

# CLIMATE RESILIENT INDUSTRIES – INDUSTRIAL REVOLUTION 4.0 (IR4.0)

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CONFERENCE ON FUTURE OF WORK, FUTURE SKILLS

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# Outline

## **1. Introduction**

National Context Readiness

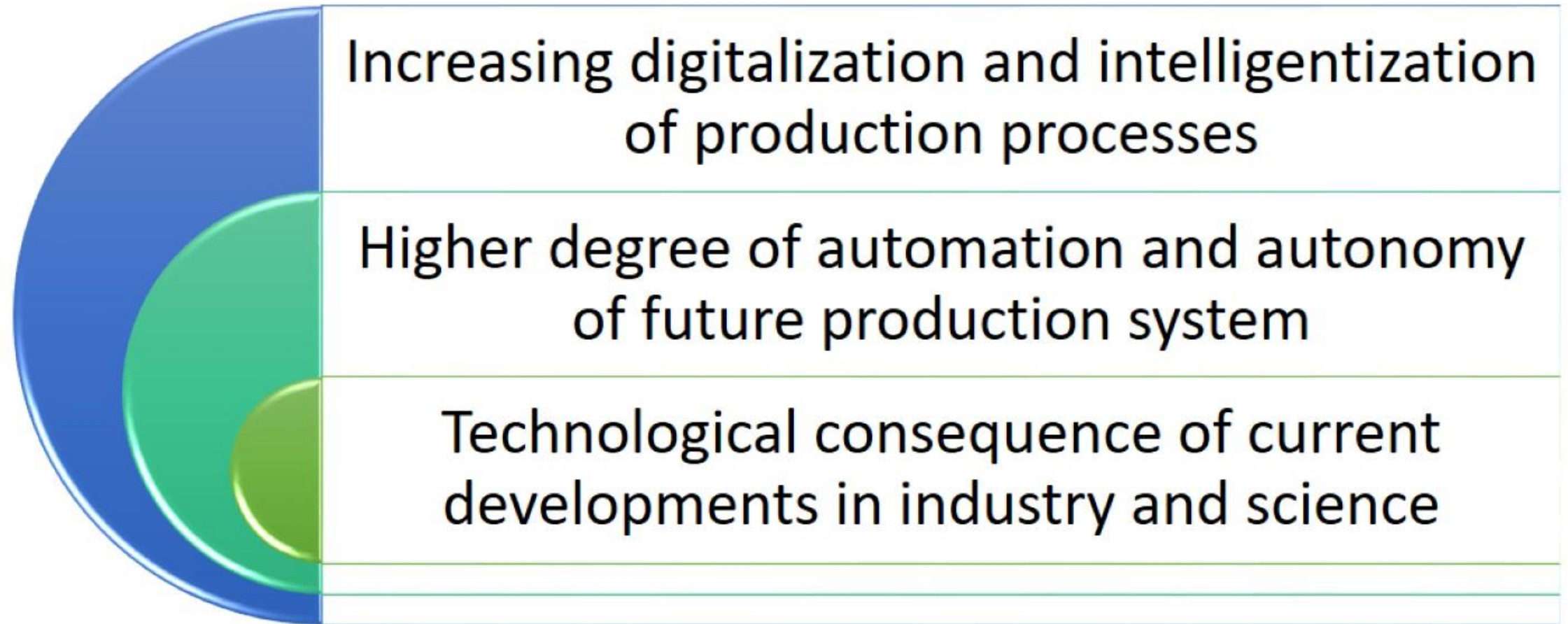
## **2. The role of IR4.0 in climate change mitigation**

- a. Can IR4.0 be a key player in mitigating climate change? Is there a “Green” Industry in IR4.0?
- b. What are the IR4.0 technologies applied to manufacturing and support activities linked to environmental sustainability?
- c. Fostering low emissions climate resilient industries at the global, regional, and country level

## **3. Conclusion**

# 1. Introduction

Features of IR4.0...



# 1. Introduction

Leverage on competitiveness but,...

Climate change

Environmental Pollution

Natural Resources

Sustainability



# 1. Introduction - National Context Readiness

**With the emergence of IR4.0,  
two schools of thought have  
occurred:**

- Huge incoming labour substitution and subsequent job displacement; and
- Unlimited opportunities and new job categories.

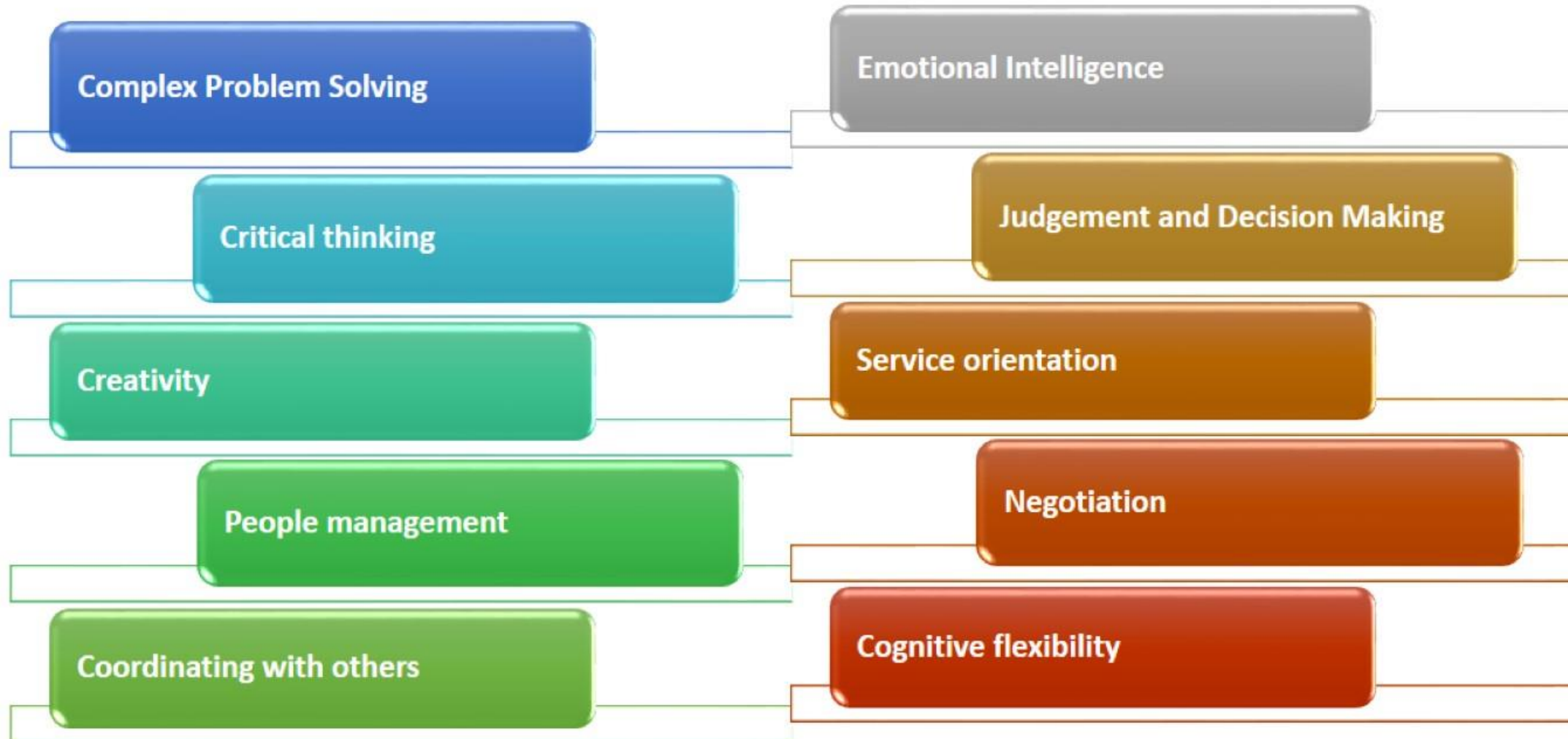
IIOT

AI

Human  
Labour

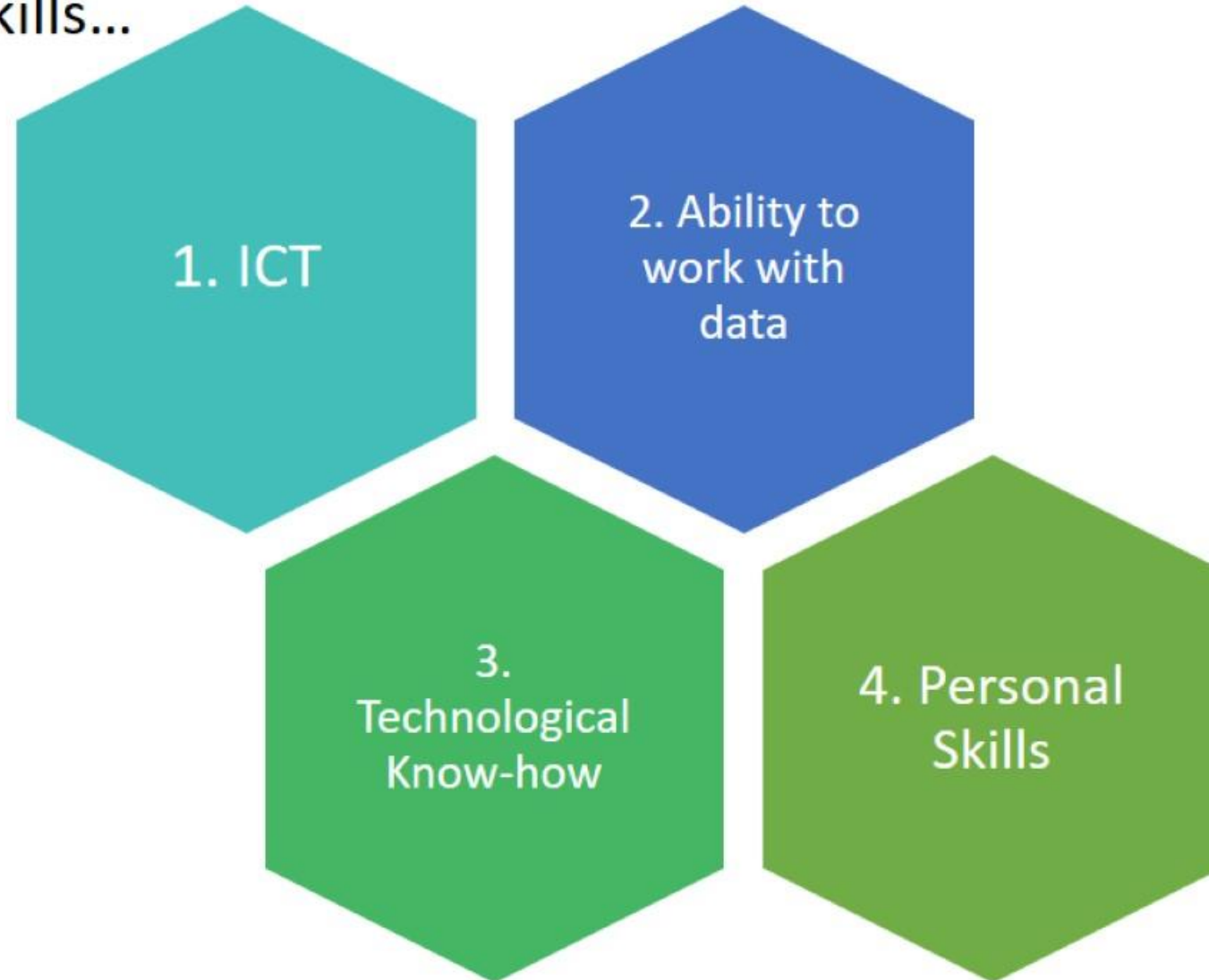
# 1. Introduction - National Context Readiness

Top 10 skills in 2020...



# 1. Introduction - National Context Readiness

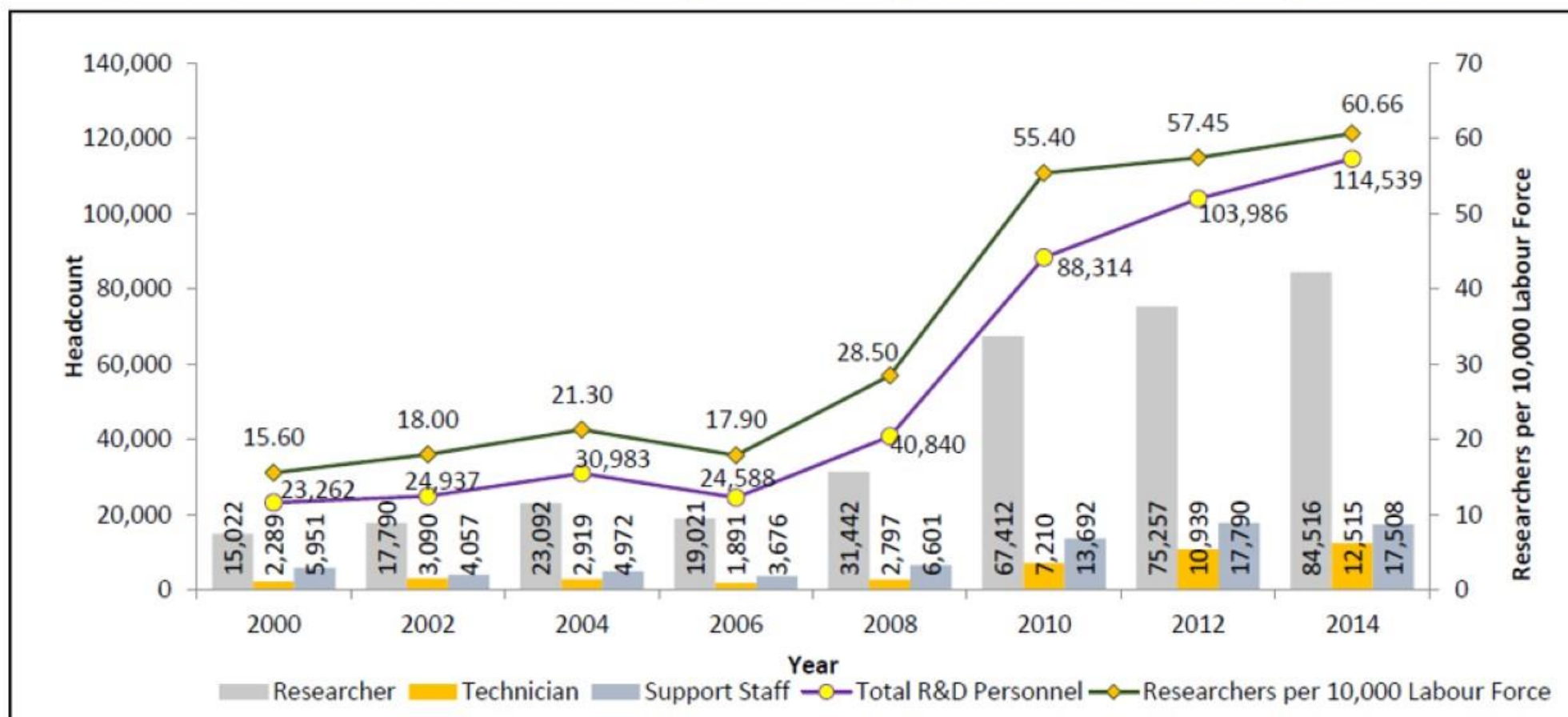
Qualifications and Skills...



# 1. Introduction - National Context Readiness

## R&D personnel and researchers per 10,000 labour force: 2000-2014

- Generally, Malaysia's number of R&D personnel, and researchers per 10,000 labour force were always in an upward trend since year 2000.



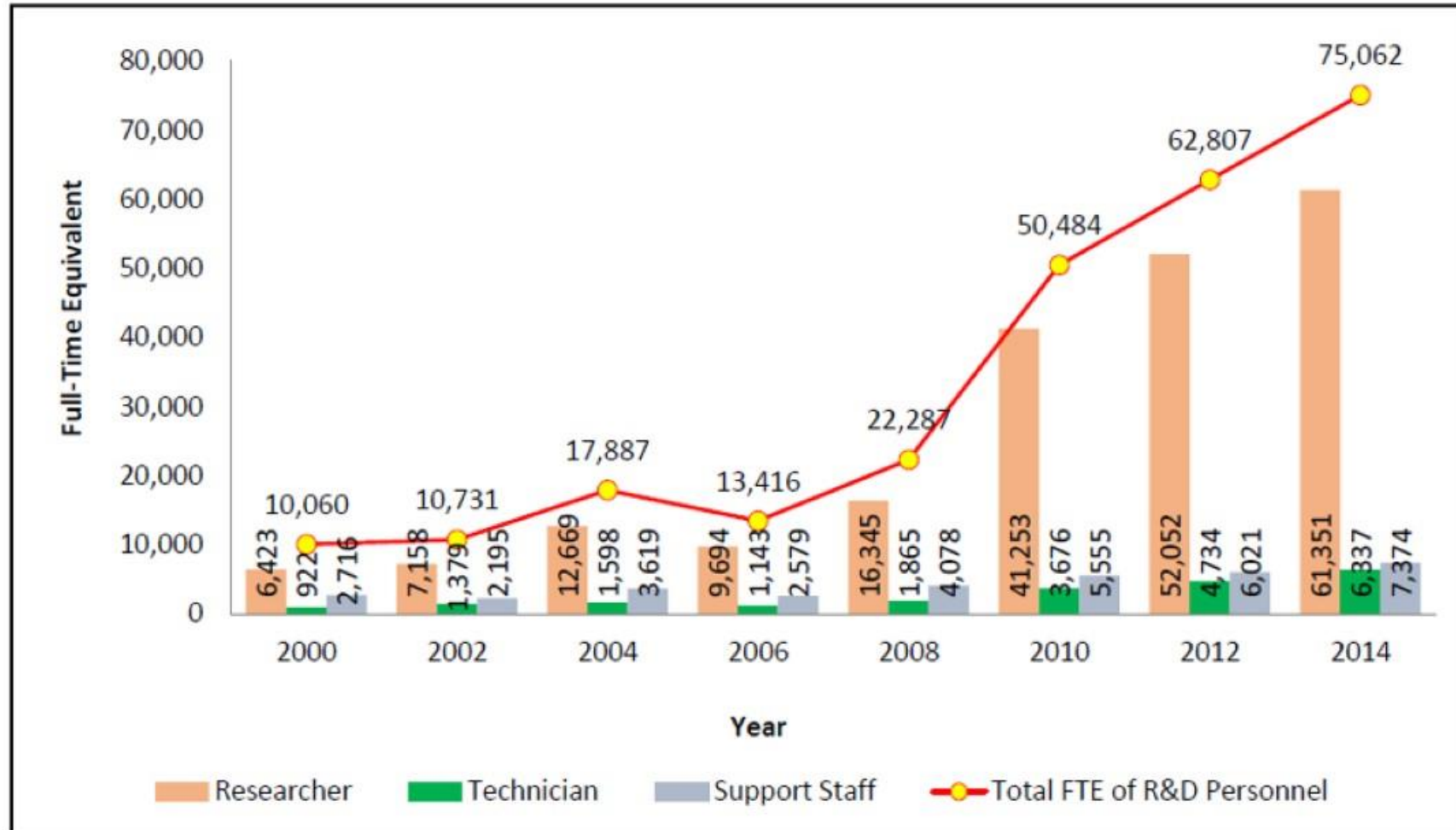
Source: National Survey of R&D in Malaysia 2013, 2015



# 1. Introduction - National Context Readiness

## Full-time Equivalent (FTE) of R&D personnel: 2000-2014

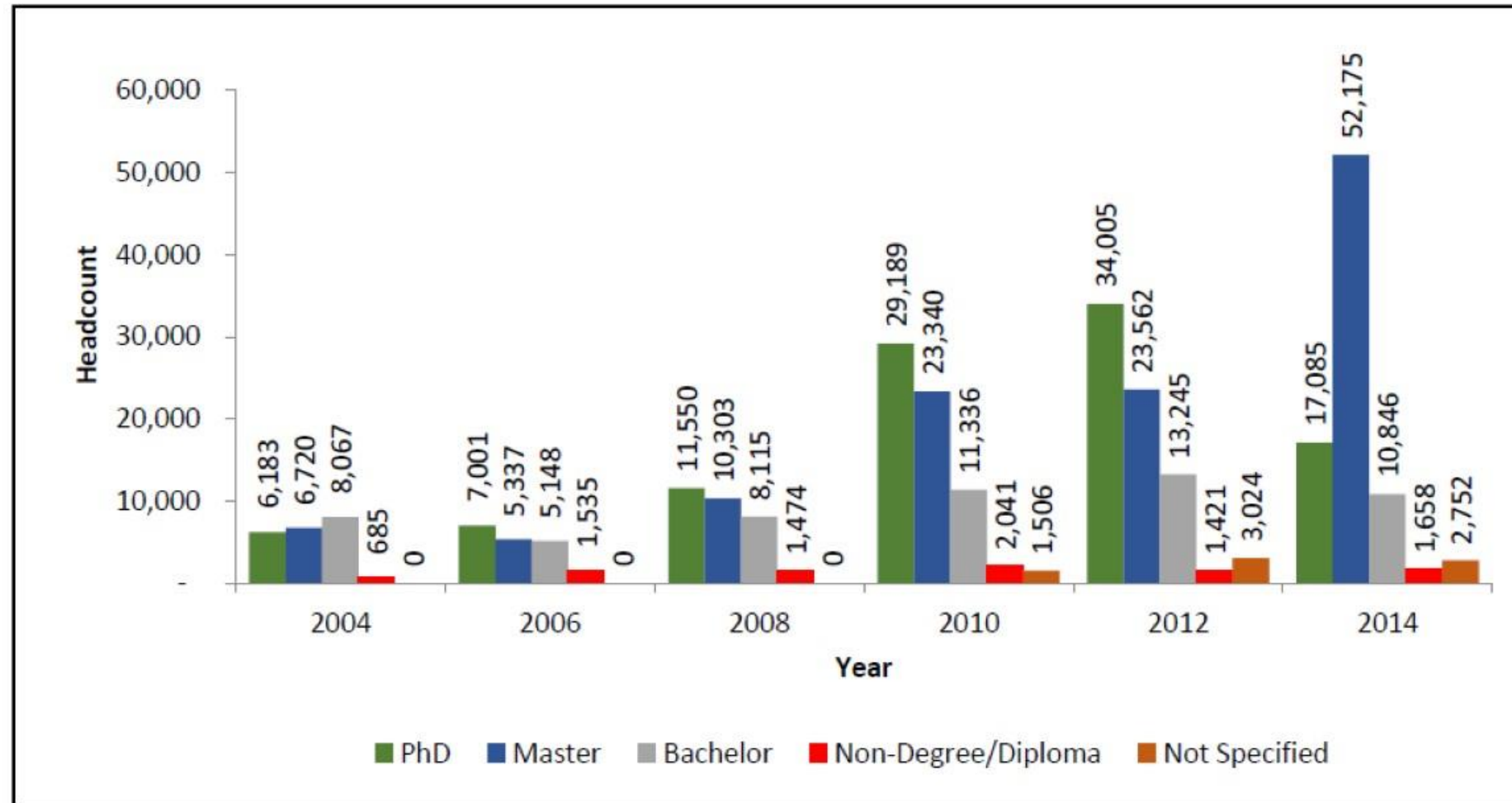
- FTE of R&D personnel in Malaysia is in a positive trend .



Source: National Survey of R&D in Malaysia 2013, 2015

# 1. Introduction - National Context Readiness

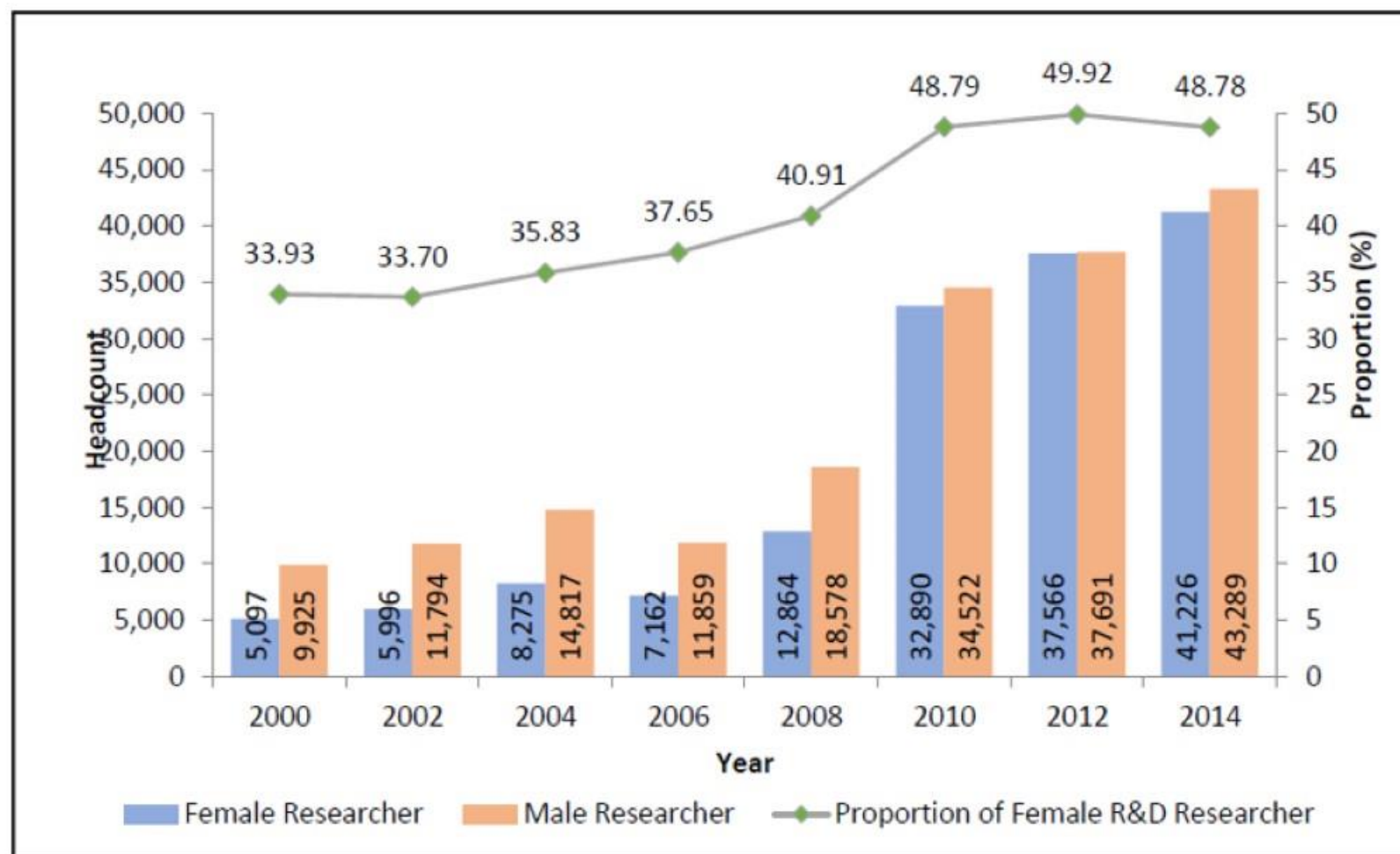
## Headcount of Researchers by Qualifications: 2000-2014



Source: National Survey of R&D in Malaysia 2013, 2015

# 1. Introduction - National Context Readiness

## Headcount of Researchers by Gender: 2000-2014



## 2. The role of IR4.0 in climate change mitigation

a. Can IR4.0 be a key player in mitigating climate change? Is there a “green” industry in IR4.0?



***Promoting Climate Resilient Industries through Innovative Technologies***



## 2. The role of IR4.0 in climate change mitigation

a. Can IR4.0 be a key player in mitigating climate change? Is there a “green” industry in IR4.0? (cont)

- Industry emissions account for 30% of total global GHG emissions

Information systems can play a role in creating intelligent and sustainable production systems of the future

Incorporate sustainability – Information systems for evaluating the “greenness” of the value chain

“Greenness” as indicators in production process / evaluate sustainability in the design and run time

## 2. The role of IR4.0 in climate change mitigation

b. IR4.0 technologies applied to manufacturing and support activities linked to environmental sustainability



# 2. The role of IR4.0 in climate change mitigation

## b. IR4.0 technologies applied to manufacturing and support activities linked to environmental sustainability (cont)

### *Overview of the main characteristics of IR4.0 in the Operation Scenario that impact on environmental sustainability*

(Bonilla SH, Silva HRO, da Silva MT, Goncalves RF, Sacomano JB. Industry 4.0 and Sustainability Implications: A Scenario-Based Analysis of the Impacts and Challenges, Sustainability 2018, 10, 3740.)

Industry 4.0 Elements	Opportunities	Effect on Flows	Impact Trend
Smart production: <ul style="list-style-type: none"> <li>IoT and CPS integration</li> <li>Real-time data control</li> </ul>	Vertical integration	Availability of reliable data about materials flows	Positive
		Availability of reliable data about energy flows	Positive
	Horizontal integration	Availability of reliable data about material consumption along the life cycle.	Positive
		Availability of reliable data about energy consumption along the life cycle	Positive
	Collection of data from consumers	Availability of subjective data	It depends
Big Data Analytics	Optimization of material consumption/ecoefficiency	Decreased material flow in manufacturing	Positive
	Optimization of energy consumption/ecoefficiency	Decreasing energy flows at the factory	Positive
	Predictive maintenance/Remote maintenance	Decreased energy flows	Positive
Additive manufacturing	Prototyping Tool and mold manufacturing Final product manufacturing Part manufacturing	Decreased waste	Positive
		Decreased materials flow	Positive
		Decreased waste	Positive
		No cutting fluids and forging lubricants	Positive
		Increased energy flows	Negative
On-demand production and customization	Elimination of the undesired functionalities of products	Decreased material and energy	Positive
	Disruptive business model/functionality and services	Extended life cycle of products/decreased end-of-life products	Positive
Smart contract/Blockchain technology	Transparency/decentralization/reliable information	Increased energy flows	Negative



# 2. The role of IR4.0 in climate change mitigation

## b. IR4.0 technologies applied to manufacturing and support activities linked to environmental sustainability (cont)

*Integration of the approaches between the SDGs and IR4.0 elements and the opportunities for improvement that emerges from that integration*

SDG	Integration through Industry 4.0 Elements	Enhanced Opportunities towards Environmental Sustainability	Effect on Flows
SDG#7 Affordable and clean energy	<ul style="list-style-type: none"> <li>Digitization (IoT and CPS)</li> <li>Real-time monitoring and data collecting</li> <li>Big data analytics</li> </ul>	Implementation of smart grids	Decreased energy flows
		Implementation of life cycle assessments	Increased renewable energy
SDG#9 Industry, innovation and infrastructure	<ul style="list-style-type: none"> <li>Digitization (IoT and CPS)</li> <li>Real-time monitoring and data collecting</li> <li>Additive manufacturing</li> <li>Novel business models</li> </ul>	Improve weak points of additive manufacturing (energy and recyclability) Extend integration with the circular economy	Decreased energy flows Decreased material flows Decreased waste flows Decreased end-of-life products
SDG#12 Responsible consumption and production	<ul style="list-style-type: none"> <li>Digitization (IoT and CPS)</li> <li>Real-time monitoring and data collecting</li> <li>On-demand production/customization</li> </ul>	Implementation of reliable and transparent sustainability reporting on-demand parts manufacturing services instead of tangible product	Increased reliable data Decreased material flows Decreased waste flows
SDG#13 Climate actions	<ul style="list-style-type: none"> <li>Digitization (IoT and CPS)</li> <li>Real-time monitoring and data collecting</li> <li>Big data analytics</li> <li>Blockchain</li> </ul>	Implementation of smart grids	Decreased energy flows
		Implementation of life cycle assessments	Increased renewable energy
		Blockchain-enabled emission trading	Decreased GHG emission

(Bonilla SH, Silva HRO, da Silva MT, Goncalves RF, Sacomano JB. Industry 4.0 and Sustainability Implications: A Scenario-Based Analysis of the Impacts and Challenges, Sustainability 2018, 10, 3740.)



## 2. The role of IR4.0 in climate change mitigation

c. Fostering low emissions climate resilient industries at the global, regional, and country level

*“Applying innovative technologies in the industry can address the dilemma by reducing energy consumption and thus, carbon emissions. Innovation within SDG9 framework can promote economic prosperity through sustainable industrialization and the development of climate resilient infrastructure and industries whilst establishing societal ecosystems that mitigates and are adapted to future advancement of climate change”*

*UNFCCC COP24 UN Side event on SDG9  
5 December 2018, Katowice, Poland*

## 2. The role of IR4.0 in climate change mitigation

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Promoting Climate Resilient Industries through Innovative Technologies:  
**A call to global climate actions...**

Emissions neutral by 2050

Net-zero carbon buildings

Businesses to set science-based targets

Forest, food, land-focused coalition

100% zero emissions transport future  
by 2030

Investors – low carbon transformation



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**A call to global climate actions...**

### Energy systems:

Transition to a future based on renewable energy, new storage technologies, electric mobility, smart grids, smart systems, shift to shared mobility

### Inclusive Economic Growth:

Businesses to play significant role in reducing risk of climate disruption, growing the clean energy economy, enabling a just transition that generates quality jobs

## 2. The role of IR4.0 in climate change mitigation

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Promoting Climate Resilient Industries through Innovative Technologies:

### Regional economic integration - ASEAN...

#### Key opportunities

- Increasing wealth
- Powerful force for economic inclusion
- Empowering SMEs
- Opportunities for leap frogging
- Connecting the unconnected
- Fighting congestion and road deaths
- Improving environmental management
- Transforming agriculture
- Improved health and healthcare
- Upgrading disaster preparedness

#### Challenges

- Job losses and disruption
- Inequality and political instability
- The end of traditional 'factory asia'
- Concentration on market power by global giants
- More exposure and vulnerability to cyber attacks

***....Calls for new approach to regional governance***

*Source:  
ASEAN 4.0: What does the Fourth Industrial Revolution mean for regional economic integration, World Economic Forum & Asian Development Bank (ADB) White Paper, November 2017.*

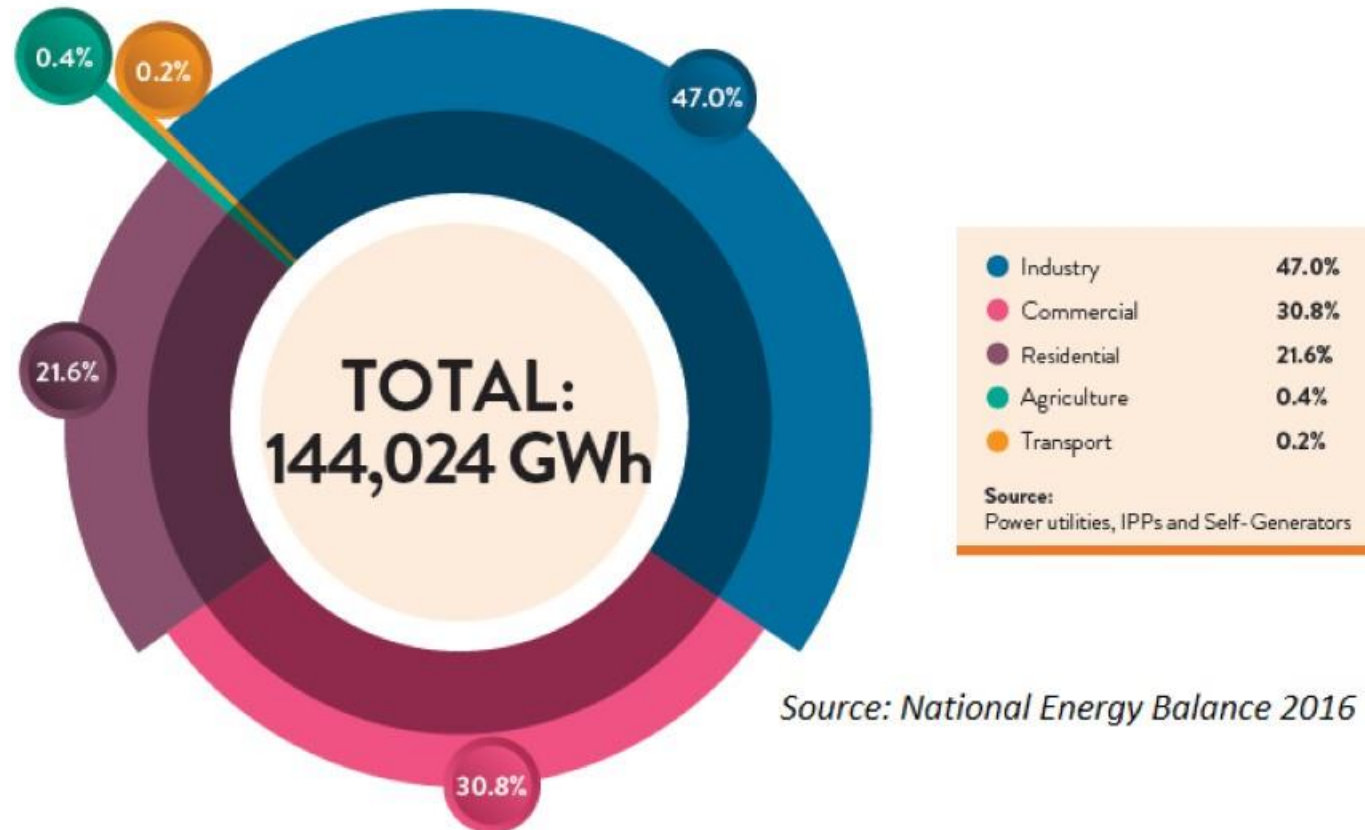


## 2. The role of IR4.0 in climate change mitigation

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Promoting Climate Resilient Industries through Innovative Technologies:  
The Malaysian context...

Energy system:  
Power sector

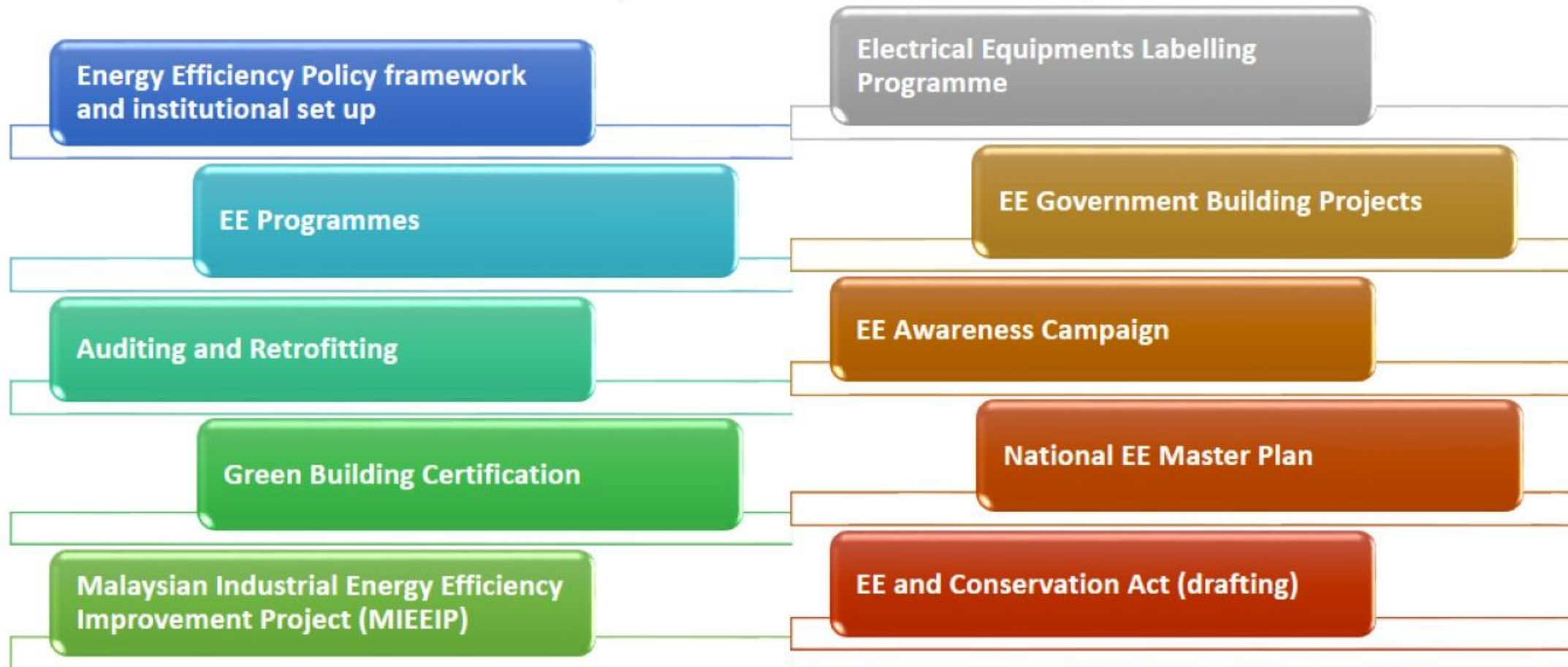


Source: National Energy Balance 2016

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Promoting Climate Resilient Industries through Innovative Technologies:  
**The Malaysian context...**



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Promoting Climate Resilient Industries through Innovative Technologies:  
The Malaysian context...

**Nationally Determined Contributions (NDC)**

**45% reduction of Carbon Intensity (carbon emission per GDP) relative to 2005 level by 2030**



### 3. Conclusions

- To avoid increased inequality and unemployment in the future, planned actions should be undertaken by government today, in order to establish a workforce that will possess the required skills for a changed world.
- IR4.0 can be well placed to address the interconnected economic, environmental and social challenges facing societies from promoting sustainable economic growth to climate change mitigation.

**Thank you**