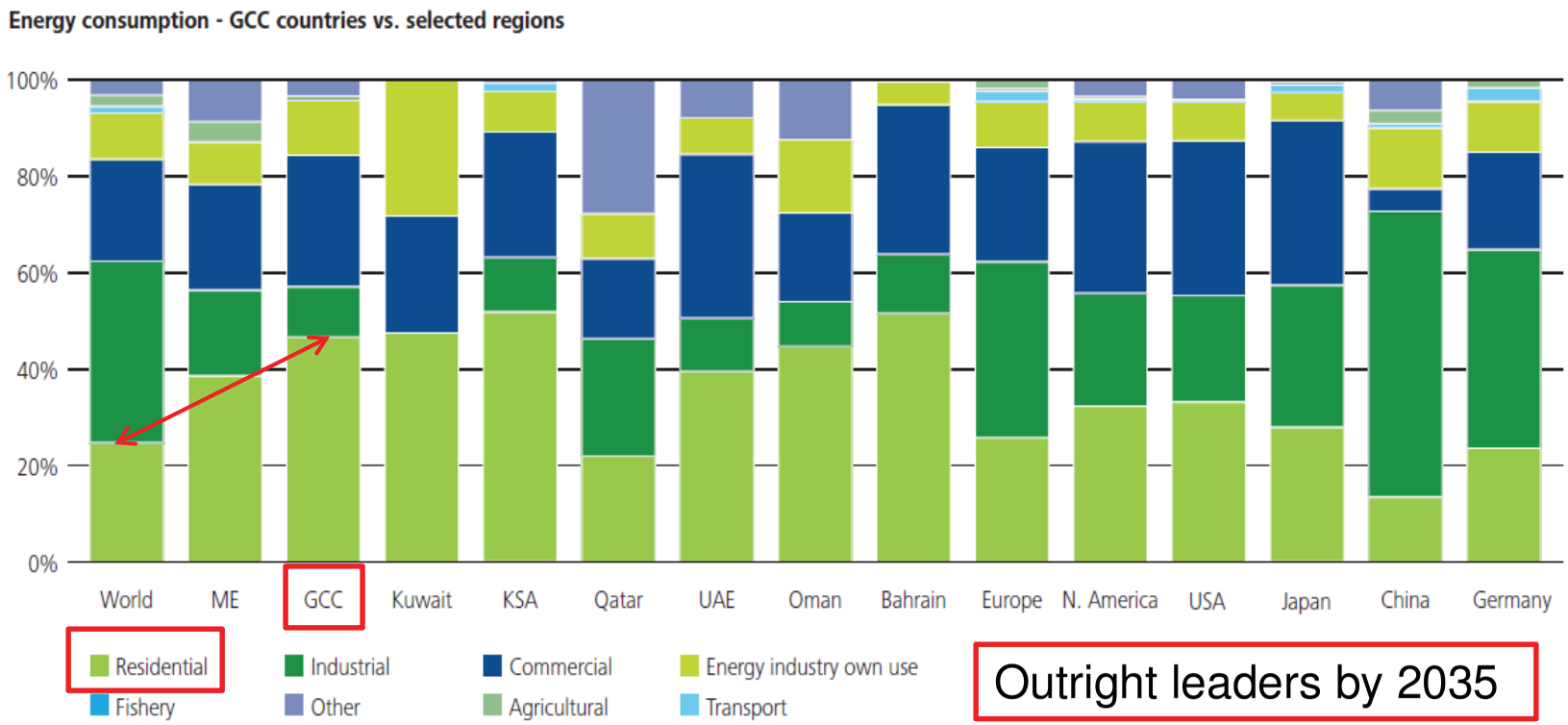
- GCC countries' consumption is driven largely by home use,
- GCC countries residential use - 47%
- Global average residential use - 25%
- GCC Growth rate per capita electricity consumption (2007-2035) – 2.5 % annually



Source -http://www.zawya.com

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GCC Citizen CO2 production

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- The residents of the Gulf produce about ten times as much CO2 as the average global citizen.
- According to the International Energy Agency (IEA), the combined countries in the Gulf Cooperation Council (GCC) annually emit 26.3 tones of CO2 per capita, and thus six times as much as the global average.
- Qatar itself has had the highest CO2 balance worldwide with 55.43 tones per capita ten times higher than the average.
- The emirate's poor emissions balance is partly explained by its position as the world's largest producer of liquefied natural gas, a technology with high CO2 emissions. In total, 67 per cent of Qatar's CO2 emissions are attributable to the oil and gas sector.
- The operation of air conditioning alone, for example, accounts for nearly 67 per cent of the energy consumption of private households.

Average global citizen CO2 production

GCC citizen CO2 production

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Forecasted Energy consumption within the GCC

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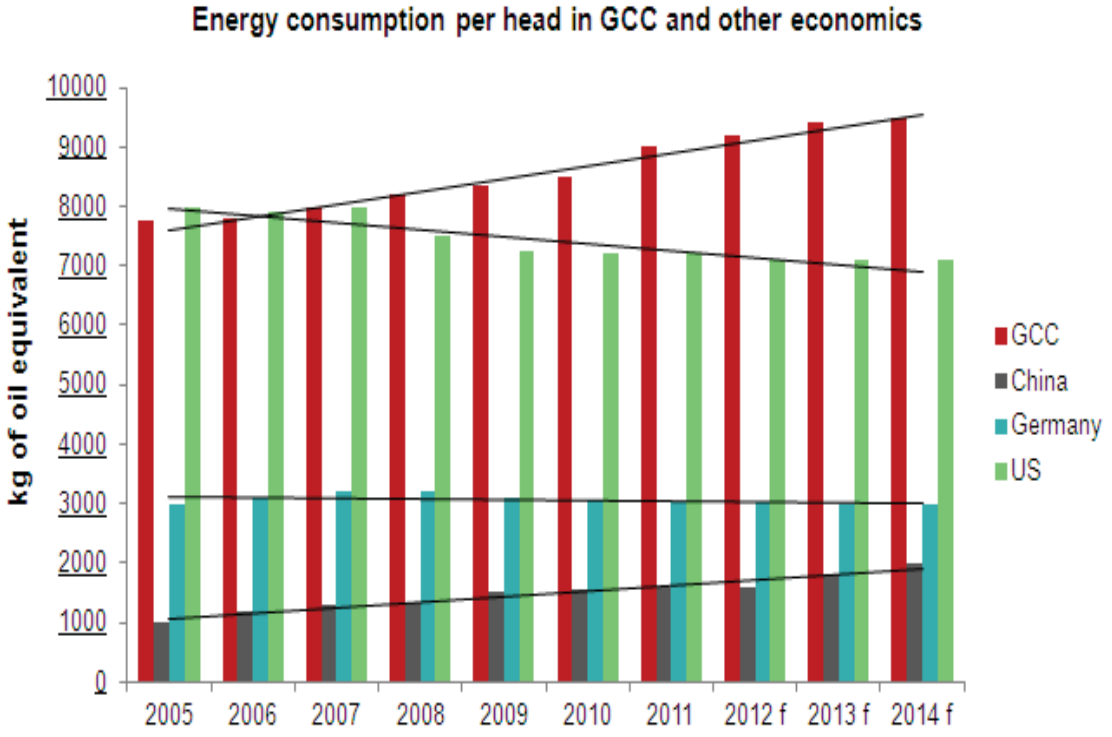
Rising Electricity Demand in Qatar

According to Qatar General Electricity and Water Corporation, electricity production at the end of the second quarter of 2008 stood at approximately 4263 Megawatts (MW), and is expected to double by 2011 to more than 8707 MW. The rapid growth population in Qatar, from 1.7 million to 1.9 million by 2014, is intensifying the demand for electricity and water, leading to multi-billion dollar power generating projects; some using renewable energy which is making inroads into sources of power for this region.

- Qatar will account for 2.22% of Middle East and Africa (MEA) regional power generation
- Electrical consumption per capita is expected to increase by 28%
- Electricity generation will increase by 49.1%
- Power consumption is expected to increase from an estimated 20TWh in 2009 to 33TWh by the end of 2014



Source: Economist Intelligence Unit.

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Energy Facts - Qatar

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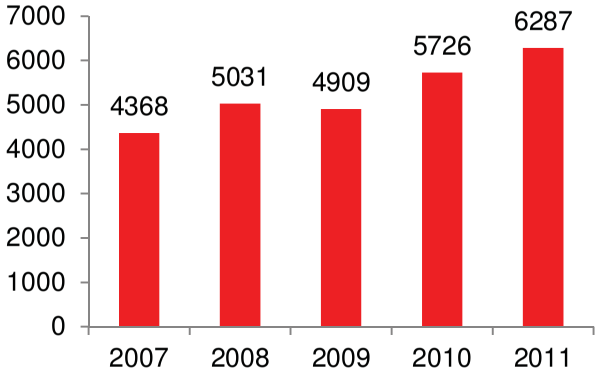
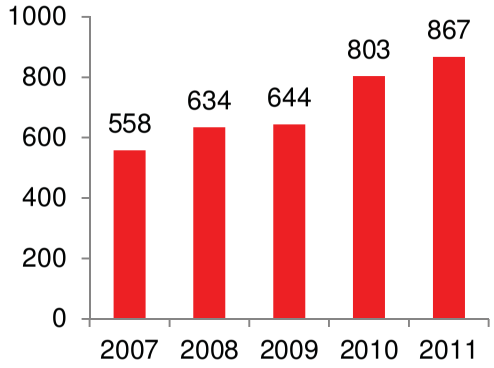
- **Highest CO_2 balance worldwide**
  55.43 tonnes per capita
  Ten times higher than the average
- **Oil and gas sector**
  67 % of Qatar's CO2 emissions
- **Electricity generation will increase by 49.1% till 2014**
- **Air-conditioning of private households**
  70 % of the energy consumption

R/P Ratio – 39.3

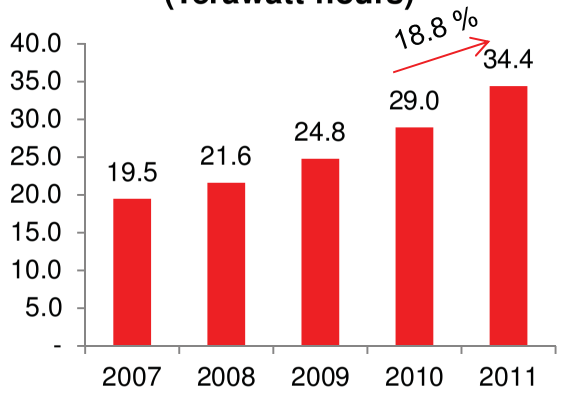
Production (million barrels/Yr)



Domestic Consumption (million barrels/Yr)



Electricity Generation (Terawatt-hours)



Reserves-to-production (R/P) ratio - If the reserves remaining at the end of any year are divided by the production in that year, the result is the length of time

Source : BP

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QATAR FUTURE PROJECTS

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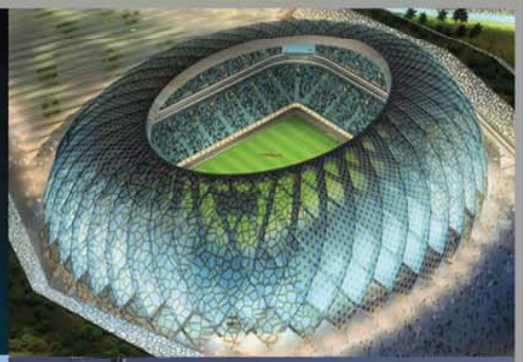








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Qatar Future Projects leading to increase energy consumption

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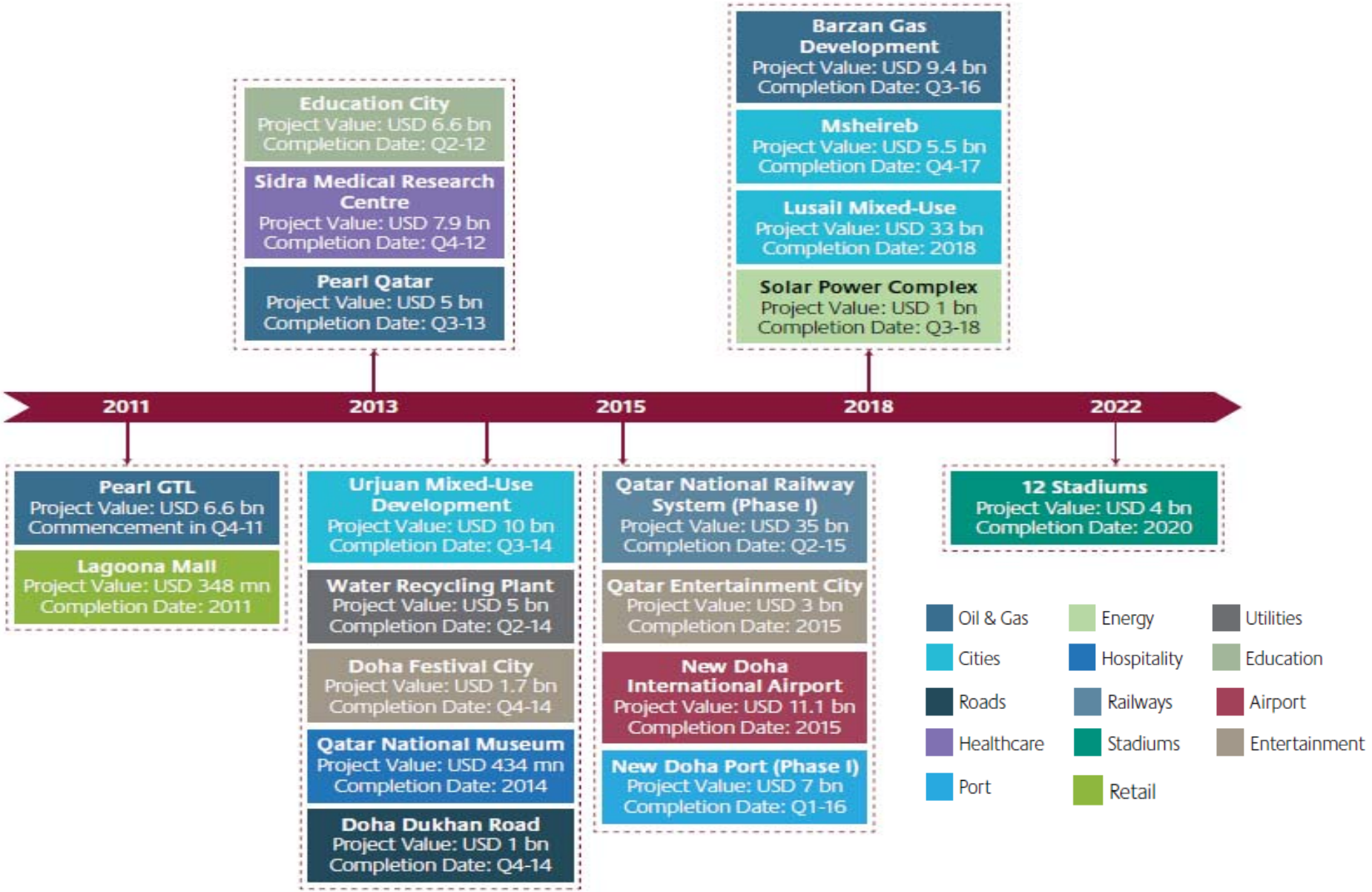
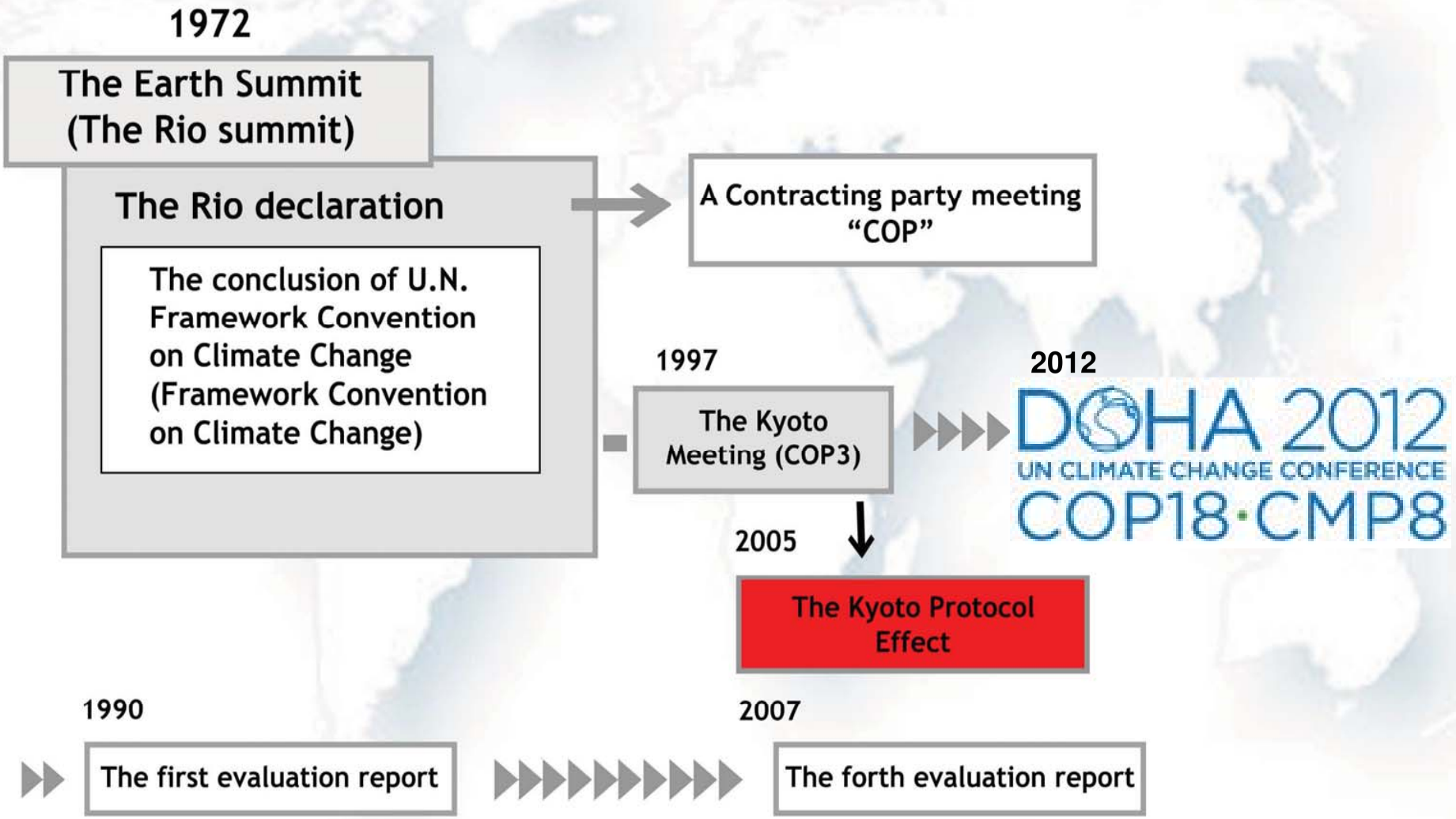


Source : The Commercial Bank of Qatar (Q.S.C.)

What is the World doing about the situation?

Trends


1972
The Earth Summit
(The Rio summit)
The Rio declaration
The conclusion of U.N. Framework Convention on Climate Change (Framework Convention on Climate Change)
A Contracting party meeting "COP"
1997
The Kyoto Meeting (COP3)
2012
DOHA 2012
UN CLIMATE CHANGE CONFERENCE
COP18·CMP8
2005
The Kyoto Protocol Effect
1990
The first evaluation report
2007
The forth evaluation report

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Kyoto Protocol

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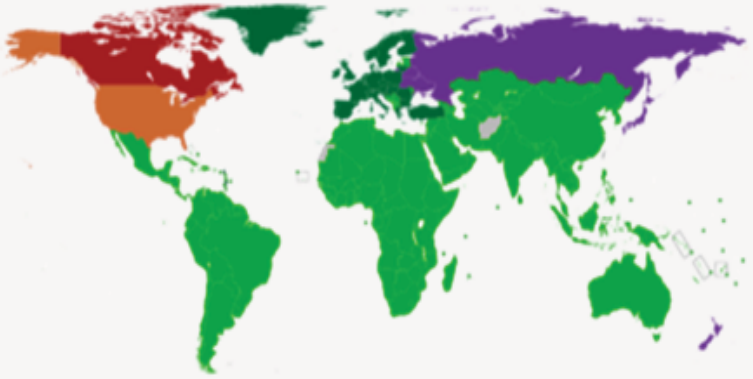
- The Kyoto Protocol treaty was negotiated in December 1997 at the city of Kyoto, Japan and came into force February 16th, 2005

- The Kyoto Protocol is a legally binding agreement under which industrialized countries will reduce their collective emissions, over a five-year period 2008-2012, of greenhouse gases by 5.2% compared to the year 1990.

- The goal is to lower overall emissions from six greenhouse gases - carbon dioxide, methane, nitrous oxide, sulphur hexafluoride, HFCs, and PFCs

- **Qatar** ratified the UNFCCC in 1996 and the Kyoto Protocol in 2005. It is a non-Annex 1 UNFCCC party and therefore not obligated to set emission control targets, **BUT** is making voluntary efforts and plans to reduce its national greenhouse gas emissions.

Kyoto Protocol to the United Nations Framework Convention on Climate Change



Kyoto Protocol participation map
(commitment period: 2013-2020)

- Parties; Annex I & II countries with binding targets
- Parties; Developing countries without binding targets*
- States not Party to the Protocol
- Signatory country with no intention to ratify the treaty, with no binding targets
- Countries that have renounced the Protocol, with no binding targets
- Parties with no binding targets in the second period, which previously had targets*

*Note: As part of the 2010 Cancún agreements, 76 developed and developing countries have made voluntary pledges to control their emissions of greenhouse gases.

What is the EU doing about the situation?

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Refrigerant – R22 Phase Out in EU

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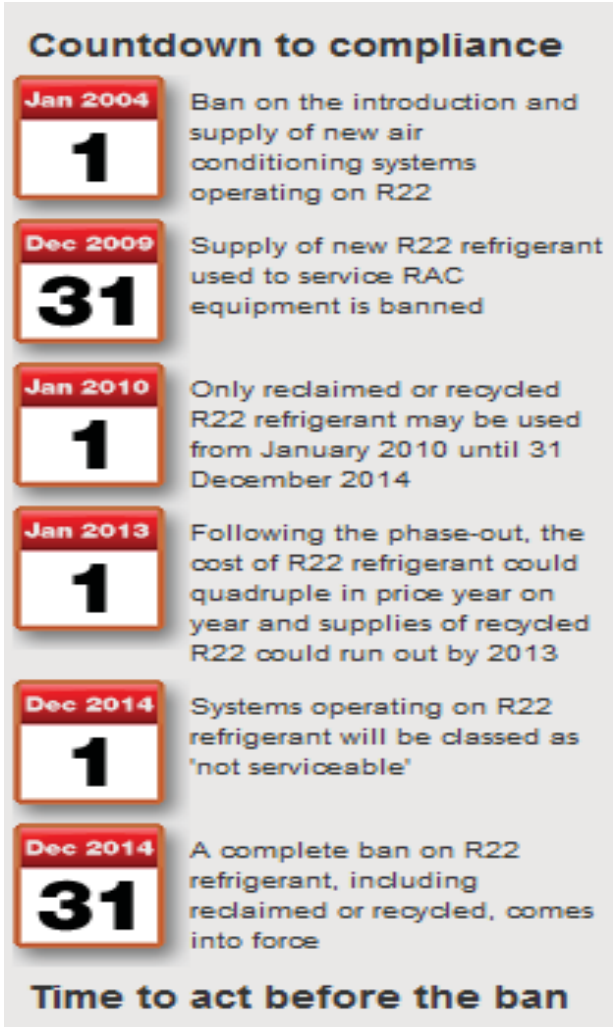


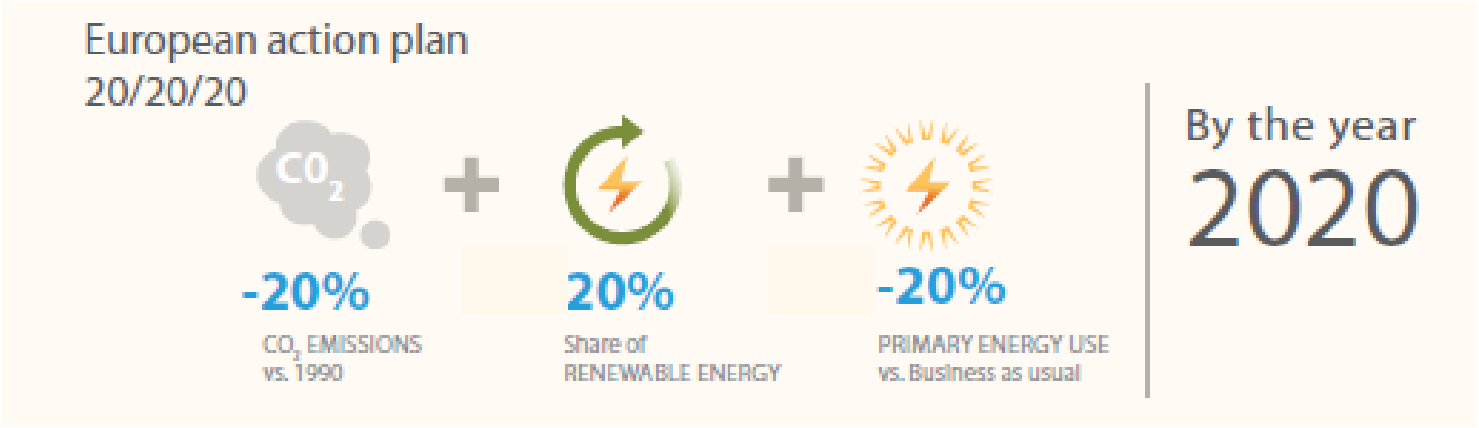
BACKGROUND TO THE BAN

In the continuing bid to beat global warming, new legislation is enforcing the removal and replacement of R22 refrigerants which have been shown to have a detrimental effect on the ozone layer. The EC Ozone Regulation provides the legislative framework for EU member states to meet their obligations to halt damage to the ozone layer. A programme to phase out ozone-depleting substances began in the 1990s with a ban on the most harmful CFCs, such as R12. This was followed by a ban on new equipment using 'transitional' CFCs, which includes R22, in 2001 (2004 for smaller air conditioning systems).

What makes R410a a better refrigerant?

R410a is more environmentally friendly. It has a zero Ozone Depleting Potential, so if the system does leak, the escaping refrigerant won't harm the ozone.

202020 EU Policy



To help achieve the above targets:
The Energy Related Products (ERP) Directive specifies minimum ecodesign requirements, such;
as higher energy efficiency ratings, which must be integrated into air conditioning products with a capacity of less than 12kW from 2013 (EuP Lot 10).
The directive affecting VRV/VRF systems is currently scheduled to start in 2015, which will enforce minimum energy requirements of products being imported in to the EU (EuP Lot 6/21).

EU 2050 Road Map

On 15 December 2011, the European Commission adopted the Communication "Energy Roadmap 2050".
The EU is committed to reducing greenhouse gas emissions to 80-95% below 1990 levels by 2050 in the context of necessary reductions by developed countries as a group.
In the **Energy Roadmap 2050** the Commission explores the challenges posed by delivering the EU's decarbonisation objective while at the same time ensuring **security of energy supply** and **competitiveness**.

The Energy Roadmap 2050 is the basis for **developing a long-term European framework** together with all stakeholders.

Video. Stakeholders conference on energy roadmap 2050

http://webcast.ec.europa.eu/eutv/portal/archive.html?viewConference=14158

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Environmental Contribution

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15 MINUTES OF CYCLING >>> 10 WATT-HOURS ELECTRICITY>>> EARN A FREE MEAL

SOLAR PARKING LOTS CHARGE COMMUNITY BIKES WITHOUT TAPPING THE GRID

Qatar initiative

qatar 2022

1st CO_2 –neutral football world cup

- **Qatar National Convention Center**
- **LEED Gold Certified**
- **12.5% of total building energy produced by Solar roof**

PLANET'S 1.3 BILLION CATTLE USED TREADMILLS FOR EIGHT HOURS A DAY, THEY WOULD GENERATE 6 PERCENT OF THE WORLD'S POWER

Many countries are still in "grow dirty and clean up later" philosophy

While

QATAR is ahead adopting Qatar Building Code(Green building) for all building by

2020

Are We Responding ???

The Future – How to proceed

- In order to meet both the future energy demands of the region, whilst also reducing the production of CO2 output of the GCC countries to sustainable levels, two approaches must considered and acted upon.

Approach 1 – The use of renewable energies

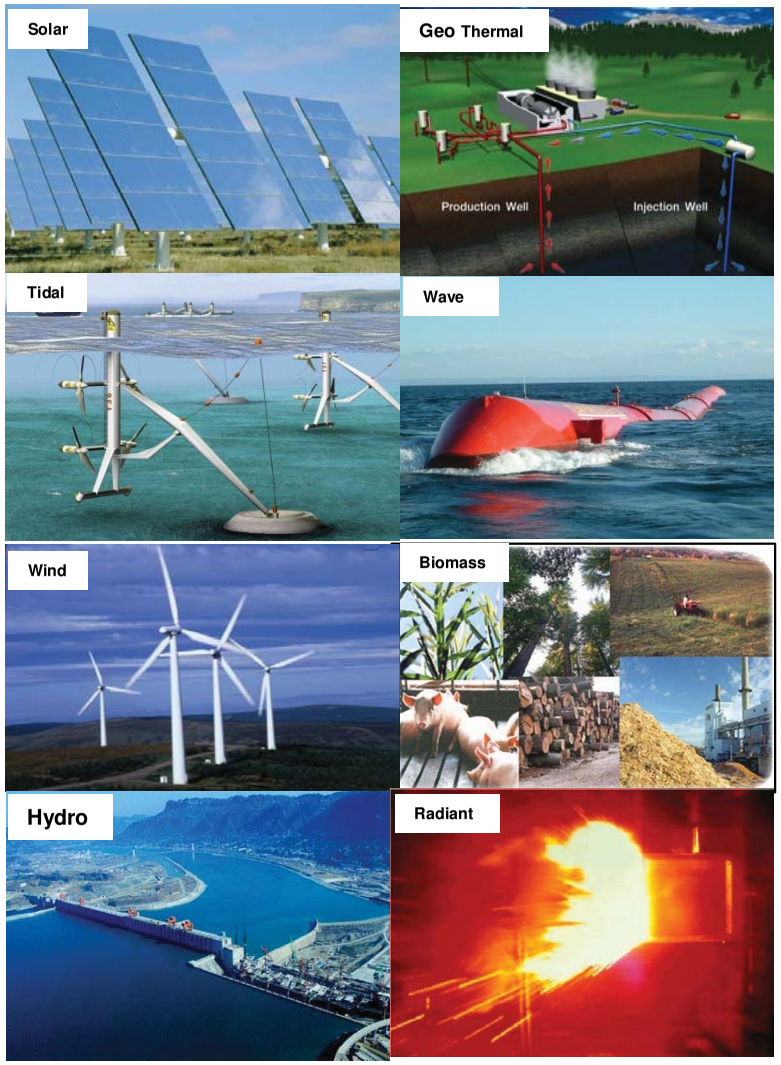
1. Solar Energy
2. Wind Power
3. Hydropower
4. Geothermal Energy
5. Biofuel
6. Biomass
7. Bioplastics
8. Bioasphalt

Approach 2 – Reducing energy consumption

1. Assess how your building consumes and wastes energy
2. Use more energy efficient equipment..
3. Match HVAC and lighting output to occupancy.
4. Maintain equipment for maximum efficiency.
5. Maximize lighting efficiency
6. Measure water usage and waste.
7. Schedule cleaning during regular work hours.
8. Insulate thoroughly.
9. Meet LEED standards.
10. Make building occupants more informed

Energy Approach

Renewable Generation



Consumption

- Smart HVAC
- Smart Controls
- Smart Lighting
- Smart Energy monitoring
- Building Design
- Smart water solution
- Awareness

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Renewable energies within Qatar

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- **Solar Energy** - With an average daily horizontal irradiance of 5.8 kWh/m2, Qatar is well-placed to utilise solar energy.
- **Wind Power**- With 3.9 hours of full-load wind on average daily, Qatar has a reasonable potential for wind energy. Wind turbine installations are being considered on the Qatar-Bahrain causeway in an effort to improve project sustainability.
- **Geothermal Energy** - Qatar has a reasonable geothermal potential, with the efforts of the country to acquire expertise in the field to develop their resource being praised by one of the world's main geothermal powers, Iceland.
- **Biofuel** - There are significant financial incentives available for the successful adoption of aviation biofuels. Qatar Airways has not yet specified feedstocks, but has announced the start of a project with Verno Systems, a US biofuels firm.

Solar Farms

Wind Farms

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Reducing energy consumption within Qatar

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- The Qatar General Electricity and Water Corp (Kahramaa) has announced a plan to reduce electricity consumption in the country by 20% and water consumption by 35% in the next five years. *Source ameinfo.com*

- This will be achieved through a variety of means ranging from public awareness campaigns to laws and regulations to rationalise consumption of water and electricity. *Source ameinfo.com*

- Kahramaa has already issued guidelines to the public on ways and means to rationalise water and electricity consumption. The ongoing awareness campaign will be intensified and penalties would also be imposed on those violating the guidelines. *Source ameinfo.com*

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Toshiba's Initiative

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Renewable Generation

- Solar Power
- Nuclear Power
- Hydro Power
- Wind Power
- Geothermal Power

Toshiba CO2 Capture Technology

SMART Consumption

- Smart Air Conditioning
- Smart Lighting Control
- Smart BEMS
- Smart Security
- Smart Elevator
- AMI

AMI : Advance Metering Infrastructure

Toshiba VRF
High Ambient Markets
Made in Japan

Smart Air Conditioning

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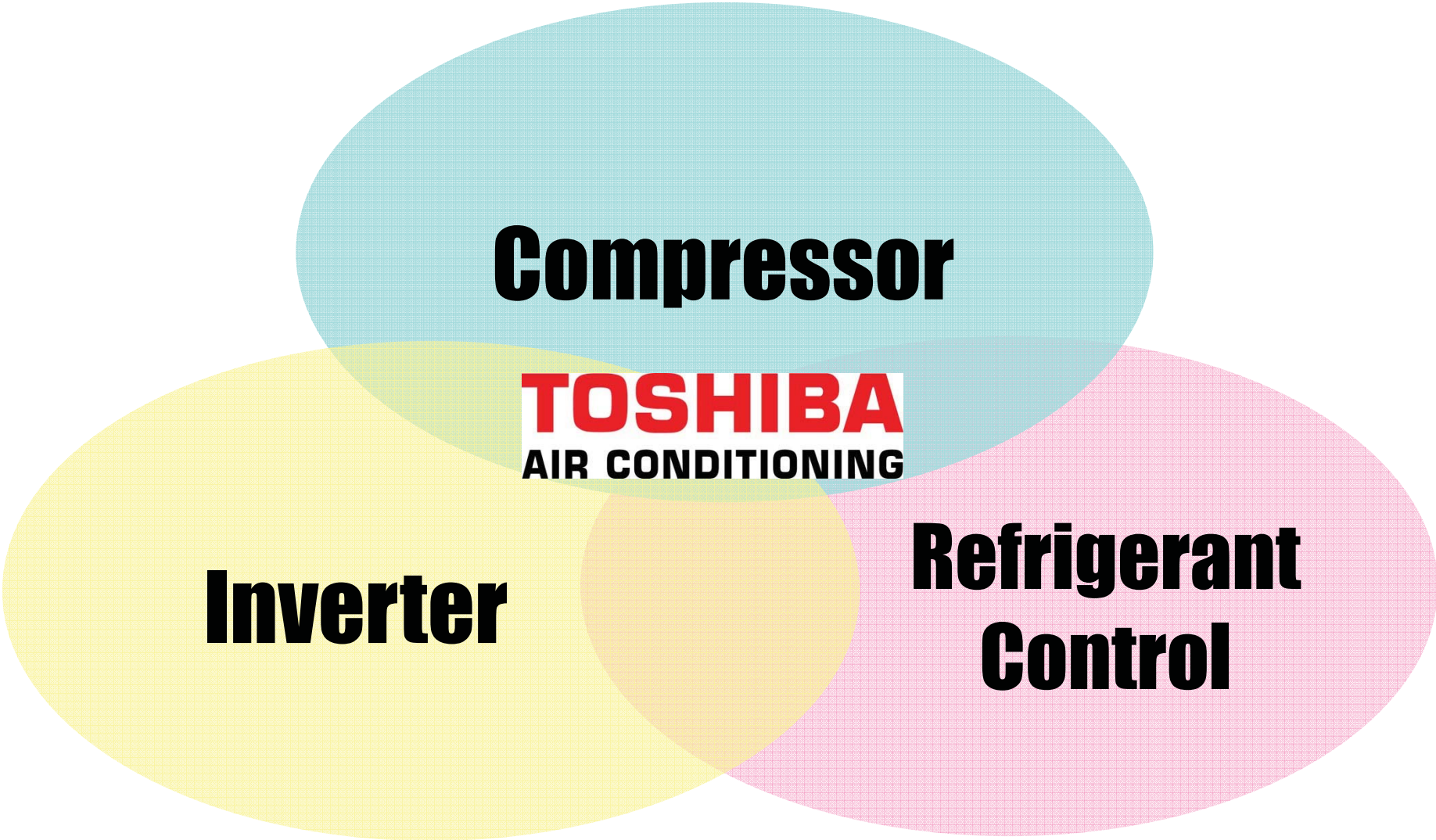
Toshiba Core Technology



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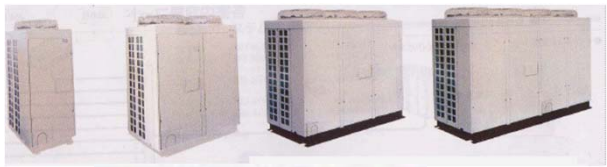
Toshiba VRF History

Toshiba has considerable expertise and knowledge regarding the key technologies of VRF air conditioning design, due to its long history of involvement with the product.

1985	Multi System AC	
1987	Super Multi	Multi controller
1994	Wide Multi	Optimal ref control free branch piping
1999	MMS	Module CDU Oil balance control
2003	SMMS	All inverter control R410A DC twin rotary comp
2005	Mini SMMS	Small capacity VRF
2010	SMMS-i	3 inverter control, High energy efficiency
2012	SMMS-i **High Ambient**	3 inverter control, High energy efficiency



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New SMMS-i

The next-generation “i-quality” trio !

SMMS i
SUPER MODULAR MULTI SYSTEM

imagination
innovation
intelligence

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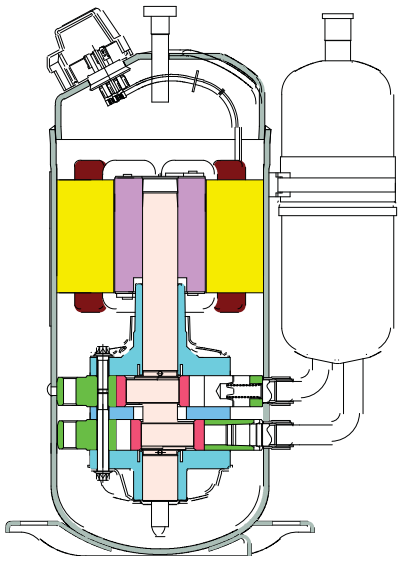
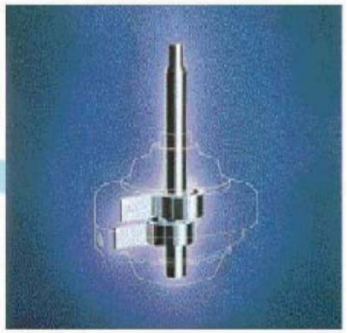
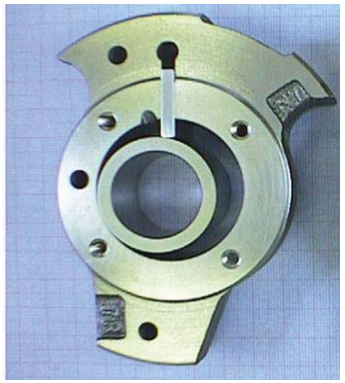
Compressor Comparison in VRF

Rotary compressor

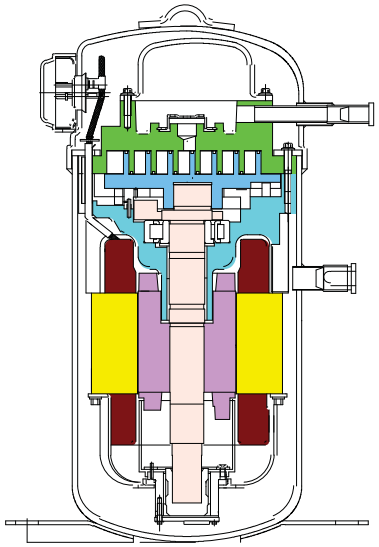


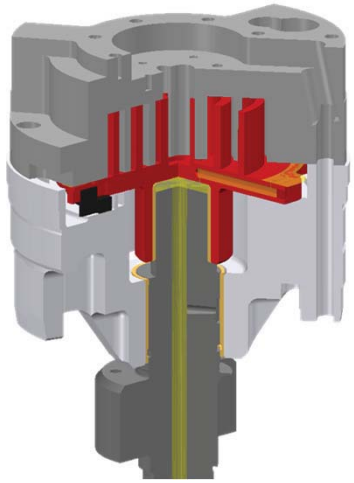


DC Twin Rotary Compressor
- High Reliability
- High Efficiency
- Low Noise



Scroll compressor





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Compressor Comparison in VRF

Type of the compressor

All inverter	INV COMP	INV COMP
Single Inverter	INV COMP	--
Inverter + fix speed	INV COMP	FIX speed COMP
Digital Scroll	FIX speed digital scroll COMP	FIX speed COMP

***TOSHIBA** has unique presence with **INV** + **INV** compressor in VRF air-conditioners.*

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All inverter DC twin rotary compressor VRF

SMMS i
SUPER MODULAR MULTI SYSTEM

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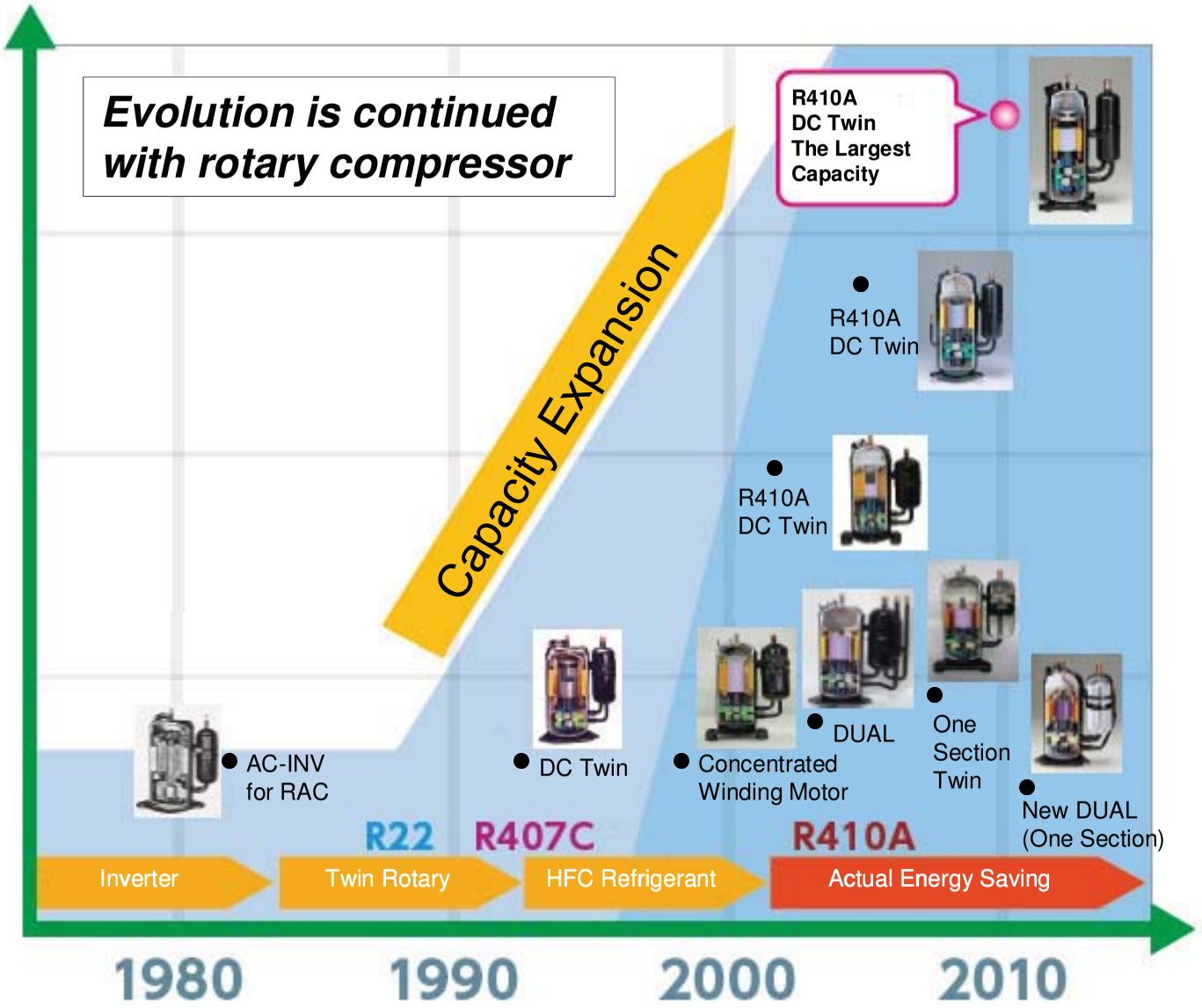
Toshiba Compressor Line Up


Chiller


VRF


PAC


RAC



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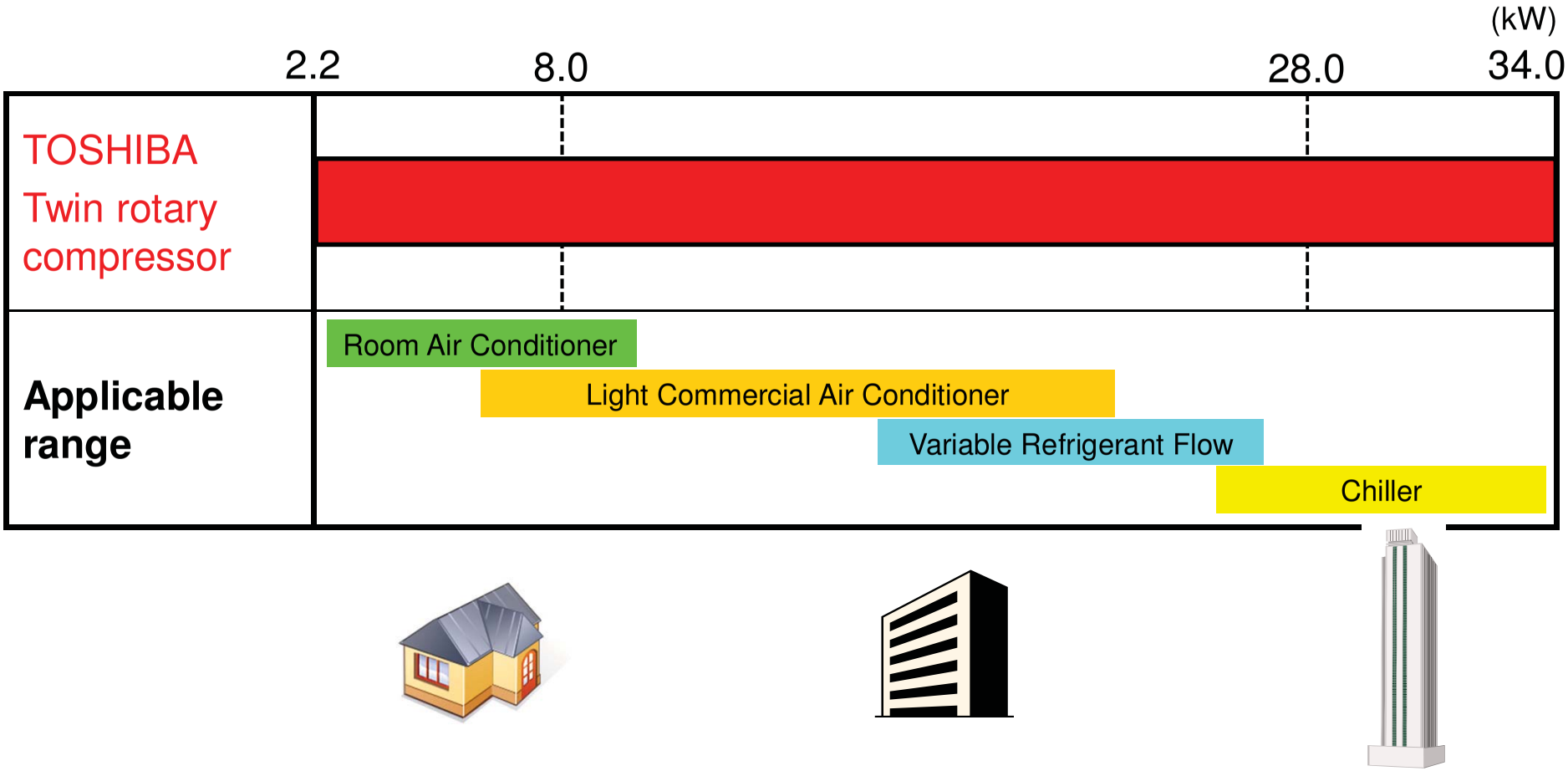
Compressor Capacity Range



In general, rotary compressor covers for small and medium capacity.

But, the TOSHIBA rotary compressor has from 2.2kW to 34.0kW, from residential air conditioner to chiller, as line up.

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Rotary Compressor

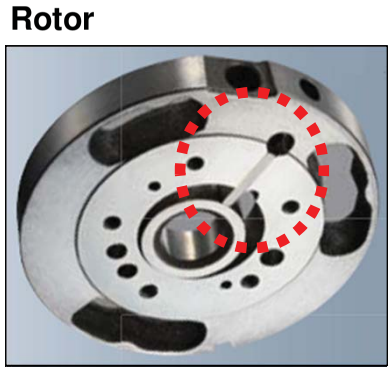
The blade thickness is reduced

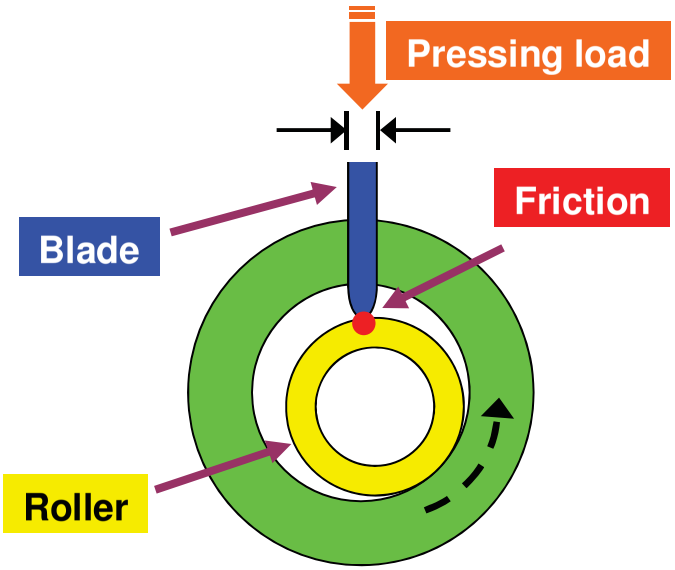
The back side area of blade is reduced

Reduction of the pressing load

Reduce the friction

Motor efficiency increase



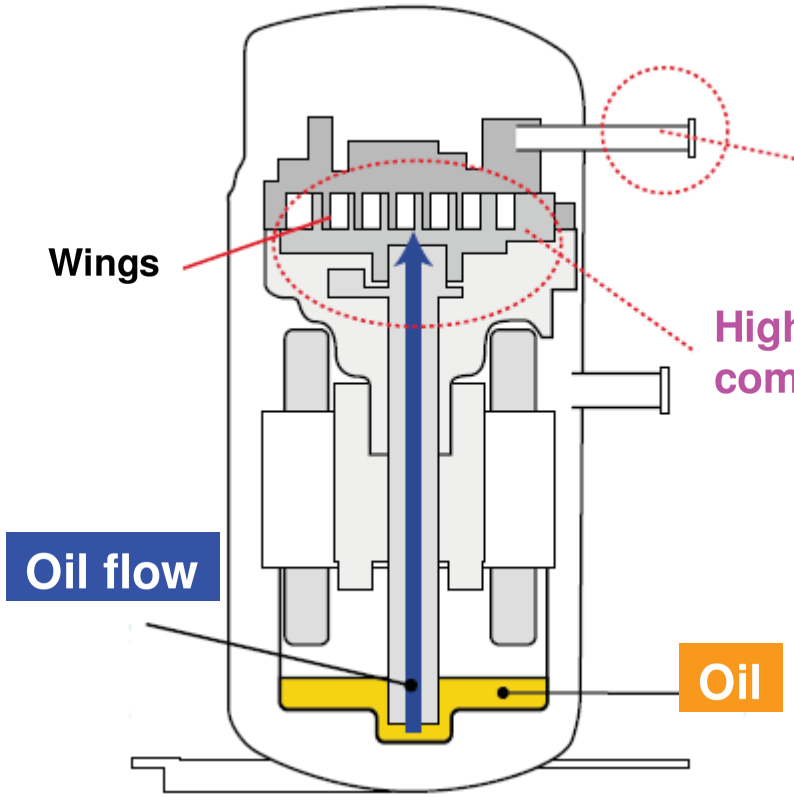


By using TOSHIBA unique and latest technology, it could reduce the friction between roller and blade.

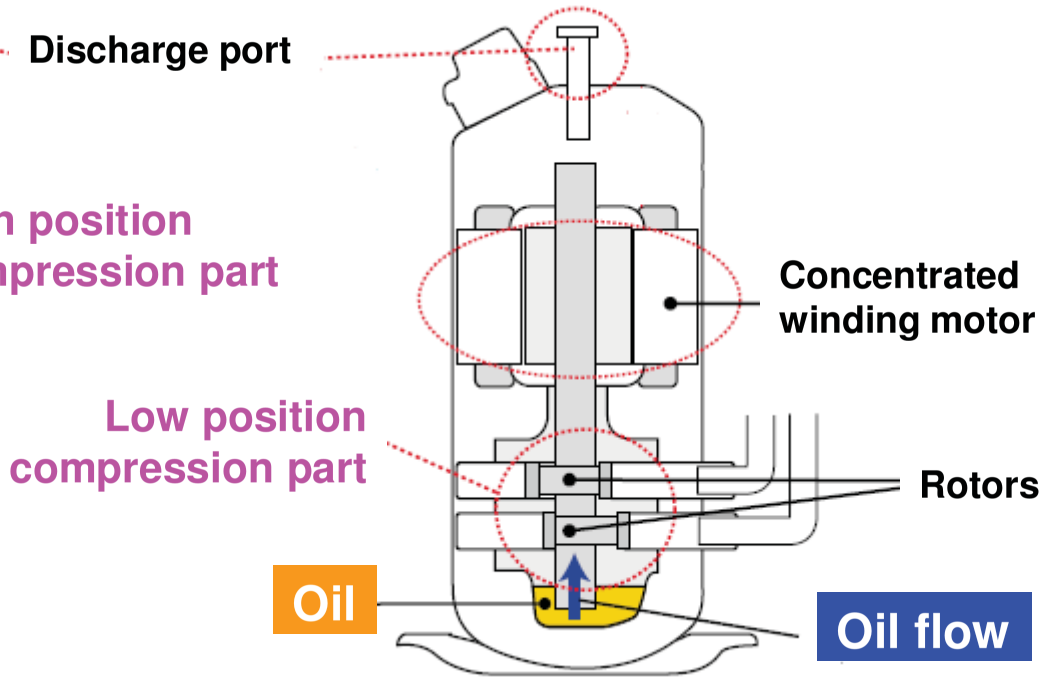
TOSHIBA
AIR CONDITIONING

Compressor Design Comparison

Scroll compressor



Rotary compressor



Rotary compressor is easy supplying the lubricating oil to compression part because of low position.
And the lubricating oil is easy to flow to the refrigerant cycle because the compression part is near the discharge port.