



UNITED ARAB EMIRATES  
MINISTRY OF CLIMATE CHANGE  
& ENVIRONMENT

# UAE GREEN JOBS PROGRAM: JOBS & SKILLS FOR THE UAE'S GREEN ECONOMY TRANSFORMATION

2019

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## EXECUTIVE SUMMARY

The United Arab Emirates (UAE) is transforming its economy at a high speed by heavily investing in sustainable initiatives such as renewable energy, energy efficiency, public transport and cleaner vehicles, and green building and eco-cities. As industries shift toward greener production methods, products, and services, the opportunities to create 'green jobs' will also emerge along with economic benefits. However, the country needs to work fast to fill the potential gaps in knowledge and skills required for green jobs through a range of measures in different policy domains in order not to miss these opportunities.

This report aims to provide a starting point to explore and coordinate policymaking and

stakeholder actions targeting green jobs in the UAE. The first half of the report takes stock of the latest global understanding and practices on green jobs: what is meant by a green job, how employment issues relate to greening the economy, what types of policies are generally adopted for promoting green jobs, and how to monitor and analyze their trends for policymaking. The second half sheds light on the current status of green jobs and relevant policies in the UAE, makes a first attempt at estimating the number of existing and future green jobs, and outlines next steps to improve understanding and develop more targeted policies.

## WHAT IS A GREEN JOB?

Although there has been no single definition to date, the International Labour Organization (ILO) defines green jobs as those that "reduce the consumption of energy and raw materials, limit greenhouse gas emissions, minimize waste and pollution, protect and restore ecosystems and enable enterprises and

communities to adapt to climate change". Green jobs are not exclusive to the industries designed for environmental objectives such as renewable energy and energy efficiency, but they can also be found in traditional sectors such as manufacturing and construction.

## STRUCTURAL CHANGE DUE TO GREENING JOBS

The uptake of green jobs may stimulate a structural change in the job market in the medium to long term. This can happen in different ways:

- Shift in demand within and between sectors: Any job market change implies a decrease in demand for some occupations and an increase in demand for others.
- Emergence of new occupations: Entirely new job portfolios, occupations, and entrepreneurial opportunities may be created in the emerging green sectors.

- Greening of existing jobs: As the corporate processes of production and operation will increasingly be required to be more efficient and greener, some existing job portfolios will need to include environmental responsibilities. Although the net creation of jobs is an expected outcome of a green economy transition, the nature of changes may be specific to the country and industry context.

## POLICIES FOR GREEN JOBS

Policy measures to promote and leverage green jobs cut across different policy domains such as environment, finance, education, and labor, and thus need to be aimed at making the right policy mix and enduring coherence between ministries. The European Union categorizes green jobs policies

into primary measures, supporting measures, and financial tools. ILO largely classifies relevant policies into those of supply-side (e.g., technology deployment; investment) and demand-side (e.g. education; human resources).

## OTHER COUNTRIES' APPROACHES TO GREEN JOBS

Countries differ in their approach to promoting green jobs. In many developed countries, the educational and technological bases exist and require measures to favor green industries over others. Typically, an overarching sectoral policy (such as that of energy in Germany) and/or fiscal stimulus (as in the United States) has been adopted to create jobs in green sectors and to green conventional jobs.

In developing countries, the driver for integrating green jobs into public policy comes from the need to address pressing socio-economic challenges. For example, the Philippines' green jobs policy is led by its labor authority, focusing on capacity building of the workforce on necessary knowledge and skills.

## ESTIMATING GREEN JOBS

The quantification of green jobs provides sound evidence to allow timely, appropriate policy interventions. This needs to start with developing a definition of what constitutes green jobs. Each country needs to determine whether the following types of jobs are concerned according to their policy questions:

- Jobs in green industries that directly contribute to producing green products or services;
- Jobs in green industries that do not directly contribute to green products or services;
- Jobs in non-green industries that directly contribute to greening production processes, products or services; and

- Jobs in non-green industries that indirectly contribute to green industries or greening non-green industries.

Depending on the availability of resources and data on economic activity and labor markets, the methodologies for estimating green jobs can be selected, including: use of labor statistics; surveys; applying employment factors; conducting input-output (I-O) analysis; and modeling long-term economic changes.

## THE STATE OF GREEN JOBS IN THE UAE

To understand the current status of green jobs in the UAE, relevant business activities and initiatives in the ten sectors expected to contribute to the UAE Green Agenda 2030 were reviewed: energy; waste management; manufacturing; buildings and construction; agriculture, forestry and fisheries; transport; services; academia; and the public sector. The first attempt to quantify green jobs in each sector was also made by using employment factors from other countries, which were then applied to the already confirmed national targets and technology deployment plans, as well as existing growth prospects.

The current number of green jobs in the UAE was estimated at around 49,500 or roughly %0.7 of the total workforce. The public sector, waste management and recycling, tourism and transport are the most significant sources of green jobs today. By 2021, around 68,000 green jobs will be present and the number could reach 83,000 in 2030 as more sustainable practices are adopted. While the public sector remains an important source of green jobs, renewable energy, waste management, and transport will gradually come to dominate the green jobs market toward 2030.

Preliminary estimation of green jobs (per year) in the UAE			
Species	2018	2021	2030
<b>Energy</b>			
Renewable energy*	1,120	9,634	5,712
Energy efficiency	200	850	2,400
District cooling	2,190	4,000	7,670
<b>Waste management</b>			
Collection	7,400	(7,400)	(7,400)
Recycling	1,436	4,725	9,450
Waste to energy	-	590	758
Wastewater	3,800	(3,800)	(3,800)
<b>Manufacturing</b>	3,000	3,050	3,108
<b>Buildings &amp; construction</b>	2,687	2,700	2,750
<b>Agriculture</b>	1,270	1,520	2,270
<b>Forestry</b>	-	-	-
<b>Fisheries</b>	223	370	600
<b>Transport</b>	5,376	7,719	14,750
<b>Services</b>			
Financial services	64	70	100
Professional	450	(450)	(450)
Wholesale & retail	400	(400)	(400)
Tourism	6,000	6,475	7,900
<b>Academia</b>	154	(154)	(154)
<b>Public sector</b>	13,750	(13,750)	(13,750)
<b>TOTAL</b>	<b>49,520</b>	<b>67,657</b>	<b>83,422</b>
[Nuclear power]		17,000	

\*Without manufacturing. Construction jobs counted as up to 2018 no longer exist. Construction jobs counted for 2021 and 2030 will also cease after completion. ( ): Assumed no growth due to lack of projections

It should be noted that this method of estimation inherently involves assumptions and simplifications and a margin of error is inevitable. More accurate quantification can be made in the coming years

## UAE POLICIES FOR GREEN JOBS

There has been no single policy specifically targeting the promotion of green jobs in the UAE to date. However, several policies that relate to green jobs are being implemented. These policies come in various forms – mostly as supply-side policies. For example, clean energy policies rely on target-setting to encourage investment.

Demand-side policies will become critical to advance green jobs. Green jobs can be considered

by conducting enterprise surveys, developing national employment factors, and holding sectoral consultations.

## WAY FORWARD

Green jobs policies cannot be created in isolation, and a collaborative approach across sectors is essential to effectively address needs for harnessing the potential of green jobs. As an immediate step forward, the establishment of two multi-stakeholder working groups is proposed: a Policy Coordination and Research group to identify and enhance relevant sectoral initiatives and develop enabling policies and educational curricula; and a Measurement and Monitoring group to develop the methodology for quantifying and forecasting

in relation to national employment issues such as Emiratization, migration, and female participation. The alignment of higher education and vocational training policies and curricula with labor market demand will be key to equip the youth with knowledge and skills required for the green economy and to enable the existing workforce to adapt to the emerging green jobs.

green jobs and monitor the progress regularly.

Such groups may engage: federal and local authorities in charge of the environment, energy and water, economy and industry, human resources, education, and statistics; industry associations and leading businesses; education providers; civil society organizations; and academic experts in labor, education and environmental policies and economics.

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## ACRONYMS

ADNOC	Abu Dhabi National Oil Company
ADQCC	Abu Dhabi Quality and Conformity Council
ACTVET	Abu Dhabi Centre for Technical and Vocational Education
ADGM	Abu Dhabi Global Market
AGEDI	Abu Dhabi Global Environmental Data Initiative
ARRA	American Recovery and Reinvestment Act
BAU	business-as-usual
BIBB	Bundesinstitut für Berufsbildung (Federal Institute for Vocational Training, Germany)
CEA	Certified Energy Auditor
CEM	Certified Energy Manager
CGE	computable general equilibrium
CO2	carbon dioxide
CNG	compressed natural gas
CSP	concentrated solar power
DEWA	Dubai Electricity and Water Authority
DFX	Dubai Financial Market
DIHK	Deutscher Industrie- und Handelskammertag (Association of German Chambers of Commerce and Industry)
DOLE	Department of Labour and Employment, Philippines
DPM	Department of Urban Planning and Municipalities, Abu Dhabi
DTCM	Department of Tourism and Commerce Marketing, Dubai
EAD	Environment Agency – Abu Dhabi
EGA	Emirates Global Aluminium
EGBC	Emirates Green Building Council
EGSS	environmental goods and services sector
EHS	environment, health, and safety
ENEC	Emirates Nuclear Energy Corporation
ENOC	Emirates National Oil Company
EOI	School for Industrial Organisation, Spain
ESCO	energy services company
ESMA	Emirates Authority for Standardization and Metrology

EU	European Union	MoHRE	Ministry of Economy, UAE
FAO	Food and Agriculture Organization of the United Nations	MSC	Ministry of Human Resource and Emiratization, UAE
FANR	Federal Authority for Nuclear Regulation, UAE	MW	Marine Stewardship Council
FCSA	Federal Competitiveness and Statistics Authority, UAE	NDC	megawatt
FEWA	Federal Electricity and Water Authority, UAE	NGO	Nationally Determined Contribution
FiT	feed-in tariff	NOx	non-governmental organization
FTE	full-time equivalent	O&M	nitrogen oxides
GCC	Cooperation Council for the Arab States of the Gulf (Gulf Cooperation Council)	OECD	operation and maintenance
GSO	GCC Standardization Organization	PQP	Organisation for Economic Co-operation and Development
GDP	GCC Standardization Organization	PV	Pearl-qualified professional
GGGI	gross domestic product	QCEW	photovoltaic
GHG	Global Green Growth Institute	R&D	Quarterly Census of Employment and Wages
GW	greenhouse gas	RSB	research and development
GWS	gigawatt	RTA	Regulatory and Supervisory Bureau, Dubai
	Gesellschaft für Wirtschaftliche Strukturforchung (Institute of Economic Structures Research, Germany)	SAM	Roads and Transport Authority, Dubai
HSE	health, safety and environment	SCA	social accounting matrix
HVAC	heating, ventilation, and air conditioning	SDGs	Securities and Commodities Authority, UAE
IAEA	International Atomic Energy Agency	tCO <sub>2e</sub>	Sustainable Development Goals
IAT	Institute of Applied Technology, UAE	TR	tons of carbon dioxide equivalent
IEA	International Energy Agency	TVET	tons of refrigerant
ILO	International Labour Organization	UAE	technical vocational education and training
I-O	input-output	UN	United Arab Emirates
IRENA	International Renewable Energy Agency	Environment	United Nations Environment Programme
ISCO	International Standard Classification of Occupations	UNWTO	World Tourism Organisation of the United Nations
ISIC	International Standard Industrial Classification	USGBC	United States Green Building Council
KHDA	Knowledge and Human Development, Dubai	WTTC	World Travel and Tourism Council
KEPCO	Korea Electric Power Corporation		
kW	kilowatt		
LEED	Leadership in Energy and Environmental Design		
MENA	Middle East and North Africa		
MOCCA	Ministry of Climate Change and Environment, UAE		

## INTRODUCTION

The UAE is actively pursuing the greening and diversification of its economy under the UAE Vision 2021, the UAE Centennial 2071, the UAE Green Agenda 2030, and the National Climate Change Plan 2050. As this major transformation progresses, a significant increase in demand for jobs related to energy efficiency, renewable energy and other environmental areas is expected. The jobs in these areas are broadly called “green jobs”.

The Green Agenda, which was approved by the Cabinet in January 2015, outlines five strategic objectives (pillars) and twelve programs as an overarching framework of actions for the country’s green economy transformation. Since fostering jobs and skills for the prospective green sectors is considered as a prerequisite for the successful transformation, one of the programs was dedicated to the Green Workforce and Talent Program under the strategic objective of Social Development and Quality of Life.<sup>1</sup>

In support of the work of this important part of the Green Agenda, the Ministry of Climate Change and Environment (MOCCA) launched the UAE Green Jobs Program and convened the first stakeholder workshop in December 2017. To ultimately harness the full potential of green jobs, the stakeholders agreed that the Program should pursue the following objectives:

- Support an efficient and smooth transition to a green economy
- Leverage job opportunities from greening industry, especially for UAE nationals
- Address the gaps in knowledge and skills that may hold back the transition; and

- Assess the status, potential and progress of green jobs by enabling their quantification
- This report aims to shed light on the concept of green jobs and global policy practices, make a preliminary estimation of existing and future green jobs in the UAE, and analyze existing information and recent developments on relevant policies to identify next steps and means of collaboration with stakeholders in the coming years. The report is meant as a starting point for the discussion on green jobs and related policies. Where estimations are presented, an attempt has been made to explain the limitations of methodology and data availability. Estimations are by no means definitive as several assumptions and simplifications were involved.

The first part of the report presents a global overview of existing knowledge on the concept of green jobs and its significance to the green economy. It then discusses approaches and ongoing initiatives on green jobs around the world to set the scene for the preliminary analysis and policy discussion on the subject in the UAE context. The second part looks into various sectors in the UAE which have potential for generating green jobs and provides an estimation of current and prospective green jobs numbers. Finally, education and employment policies in the UAE are briefly reviewed to provide a basis for future work. The report concludes with recommendations for policy coordination with various stakeholders across the country.

This report was compiled in partnership with the Global Green Growth Institute (GGGI) and supported by interviews and consultation with authorities and experts which are acknowledged below:

- Ministry of Education
- Ministry of Energy and Industry
- Ministry of Human Resources and Emiratization
- Federal Authority for Nuclear Regulation
- Federal Competitiveness and Statistics Authority
- Emirates Youth Council
- Environment and Protected Areas Authority Sharjah
- Abu Dhabi Department of Economic Development
- Abu Dhabi Education Council
- Abu Dhabi Centre for Technical and Vocational

Education and Training

- Environment Agency – Abu Dhabi
- Emirates Skills
- Dubai Knowledge and Human Development Authority
- Ras Al Khaimah Environment Protection and Development Authority
- International Renewable Energy Agency
- Professor Toufic Mezher, Khalifa University
- Simon Bangs, Sustainable Recruitment Solutions
- Deepthy K.B., Regional Director, Middle East, Green Building Certification Inc.
- Dr. Florian Eppink

<sup>1</sup>For the UAE Green Agenda 2030, see MOCCA (2016). UAE State of Green Economy Report 2016, available at [www.moccae.gov.ae](http://www.moccae.gov.ae).



## PART I: Global Practices on Green Jobs

As governments and industries around the world increasingly look into opportunities from greening the economy, they are also trying to assess societal benefits and impacts from this economic transformation, particularly from “green jobs”. But what, exactly, is a green job? What can the government do to green the workforce? How are green jobs counted? The first half of the report reviews the scope and definitions of green jobs and outlines different policy approaches to support their promotion, taking stock of research and practices from leading countries and international organizations.

# 1. A GLOBAL OVERVIEW OF GREEN JOBS

## 1.1. WHAT IS A GREEN JOB?

In recent years, the international community has been looking into the economic and social implications of the transition to a green economy. The concept of “green jobs” has become a matter of interest and debate in different parts of the world as a tangible opportunity to convince policymakers, industry, and the public to strive for sustainable development.

Although there has been no single, unified definition of green jobs to date, the International Labour Organization (ILO) defines green jobs as those that “reduce the consumption of energy and raw materials, limit greenhouse gas emissions, minimize waste and pollution, protect and restore ecosystems and enable enterprises and communities to adapt to climate change”.<sup>1</sup> That is, people who hold a green job are contributing to reducing environmental impacts or preserving natural resources of their organization, sector, region, country, and/or the entire planet. As the ILO states, green jobs are not exclusive to industries designed for environmental objectives, such as renewable energy and energy efficiency,

but can also be found in traditional sectors such as manufacturing and construction. As production processes go greener in traditional sectors, jobs within those sectors will also become greener, contributing to the transition to a green economy.<sup>ii</sup>

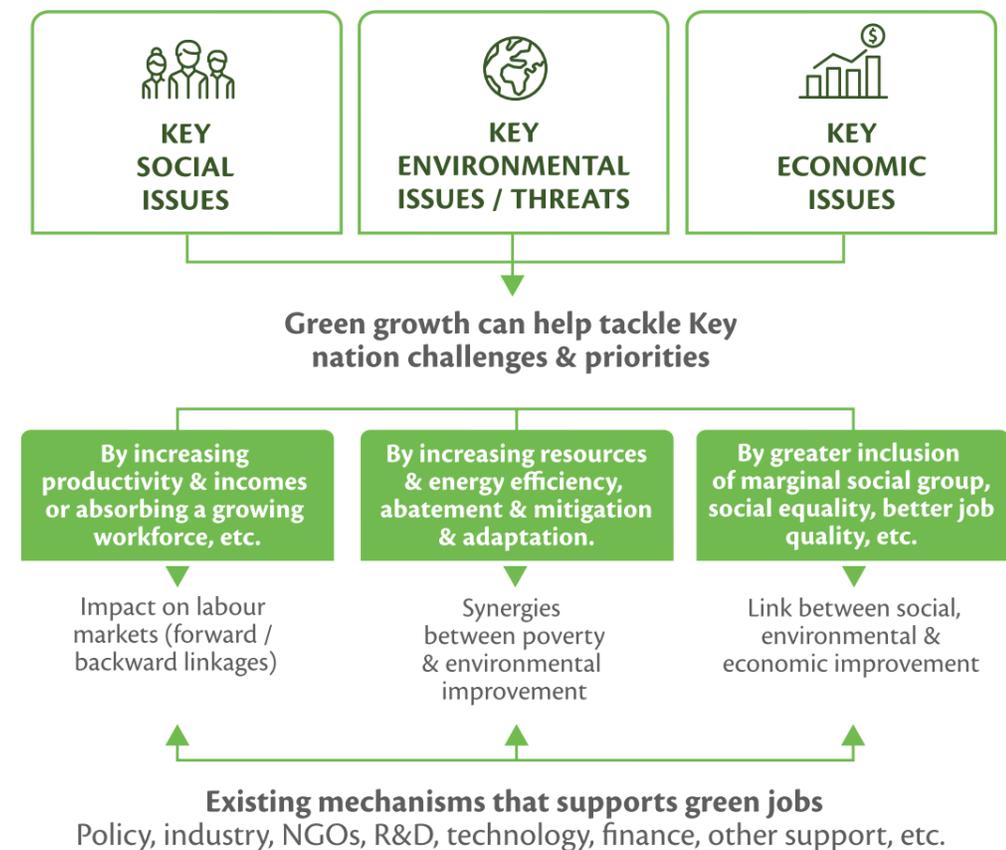
Even though the ILO definition (or variations thereof) is the most widely used, alternative approaches see green jobs from the output or process in which those jobs are involved, as is the case of the United States. The output approach defines green jobs as jobs in businesses that produce goods or provide services that benefit the environment or conserve natural resources. The process approach refers to jobs in which workers’ duties involve making their entity’s production processes more environmentally friendly or use fewer natural resources.<sup>2</sup> On the other hand, Australia and New Zealand made attempts to define specific occupational groups where green jobs are generated.<sup>3</sup> To date, each country is attempting to capture green jobs according to its specific needs and policy questions.

## 1.2. GREEN JOBS IN GREEN ECONOMY TRANSFORMATION

The notion of green jobs is an important, indispensable element of a country’s transformation toward a green economy. Green jobs and green economy are deeply interrelated in a few dimensions where policymakers need to pay clear attention to develop successful measures. Adopting green economy policies stems from the desire to address key social, environmental and economic

issues, which, in turn, have implications on various employment and social welfare aspects, notably job creation in new or transitioning sectors. On the other hand, policy measures specifically targeted to create green jobs may benefit the economy broadly, as summarized by the ILO: “green jobs can act as a catalyst for the transition to a green economy and can be a policy objective in themselves.”<sup>4</sup> (Figure 1).

Figure 1: Mutual effects of green economy and green jobs policies<sup>5</sup>



As green jobs may require new skill sets, it is also important for the country to make adequate skills readily available so as to prepare for and drive changes and attract more green investment. On

the other hand, mismatches between demand and supply of skills may hold back the green economy transition and miss significant opportunities.

<sup>ii</sup>The United Nations Environment Programme (UN Environment) defines green jobs as “work in agricultural, manufacturing, research and development (R&D), administrative, and service activities that contribute substantially to preserving or restoring environmental quality. Specifically, but not exclusively, this includes jobs that help to protect ecosystems and biodiversity; reduce energy, materials, and water consumption through high efficiency strategies; de-carbonize the economy; and minimize or altogether avoid generation of all forms of waste and pollution.” [UN Environment (2008). Green Jobs: Towards decent work in a sustainable, low-carbon world. UNEP/ILO/IOE/ITUC]

### 1.3. SECTORS WITH GREEN JOBS

In consideration of which economic sectors and what kind of professional activities may provide or create green jobs, the ILO offers the following guiding questions:<sup>6</sup>

1. Does the sector or activity make direct use of natural resources?
2. Does the sector or activity support better environmental management through e.g.:
  - Management of land or water for production of goods and services;
  - Reduction of pollution and management of waste;
  - More efficient use of energy and natural resources;
  - Providing products and services that have a significantly lower environmental impact than alternative options?
3. Is the sector concerned with managing and mitigating environmental risks on people and the economy?

ε. Does the sector or activity have a high degree of reliance on good environmental quality? That is, the sectors and activities commonly leading to green jobs consist of: eco-friendly products; sustainable agriculture, forestry and fisheries; waste and resource management; sustainable energy production and distribution; activities for climate change adaptation (e.g., construction, infrastructure and land-related sectors); resource and energy efficiency services; green construction and energy/water efficiency in buildings; transportation (e.g., manufacture of greener vehicles and equipment; public transport and urban transit systems); and sustainable tourism. It is important to note that the same sector or activity may or may not generate green jobs. For instance, jobs in traditional farming and fishing cannot be considered as green when it depletes ecosystems. Only when clean energy is involved, energy production and distribution activities may be included in green jobs.

### 1.4. EXPECTED SHIFTS IN JOBS

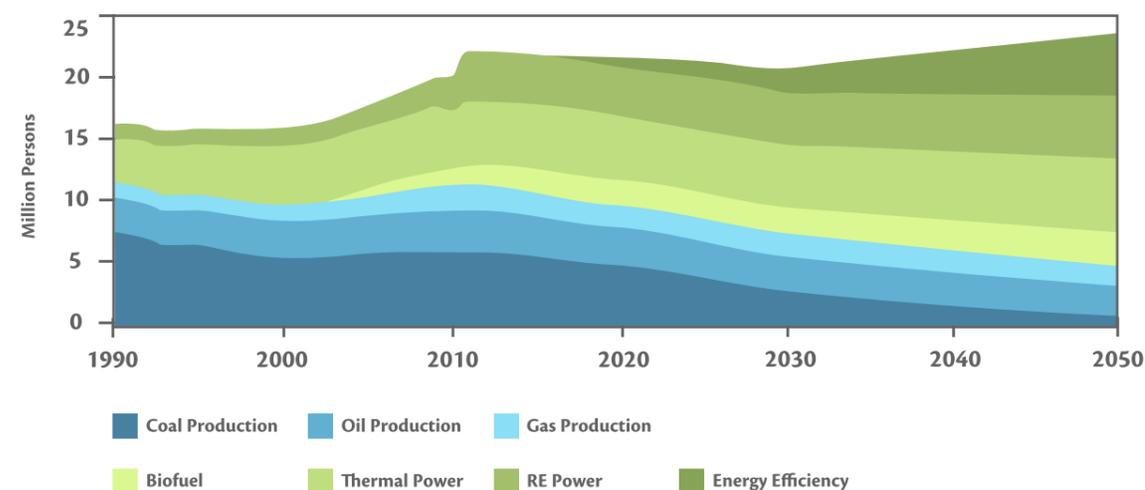
The prospective uptake of green jobs may stimulate a structural change in the job market in the medium to long term. An ILO study outlines the three primary ways in which the shift in jobs is expected and how countries could cope with the change:<sup>7</sup>

- Shift in demand within and between sectors: Any job market change implies a decrease in demand for some occupations and an increase in demand for others. The transition to a greener economy may involve the shift of jobs from resource-intensive sectors (e.g., oil and gas) to green sectors (e.g., renewable energy). Retraining of the workforce may be required to allow those who are affected by restructuring to access to green jobs.
- Emergence of new occupations: Entirely new job portfolios, occupations, and entrepreneurial opportunities may be created in the emerging green sectors. Such opportunities can be leveraged through the development of new training programs or the upgrade of existing programs in technical vocational education and training (TVET) and higher education.

- Greening of existing jobs: As the corporate processes of production and operation will increasingly be required to be more efficient and greener, some existing job portfolios will need to include environmental responsibilities. This may require the integration of environmental curricula at diverse levels of education, including primary, secondary and higher education, TVET, and lifelong learning.

The United Nations Environment Programme (UN Environment) estimated in its 2011 report the long-term shift in the energy sector jobs that would occur as the portfolio of energy sources will change over time. According to its G2 scenario<sup>iii</sup>, and compared to a business-as-usual (BAU) scenario, employment will be created in the areas of energy efficiency and renewable energy, adding 5.1 million jobs in energy efficiency and growing from 3.3 million to 5.2 million jobs in renewable power generation between 2010 and 2050<sup>8</sup>. Employment in thermal power will decrease from 5.5 million to 5.3 million jobs, while jobs in coal production will shrink from 1.8 million to 0.8 million. The total number of energy-related jobs will see an increase as demand grows (Figure 2).

Figure 2: Estimated long-term shift in energy sector jobs<sup>9</sup>



<sup>iii</sup>The G2 scenario assumes an annual investment of USD 656 billion in biofuels and other renewable energy technologies between 2010 and 2050 (see Chapter 3).

In the World Employment and Social Outlook 2018, ILO also estimated the net job creation and losses in the energy sector by 2030 in case of pursuing the 2°C Scenario (2DS) defined by the International Energy Agency (IEA) compared to its

60C Scenario (6DS), which is largely a continuation of current trends. A total of around 2.5 million jobs will be additionally created in diverse renewable energy fields, whereas approximately 400,000 jobs will be lost in fossil fuel-related activities (Table 1).<sup>10</sup>

Table 1: Estimated job gains and losses in the energy sector<sup>11</sup>

Sub-sectors gaining jobs		Sub-sectors losing jobs	
Production of electricity by solar thermal energy	3.0%	Production of electricity by coal	-0.19%
Production of electricity by geothermal energy	0.4%	Extraction of crude petroleum and services related to crude oil extraction, excluding surveying	-0.11%
Production of electricity by wind	0.4%	Extraction, liquefaction, and regasification of other petroleum and gaseous materials	-0.08%
Production of electricity by nuclear energy	0.3%	Petroleum refinery	-0.05%
Production of electricity by biomass and waste	0.3%	Manufacture of gas, distribution of gaseous fuels	-0.03%
Production of electricity by solar photovoltaics	0.3%	Mining of coal and lignite; peat extraction	-0.03%
Production of electricity by hydropower	0.2%	Extraction of natural gas and services related to natural gas extraction, excluding surveying	-0.03%

Note: Figures refer to percentage difference in employment up to 2030.

The ILO study also looked into the regional difference in those net job creation and losses. As far as current economic structures are unchanged, the Middle East will be the most negatively

affected by the forthcoming energy transition as it is estimated to lose nearly 0.5% of energy-sector jobs (Figure 3).<sup>12</sup>

Figure 3: Estimated changes in energy-sector jobs by region<sup>13</sup>



While most studies available to date conclude that the transition to a green economy will have positive net employment, whether the newly created jobs will offset the job losses is under the ongoing international debate and may be highly location-

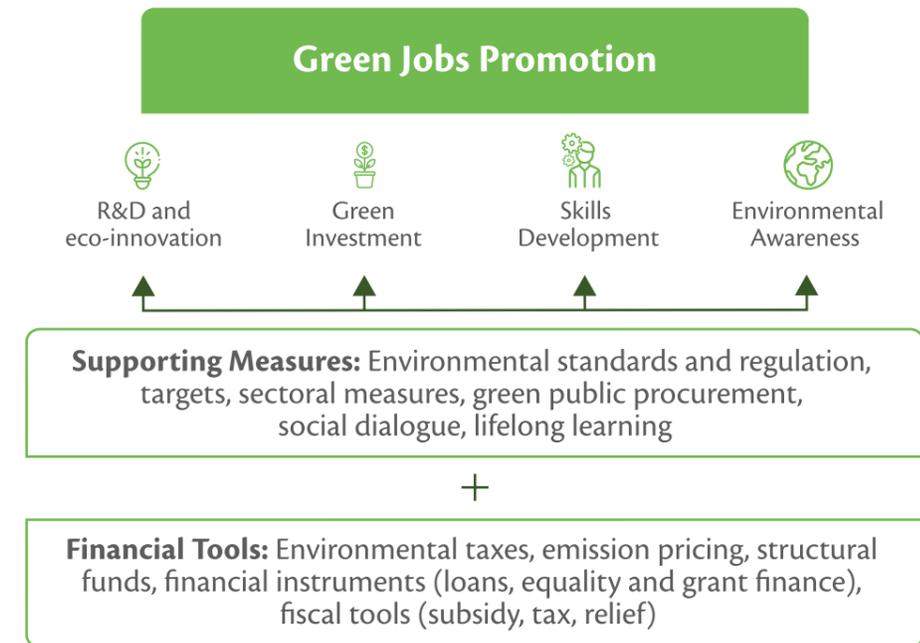
specific. It is important to note that those who will acquire green jobs are not necessarily those who will have lost their jobs. Therefore, active retraining policies would be required to avoid long-term unemployment of those laid off.

### 1.5. POLICIES FOR GREEN JOBS

The European Union (EU) documents a range of policy measures that have already been applied by its Member States to promote and leverage green jobs. As Figure 4 shows and more detailed

are provided below, those measures are largely categorized into primary measures, supporting measures, and financial tools.

Figure 4: Types of policy measures to promote green jobs<sup>14</sup>



The European Union (EU) documents a range of policy measures that have already been applied by its Member States to promote and leverage green jobs. As Figure 4 shows and more detailed

are provided below, those measures are largely categorized into primary measures, supporting measures, and financial tools.

**Primary measures:** Although those measures may not be specifically targeted for promoting green jobs, their successful implementation would directly affect the creation of new jobs and the shift in the existing job portfolios:

- **R&D and eco-innovation:** Innovation is a backbone to create new green products and develop improved production and consumption patterns which would, in turn, generate green jobs. The policies to support innovation include support for research and development (R&D) through funding, subsidies and tax credits, and networks or industry clusters for knowledge transfer, business incubation, and collaboration.
- **Green investment:** Investment in new infrastructure and upgrades to existing infrastructure require labor and technical input, creating jobs for construction workers, designers, engineers, and their supply chains. Government support through stable policy frameworks with clear strategies and targets, and seed funding or risk guarantees could attract investment in green infrastructure such as renewable energy, green transport, and green buildings.
- **Skills development:** Managing the changes in skill needs requires an integrated approach to education and labor policies. Establishing an agile, responsive education and vocational training system would support job creation by providing tailored curricula and certification schemes that respond to the emergence of new professions due to greening the economy.
- **Environmental awareness:** The level of environmental awareness among stakeholders and the public would define how fast the country could be transformed into a green economy and could benefit from the transition. Not only the government but all stakeholders can play a part in raising awareness through diverse means and channels.

**Supporting measures:** In addition to the primary measures, other regulations and policy frameworks could indirectly induce green jobs through raising needs and demands for greener products and production methods, including environmental standards, eco-labeling and certification schemes, planning rules and building regulations, green public procurement, and sectoral policies and targets.

**Financial tools:** Use of fiscal measures or market-based mechanisms such as environmental taxes, emissions trading, and slab tariffs could direct the overall course of investment and industry development toward resource efficiency by affecting the cost of goods and services, thus influencing the behavior of producers and consumers and inducing the needs of skills for greening.<sup>15</sup>

ILO provides an alternative approach to understanding and categorizing the measures supporting green jobs, drawn from a study of 13 countries:<sup>16</sup>

**Demand-side policies:** Measures that influence the demand for green jobs by facilitating green investment and greener business operations, including fiscal and investment policies, sectoral and trade policies and standards, and industrial development policies.

**Supply-side policies:** Measures that influence the supply of qualified and suited workers by focusing on human resources development, labor mobility and migration, and educational and skills development policies.

**Labor market measures:** Measures to ensure decent work as an important element of green jobs by focusing on employment services, protection of workers, and social dialogue.

ILO generally observed that as countries are more experienced with green jobs, more supply-side measures are introduced. It recommends the following actions to overcome the challenges of promoting green jobs:<sup>17 18</sup>

- Align skills development with environmental, economic and social concerns of the country;
- Focus on retraining and the development of portable skills to encourage occupational mobility;
- Match skill supplies with labor market demands through social dialogue and better information;
- Improve systems for identifying and anticipating skill needs;
- Enable teachers and trainers to keep their skills up-to-date for accommodating green jobs; and
- Changing habits and imparting green skills by raising awareness on polluting practices and everyday solutions.



## 2. INTERNATIONAL PRACTICES OF GREEN JOBS POLICIES

This chapter reviews three country examples of policies promoting green jobs to illustrate why and how governments promote green jobs. While not every aspect of their programs and initiatives can be discussed, the review particularly focuses

on policy cohesion and relevance to the national context to enable drawing lessons for the UAE. The chapter also outlines the work of intergovernmental agencies that study and advocate green jobs.

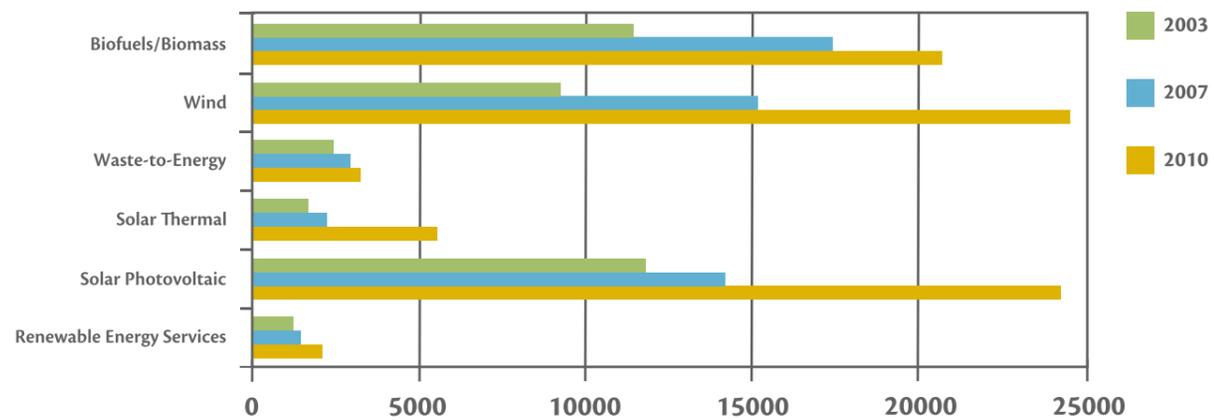
### 2.1. UNITED STATES

In response to the 2008 global financial crisis, the US Congress passed the American Recovery and Reinvestment Act (ARRA) in February 2009. This stimulus package contained a green component of between USD 67-112 billion out of the total budget of USD 840 billion, including an estimated USD 92 billion budget for clean energy, energy efficiency, and advanced vehicles and fuels, accompanied with the announcement of clean energy goals.<sup>19 20</sup> The package came with measures including research and innovation, an extension of tax credits and loan guarantees, cash grants, and faster processing

of “green patents” as well as training programs and education grants for green careers.

This stimulus is considered to have resulted in tangible economic and social benefits. In terms of employment, it is estimated that 26,600 new direct jobs were created in 2010 through the ARRA renewables and clean energy programs (Figure 5), while around 28,000 jobs were generated in energy efficiency.<sup>21</sup> It was observed that average salaries in those green jobs were slightly higher than the whole job market.

Figure 5: Estimated direct clean energy jobs created in the United States<sup>22</sup>



Taking a longer-term perspective, the Department of Labor conducted research on identifying and anticipating skill needs for “green-collar” jobs and greening existing occupations, along with setting a definition of green jobs and conducting nationwide surveys to count the number of green jobs.<sup>23</sup> The report identified 12 sectors that would become the focus of a greening the economy, including renewable energy, transportation, energy efficiency,

green construction and energy trading. In addition, 60 existing jobs would take on greener aspects and require new green skills, including very highly skilled occupations, such as those in science and engineering, and other less technical occupations such as construction laborers, hazardous waste removal workers, and jobs involved in building trades.

### 2.2. GERMANY

Since long before Energiewende (energy transition) policy was introduced in 2010, Germany had been heavily promoting energy efficiency and renewable energy. In the late 1990s, the government began introducing gradual increases in the tax rates on oil and gas and introduced a new levy on electricity. As a result, fossil fuel consumption has continually declined as a clear incentive for industrial sectors to deploy energy-efficient technologies and processes emerged. The country has seen a remarkable progress in renewable energy deployment since enacting the Renewable Energy Sources Act in 2000, which included a feed-in tariff (FiT) scheme and a cap and trade system among other measures. Responding to the criticism of the resulting higher electricity prices,<sup>24</sup> the latest 2017 version of the Act introduced auction systems that would help lower the costs of renewable energy projects.<sup>25</sup>

employed in renewable energy-related fields by 2010, the majority of which were in biomass, wind and solar energy. This number remained relatively constant until 2013<sup>26</sup> and dipped slightly by 2016 to 325,000 jobs.<sup>27</sup> Estimates indicate that the net growth potential of renewable energy jobs is up to 275,000-300,000 jobs by 2050.<sup>28</sup>

It is estimated that around 340,000 people were

In addition to the above demand-side measures, “Environment Creates Perspectives” program was launched in 2006, which aimed to identify and foster the trades, skills and competencies required by the emerging environmental sector. The program brought together the Ministry of Environment, the Ministry of Education and Research, the Chamber of Commerce (DIHK), and the Federal Institute for Vocational Training (BIBB). In cooperation with environmental technology and renewable energy firms and business associations, 6,000 additional apprenticeship positions were created in 2009.

### 2.3. PHILIPPINES

The Philippine Labor and Employment Plan 2011-16 aimed to address the interrelated goals of economic growth, human development, and employment.<sup>29</sup> As a response to the issue of high unemployment rates in the country, the Plan proposed to mainstream green jobs through labor market policies to ensure decent work and spur innovation. The Philippine Green Jobs Act was approved in 2016, which included legislation on fiscal and non-fiscal incentives for businesses that generate and sustain green jobs. The incentives include special tax deductions for skills training and R&D expenditures and an exemption of taxes and duties for importing capital equipment. The Act also gave a mandate to the Department of Labor and Employment (DOLE) to develop a National Green Jobs Human Resource Development Plan to fill the gaps in the skills required for the green economy transition. This Plan will include support to improve the higher education and technical vocational training systems and to understand the skills requirements for the green economy. In addition, the Philippine Development Plan 2011-16 also referred to the greening of jobs as a part of

the strategy for realizing inclusive and sustainable growth. The National Climate Change Action Plan for 2011-18 refers to green jobs to boost climate-smart industries and services.

Prior to the introduction of the Act, several research studies were conducted to support a green jobs mapping exercise by the ILO and the Institute for Global Environmental Strategies (IGES), defining green jobs, and identifying green jobs potential in ten key sectors, and providing qualitative and quantitative information in these sectors.<sup>30 31 32 33</sup> DOLE has been leading the implementation of the Act, in coordination with other government agencies and stakeholders. A total of 16 departments, authorities and commissions have been assigned with specific tasks related to green jobs. Since 2011, DOLE has launched a number of green jobs-related initiatives as part of the broader employment policy as listed in Table 2. To monitor the growth of green jobs, DOLE plans to develop a database of green careers and enterprises offering green jobs.

### 2.4. INTERNATIONAL

As highlighted below, green jobs have also been studied and advocated by a few leading intergovernmental organizations since the late 2000s as a part of their work on enabling the green economy transition and the Sustainable Development Goals (SDGs):

- International Labour Organization (ILO): ILO established the Green Jobs Program in 2009 which has since assisted over 30 countries in enabling green jobs by providing expertise and tools. The organization sees green jobs as a new opportunity to generate employment and income in many countries as well as a means to mainstream environmental concerns into the world of work. It has conducted pilot projects around the world to test policy tools, establish social dialogue, and analyze sectoral green jobs potentials.<sup>35</sup>
- Organisation for Economic Co-operation and Development (OECD): OECD conducts studies on the greening of jobs and skills as part of its Employment Program, including modelling the

impact of green growth and climate change policies on GDP and employment and industry surveys on the implementation of green growth labor market measures, the use of subsidies in job creation, etc. OECD advocates policies to support a smooth transition of workers from declining to growing firms while reforming tax and benefit systems to ensure that environmental policies do not become a barrier to employment.<sup>36</sup>

- International Renewable Energy Agency (IRENA): IRENA has compiled a Renewable Energy and Jobs annual report since 2013. According to the latest assessment, there were estimated 10.3 million renewable energy jobs in 2017 with solar PV, biomass and wind energy as the most dominant sub-sectors.<sup>37</sup> IRENA also plans to analyze gender aspects of renewable energy jobs as female participation is still relatively low in the energy sector, and has engaged in the issues of women’s access to energy.

Table 2: Green jobs-related initiatives in the Philippines<sup>34</sup>

Initiative	Description
Green Our DOLE Program	Offers opportunities for DOLE staff to engage in green jobs discussions and advocate green jobs.
Green Workplace Advocacy Program	Creates awareness on green jobs and the benefits of greening practices in the workplace.
Green My Enterprise	Provides training and consulting to help SMEs to green their operations through eco-audits, 5S, and other methods.
Green research and advocacy	DOLE’s Institute for Labor Studies organizes forums, conferences, surveys, and publications on climate change, decent work, and green jobs.
Just Transition Framework	Shapes DOLE’s policy response and strategy for enabling a fair manner of transition to green jobs.

### 3. SCOPING AND ESTIMATING GREEN JOBS

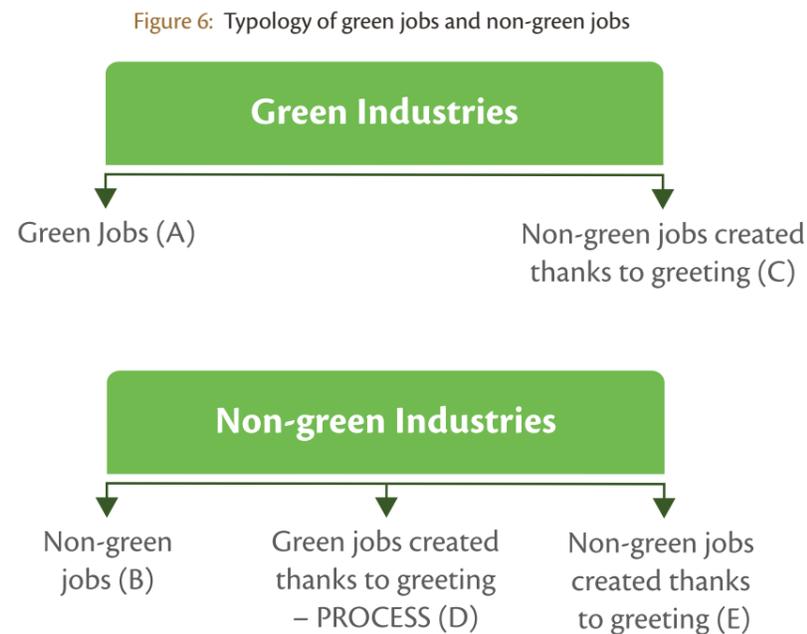
One of the most significant challenges in promoting green jobs across the economy is obtaining sound quantitative data that allow appropriate evidence-based policy interventions. It is not an easy task but essential for the government to be able to identify how many green jobs currently exist, which sectors

they populate, and how their numbers change over time. This chapter reviews global practices of how the boundaries of green jobs are set and what types of data and methodologies are applied to quantify green jobs.

#### 3.1. ESTABLISHING BOUNDARIES

The first step in measuring green jobs is setting a clear definition of green jobs. Although the ILO definition reviewed in Section 1.1 provides general guidelines, it is too broad to allow accounting of the actual number of jobs at the national level. Furthermore, ILO states that “the selection of which tools are most appropriate for carrying out a [green jobs] study is largely dependent upon the questions that it sets out to answer.”<sup>38</sup> Thus, the countries working on quantifying green jobs have created their own definition that fits their national circumstances and policy needs.

In order for the country to quantify green jobs, establishing boundaries of what needs to be measured is the essential first step. As the ILO definition shows, green jobs can be found in emerging green industries such as renewable energy and energy efficiency as well as in conventional sectors such as manufacturing and construction. The distinction between green jobs and non-green jobs in both new and conventional industries can be made according to five categories of jobs (A-E) as explained in Figure 6 and further below.



The two classifications of industries and the five categories contained within them were listed to account for all types of jobs and apply the general understanding of what constitutes a green job. This is in recognition of the fact that it is not only a matter of the nature of industry in which a job may be found; the nature of the work itself must be accounted for as well. Jobs defined as ‘non-green’ will be found in what can easily be thought of as ‘green’ industries (under most definitions), while ‘green’ jobs can be found even in the case of heavily polluting, ‘non-green’ industries.

The categorization of jobs follows this logic. Categories A and B cover green industries: those industries whose main function, product or service is directly related to improving the state of the environment, reducing pollution and conserving resources. Within these industries, a distinction is made between ‘green’ jobs, whose role is related to the activity of that particular green industry, and ‘non-green’ jobs, whose role is more of a supporting one or simply unrelated to the industry’s core function.

- A. Jobs in green industries that directly contribute to producing green products or services; e.g., ecologists, renewables engineers, or recycling plant operators.
- B. Jobs in green industries that do not directly contribute to the production of green products or services, e.g., executive assistants, accountants, or human resources.

Categories C-E cover non-green industries: industries whose activities do not relate directly to

environmental protection or resource conservation. This can be in any industry such as banking, health care, construction, and government services. Most of the jobs in these industries will not contribute to greening in any form (C). However, different types of roles may exist in these industries that contribute in some way to ‘greening’ industry, whether directly or indirectly. These roles can be categorized as green due to the fact that they either contribute to making these industries greener by looking directly at environmental impacts of their activities and attempting to minimize them (C), or by taking part in activities that indirectly support greener jobs down the value chain (D).

- C. Jobs in non-green industries that do not contribute to green industries or greening non-green industries;
- D. Jobs in non-green industries that directly contribute to greening production processes, products or services;
- E. Jobs in non-green industries that indirectly contribute to green industries or greening non-green industries, e.g., steelworkers who produce steel used for making windmills.

Policymakers can utilize this typology to define the boundaries of green jobs, which are largely dependent on the policy questions relevant for a particular country:

- A + B = jobs in green industries**
- A + D = “core green jobs” directly contributing to greening industry**
- A + B + D + E = jobs generated due to greening**

To make this typology work, it is important to have consistent boundaries of green industries in the first place. The European Statistical Office (Eurostat) provides a universal classification of the

environmental goods and services sector (EGSS), which is taken as green industries, consisting of environmental protection and resource management activities (Table 3):

Table 3: Classification of the environmental goods and services sector<sup>39</sup>

1. Protection of ambient air and climate	2. Management of forest resources
3. Wastewater management	4. Management of forest areas
5. Waste management	6. Minimization of the intake of forest resources
7. Protection and remediation of soil, groundwater and surface water	8. Management of wild flora and fauna
9. Noise and vibration abatement	10. Management of energy resources
11. Protection of biodiversity and landscape	12. Production of energy from renewable sources
13. Protection against radiation	14. Heat/energy saving and management
15. Research and development	16. Minimization of the intake of fossil resources as raw material for uses other than energy production
17. Other environmental protection activities	18. Management of minerals
19. Management of waters	20. Research and development

### 3.2. DATA COLLECTION AND ESTIMATION

Once the boundaries have been agreed, the quantification of green jobs can be conducted using different approaches. Each of the methodologies listed below can be used alone or in combination depending on the availability of time and resources, data, statistics and metrics on economic activity and labor markets in different sectors. The more detailed and comprehensive quantification process can be taken, the more accurate and timely the results will be.<sup>40 41</sup>

and job type. Such classifications should be part of national or local employment or population censuses or inventories conducted regularly by employment or statistics authorities. Data collected in this process are expressed in absolute numbers or percentages in total employment and are comparable year to year. The classification of green jobs can be added in the censuses or inventories to obtain accurate numbers.

- **Using labor statistics:** The number of how many people are with green jobs can be attained if green jobs are well defined and the available labor data are disaggregated to the level of sector, sub-sector, occupation group,
- **Conducting surveys:** Surveys offer an effective way to estimate the number of green jobs by focusing on specific questions and targeting only relevant businesses or asking government departments or analysts. The questionnaires

can be designed to extract information on what types of environmental activities an establishment is engaged in and how many employees are employed in these activities. If surveys are repeated consistently over an extended period of time, a trend of emerging the new green employment can be closely monitored.

- **Applying employment factors:** An employment factor is the number of jobs created per unit of product or service produced. If such a factor is available, the number of jobs can be estimated by multiplying the total unit of a product/service by the factor. For example, if manufacturing, installing and maintaining one megawatt (MW) capacity of solar photovoltaic (PV) panels requires 9 full-time equivalent (FTE) jobs, the employment factor of solar PV technologies is 9 FTE/MW. Building a 250-MW solar PV park could then generate  $9 \times 250 = 2,250$  FTE jobs. Employment factors can be derived from industry surveys, records of specific enterprises or projects, feasibility studies, and technical literature.
- **Conducting input-output analysis:** An input-output (I-O) table is a matrix of all sectors in an economy that details how outputs from one sector are used as inputs in other sectors. It describes the sale and purchase relationship within an economy between producers and consumers expressed in monetary value. These

tables are usually produced from national or local accounts by statistics authorities every 5-10 years. If the labor intensity of each sector can be calculated to a reasonable degree of accuracy, the tables can be used to estimate the effect on employment due to an increase in demand for services or products. The analysis can be applied to estimate how many jobs are likely to be created as a result of policy interventions or investment over the short to medium terms across sectors. I-O analysis can provide a high degree of accuracy and authority on what will happen in the economy but is limited by the availability and quality of data.

- **Modeling long-term economic changes:** It is useful for policy makers to see the potential long-term effects of policies before they are introduced. This is the purpose of computer models; they take data and run them through specially developed equations to produce likely results. Computable general equilibrium (CGE) models and system dynamics models take the work of I-O analysis a step further by simulating economy-wide responses to external changes. Typically, these models combine statistical data from I-O tables and social accounting matrices (SAMs)<sup>42</sup> with a series of economic equations designed to capture the dynamism of economies. The models allow policy makers to examine the effects of potential policy interventions over time on a variety of areas including future job creation.

<sup>42</sup>SAMs are similar tools to I-O tables with additional features of accounting income and transfer flows between institutional units.

### 3.3. EXAMPLES OF GREEN JOBS ESTIMATION

In 2011, the United States used existing labor statistics to conduct a survey on green jobs under the Quarterly Census of Employment and Wages (QCEW) program. The results showed that 3.4 million jobs were associated with the production of environmental goods and services, representing 2.6% of total employment, up from 2.4% in 2010.<sup>42</sup> The survey involved nearly 120,000 businesses and government agencies covered by federal and state unemployment insurance, which covers 95.7% of civilian employment, and targeted 325 industries associated with potential for green jobs.

Similarly, the Netherlands looked into the trend of green employment using an accounting methodology developed by Statistics Netherlands, which, in turn, took the Eurostat approach as a reference point to evaluate the EGSS contribution to the economy.<sup>43</sup> The total employment in EGSS was 113,000 FTE in 2001 and 126,000 FTE in 2013, representing a growth rate (11.5%) well above that of GDP during the same period. Jobs in EGSS were mainly concentrated in the sustainable energy sector (35%) and environmental services sector (24%) but also spread across different industries.<sup>44</sup>

In Spain, two studies were conducted into green jobs numbers. In the first, conducted by Spain's School for Industrial Organisation (EOI) and based on Eurostat guidelines for defining jobs in EGSS, the analysis of the activities undertaken by 40,000 companies and representative samples from different sectors estimated that 407,191 green jobs existed in the economy in 2009, or 2.2% of all jobs. The second study, conducted by the Observatory on Sustainability in Spain and Fundación Biodiversidad, estimated a total of 530,947 green jobs, or 2.81% of total employment for the same year.<sup>45</sup> The latter study also employed the Eurostat

methodology, with added consideration of new, emerging sources of green employment.

In countries where labor data are not readily available, different approaches are employed. A 2010 study of Bangladesh undertaken by UK-based GHK Consulting for ILO classified approximately 800,000 jobs as green, which accounted for 1.6% of the country's total 49.5 million jobs. Using a combination of literature reviews, interviews with key experts, and the most recent I-O tables, it was estimated that a further 3.5 million core environment-related jobs existed, and another 4 million jobs were indirectly supported by environment-related business activities. Government and development partner investments in climate change adaptation alone, totaling around USD 2 billion a year, supported around 1.7 million jobs in agriculture, water, construction, and public administration (out of the abovementioned core environment related jobs).<sup>46</sup>

In Mauritius, green jobs were identified as being based on either natural resource conservation, process or output. Data was collected from the Central Statistics Office, the Ministry of Environment, the forestry department and research centers, as well as through labor force surveys. Data were fed into I-O tables, which were extended to include green jobs classifications. Based on an economy-wide assessment, 34,891 green jobs existed in 2009, accounting for 6.3% of all jobs. Employing an I-O analysis, Mauritius estimated that a green scenario would result in 3,648 new jobs per year in four key sectors (agriculture, tourism, textiles, and renewable energy) compared to the conventional scenario under the assumption of a 2.5% annual growth rate.<sup>47</sup>

At the global level, UN Environment applied the CGE modeling method using Threshold 21 World model to examine the effects of investment in green activities under four scenarios: two business-as-usual (BAU) scenarios with certain levels of green investment but no policy change (BAU1; BAU2) and

two scenarios of investment with proactive green measures (G1; G2). It was generally concluded that the more green investment is made and the more green policies are introduced proactively, the more jobs will be generated (Table 4).<sup>48</sup>

Table 4: Global effects of green investment and green policies on employment by 2050

Initiative	Scenario			
	BAU1	BAU2	G1	G2
<b>Total employment in 2050</b>	4,700	4,800	4,800	4,900
<b>Direct employment gains</b>	97	176	134	238
<b>Indirect employment gains</b>	125	233	149	251

It is important to note that the numbers of green jobs shown above are generally not comparable between countries due to the differences in boundaries and categorization of employment and green jobs, estimation methods, and data availability and quality. For example, jobs in the nuclear power industry are excluded from the OECD/Eurostat definition of green jobs but

included in that of the US Bureau of Labor Statistics. Some countries consider part-time workers to be qualified as part of green jobs, while others do not. While a universal definition of green jobs would certainly facilitate benchmarking among countries, there is no international agreement at present on the common boundaries and methodology that can meet all countries' context and needs.

<sup>45</sup>Employment related to environmental goods and services roughly correspond to Eurostat's Group A 'pollution management group' and Group B 'cleaner technologies and products group.'



## PART II: Green Jobs in the UAE

The UAE has taken major strides to realize its green economy transformation by heavily investing in renewable energy, energy efficiency, public transport, green building, eco-cities, and other areas. Employment opportunities for both UAE nationals and expatriates abound. But how many green jobs exist now and will be generated tomorrow and in which sectors? What kind of knowledge and skills are required and what policies can be developed to ensure a smooth transition? The second half of the report takes a snapshot of green jobs in the UAE, including a preliminary estimation of job numbers, and proposes the way forward to advance green job creation.

## 4. UAE INDUSTRIES WITH GREEN JOBS POTENTIAL

As the global interest in and practices on green economy and green jobs are rapidly evolving, where does the potential for generating green jobs exist in the UAE? This chapter conducts a brief analysis of representative sectors in the UAE on their prospect for green jobs. Ten sectors were selected from those expected to contribute to the implementation of the UAE Green Agenda 2030 along with five strategic objectives and twelve programs – energy; waste management; manufacturing; buildings and construction; agriculture, forestry and fisheries; transport; services; academia; and the public sector. In addition to outlining the linkages between each sector's development and creation of green jobs, a rough estimation of the number of prospective jobs is attempted as far as possible to provide the scale of effects.

The methodology used for estimating the number of green jobs in this chapter relies primarily on the latest employment factors developed in other countries and published by international organizations, research institutions, or academic journals (see Section 3.2). Where such factors were unavailable, estimations of the percentage of green jobs in total employment of certain sectors were used, which were also developed in other countries. These factors were applied to the latest data on the size of the sectors of concern in the UAE, which have been published by the Federal Competitiveness and Statistics Authority (FCSA) or made public through official announcements. It should be noted that this method of estimation inherently involves the assumption of equivalence between employment factors in the UAE and other countries and some margin of error is inevitable.

Another challenge faced in this analysis concerned the distinction between counting jobs on a cumulative or per-year basis. Cumulative accounting sums up all jobs created up to a specific point in time (which can be several years), while a per-year figure represents how many jobs existed in an industry or sector in one year. Some jobs, especially in temporary activities such as construction, are usually listed on a person-year basis to represent the total number of hours required to complete projects. This differs from permanent, stable jobs, accounting for which is more straightforward using a jobs-per-year unit of measurement. Where both units were required to provide a total number, temporary jobs were averaged across a time period to arrive at an estimation of how many job per year the activity supported. The choice to present jobs on an annual basis was made to better illustrate the share of the labor market that green jobs command each year, as a cumulative figure does not support comparison with employment data reported by statistics authorities on an annual basis.

Projections for the trend of future green jobs relied on the plans for technology deployment already announced in the country or the predicted growth of particular sectors at a global or regional level, and applied constant employment factors. Therefore, it is clear that the numbers presented below will require periodic review to account for changes in the nature of certain jobs, the development of technologies affecting employment factors, and the pace of sectoral growth. Chapter 6 discusses the methodology and requirements to allow more accurate estimations and monitoring of green jobs in the UAE.

### 4.1. ENERGY

#### Renewable Energy

The UAE has been leading the region with renewable energy deployment over the last decade, starting with the establishment of Masdar (Abu Dhabi Clean Energy Company) in 2006. Among diverse renewable energy technologies, the bidding prices for concentrated solar power (CSP) and solar photovoltaic (PV) plants keep breaking world records. Notable projects include 100-megawatt (MW) Shams 1 CSP plant inaugurated in 2013 (the largest CSP in the Middle East at the time), a 1.177-gigawatt (GW) Noor Abu Dhabi Solar PV project scheduled to be operational in 2019, and the 5-GW Mohammed bin Rashid Al Maktoum Solar Park in Dubai which will be the largest single-site solar project in the world upon full completion in 2030. Other emirates are also becoming keen on solar energy deployment. For example, the Federal Electricity and Water Authority (FEWA) plans to build a 200-MW solar PV plant in Umm Al Quwain by 2021.<sup>49 50</sup>

In addition to those public mega solar projects, the Dubai Electricity and Water Authority (DEWA) launched the Shams Dubai initiative in 2015, which aims to encourage home and building owners to install solar PV panels by allowing them to feed excess power into the grid and offset the energy bill. By the end of 2017, 548 projects were completed under this scheme with 20.1 MW capacity installed. Together with mega solar projects, a total of 545 MW renewable energy capacity has been operational to date.

The UAE federal and local governments set an ambitious goal to substantially expand the role of renewable energy in the country's total energy mix. The UAE announced a clean energy target of 24% by 2021 in its nationally determined contribution

(NDC) to fulfill its commitments under the Paris Climate Agreement, which was later raised to 27%. The UAE Energy Plan for 2050 launched in January 2017 set a goal of capacity share of clean energy to 50% by 2050, 44% from renewables. At the local level, the Dubai Clean Energy Strategy 2050 aims to increase the share of clean energy in Dubai's total power output to 7% by 2020, 25% by 2030, and 75% by 2050. Ras Al Khaima launched a "Barjeel" energy efficiency and renewable energy program in late 2018 and announced its target to generate 20% of power requirements from renewable sources.

In terms of employment creation, it is important to understand what type of occupations will emerge during the different stages of renewable energy technology deployment and how this is relevant to the business development and the labor market in the country. Renewable energy deployment requires research and development (R&D), manufacturing, construction and installation, and operation and maintenance (O&M). R&D and manufacturing jobs are more likely to lead to long-term employment but mostly for companies located overseas. Installation of PV panels and construction of mega solar plants can be done locally, however those jobs are more likely temporary. O&M jobs are long-term and can also be done locally.<sup>51</sup>

However, first signs are appearing of opportunities to localize manufacturing of PV cells. A number of PV manufacturers have set up facilities in the UAE, among them are Al Maden and Noor Solar, supplying smaller scale off-grid PV solutions. Should supply chains become more localized for the provision of engineering services as well as parts and equipment, more jobs can potentially be created as the installed capacity increases in the UAE.

One available local data on renewable energy jobs is those registered under the Shams Dubai initiative to install solar PV panels on rooftops (Table 5). DEWA created a five-day course for junior and

senior-level engineers and a total of 446 engineers have been provided with adequate training to gain skills for installing PV panels by June 2018.

Table 5: Number of contractors, consultancies and engineers participating in Shams Dubai <sup>52 53 54 55</sup>

Type of jobs	2016	2017	2018
Contracting and consultancy companies registered	44	78	117 (December)
PV engineers certified	247	378	446 (June)

Employment factors of solar PV technologies vary from country to country and are differentiated in estimation units used depending on the stage of the technology deployment, where jobs per MW is used for permanent jobs generated in manufacturing and O&M (and, as a permanent job, can be accounted for on an annual basis), while temporary jobs generated in construction are measured in person-years per MW (or a full-time job held by one person for one year).<sup>56</sup> According to a report published by IRENA,<sup>57</sup> manufacturing and construction (installation) jobs created per MW of installed capacity ranged from 20 to 69.1, while O&M generated an averaged 0.48 job per MW. An analysis of over 60 studies and data sources found that direct jobs created per installed MW ranged from fewer than 10 person-years to over 40

in the manufacturing and construction phases.<sup>58</sup> More recent studies show this factor to be close to 20 person-years per MW: 6.7-6.9 (manufacturing) and 11-13 (construction and installation); the job creation in O&M is found to be around 0.5 job per MW.<sup>59 60</sup> For CSP technologies, the same studies found that 8 person-years per MW were required for construction and 0.6 job for O&M (no factor data is available for manufacturing).

Based on the current capacity and future plans of solar energy installation already announced in the UAE (assuming the same employment factors for rooftop solar PV, which should be more labor-intensive in construction and O&M than mega solar), the number of direct jobs in this area is roughly estimated and predicted as listed in Table 6.

Table 6: Estimation of UAE jobs (cumulative) in solar energy technologies

PV				
		2013-18	2019-21	- 2030
MW installed		445	2,077	3,287
	Employment factor (jobs/MW)	Jobs (cumulative)		
Manufacturing*	6.8	3,026	14,124	22,352
Construction/Installation	12	5,340	24,924	39,444
O&M	0.5	223	1,039	1,644

PV				
		2013-18	2019-21	- 2030
MW installed		100	300	400
	Employment Factor (jobs/MW)	Jobs (cumulative)		
Manufacturing*		-	-	-
Construction/Installation	8	800	2,400	3,200
O&M	0.6	60	180	240

\* Likely to be outside the UAE

Table 6 shows the cumulative job creation for each period listed in columns. This is because these periods demarcate significant phases of technology deployment and construction announced in the UAE and jobs created in these periods are added up accordingly. To arrive at an estimation of

green jobs that allows for closer monitoring and assessment, employment numbers in the energy and other sector are better presented on an annual basis. Hence, the numbers of cumulative jobs are averaged for each period as Table 7 below.

Table 7: Estimation of UAE jobs (per year) in solar energy technologies

PV				
		2013-18	2019-21	- 2030
MW installed		445	2,077	3,287
	Employment factor (jobs/MW)	Jobs (per year)		
Manufacturing*	6.8	504	4,708	2,484
Construction/Installation	12	890	8,308	4,383
O&M	0.5	37	346	183

PV				
		2013-18	2019-21	- 2030
MW installed		100	300	400
	Employment factor (jobs/MW)	Jobs (per year)		
Manufacturing*		-	-	-
Construction/Installation	8	133	800	1,067
O&M	0.6	60	180	80

\* Likely to be outside the UAE

To fulfill the abovementioned ambitious renewable energy targets set by federal and local governments, much more capacity needs to be installed than currently planned and green jobs created from renewable energy could thus be much higher than this estimate. Some plans have already been outlined for additional capacity to be installed in Abu Dhabi with a similar or larger capacity than

### Energy efficiency

The UAE's pursuit for energy efficiency in power plants, manufacturing processes, and buildings and houses could lead to producing most promising opportunities for green jobs in the UAE. The UAE Energy Plan for 2050 targets at reducing 70% of carbon emissions from power generation and improving 40% of overall energy efficiency by 2050. The Dubai Integrated Energy Strategy 2030 aims to reduce electricity and water consumption by 20% by 2020 and 30% by 2030 and has rolled out a series of demand-side management programs. Ras Al Khaimah also targets 30% energy savings by 2040 through diverse energy efficiency measures.

Among different areas of energy efficiency, retrofitting of old buildings has been one of the primary targets in the UAE. Dubai set a target of retrofitting more than 30,000 existing buildings by 2030 and established the Etihad Energy Services Company (Etihad ESCO) as an accreditor and regulator of the energy services companies (ESCOs) which pre-finance energy efficiency equipment on behalf of building owners. Twenty ESCOs are currently approved. A total of 135 projects for retrofitting nearly 2,500 buildings were implemented by the end of 2017. Etihad ESCO forecasts that 70 energy efficiency projects worth AED 400-450 million (USD 109-123 million) are in the pipeline for 2019-2020, which may include

Noor Abu Dhabi PV plant, for example.<sup>61</sup>

Another estimate of jobs in renewable energy comes from a recently published report by IRENA, in which analysis shows that the current renewables jobs total around 49,000 in the UAE and that this number will rise to 81,372 by 2030 (cumulative from 2015).<sup>62</sup>

industrial and residential retrofitting in other emirates.

As ESCOs started blooming, the positions of energy manager, energy auditor, project manager, control engineer, lighting expert, etc. are being increasingly required. A "green recruitment expert" indicated in an interview that international certifications such as Certified Energy Manager (CEM) and Certified Energy Auditor (CEA) have been some of the most sought-after skills in this sector and that employability increases in those with relevant qualifications.

With a rough assumption of 10 staff per ESCO, the current number of building energy efficiency jobs is 200. If 30,000 buildings are to be retrofitted by 2030, 2,400 jobs will have been generated. There are ESCOs which are not registered with Etihad ESCO and/or are operating in other emirates than Dubai. To acquire a better estimation, insights on the skills and the value chain of the sector would be required.

To achieve the ambitious national and local energy efficiency targets, much more efforts are required in different areas of energy efficiency such as application of ISO 50001 energy management systems in diverse industries, and green jobs created from such activities could be much higher.

### District cooling

Cooling is an integral part of the puzzle for addressing climate change and realizing a green economy. As maximum temperatures soar to over 45°C in summer, 60-70% of the UAE's energy consumption in the summer months is for air-conditioning. Conventional cooling technologies also use refrigerants that cause the depletion of the ozone layer and the global warming. As economy continues to grow and the impacts of climate change start to take hold, the UAE urgently needs to find ways to reconcile its fast-growing cooling demand and environmental goals.

While the federal government introduced the region's first efficiency standards for air-conditioning units, Abu Dhabi and Dubai have become the world leader in deploying district cooling systems. District cooling can save energy consumption by around 40% compared to conventional air conditioning, prolong the lifetime, and reduce maintenance costs of the plant.<sup>66</sup> Commissioned by the federal government in the late 1990s, the National Central Cooling Company (Tabreed) has grown into the region's leading district cooling provider. Empower set up in 2004 as a joint venture between DEWA and a sovereign investment company TECOM has grown rapidly and is currently the world's largest district cooling provider.

District cooling is set as one of the eight pillars for the Dubai Demand Side Management Strategy.

According to the Dubai Regulatory and Supervisory Bureau (RSB), the penetration rate of district cooling in the space cooling market is 18% in 2017, while the emirate is targeting 40% market penetration for district cooling by 2030.<sup>67</sup> The estimated peak cooling demand in the UAE will reach 21 million tons of refrigeration (TR) by 2030, up from 8 TR in 2010. Almost half of this demand, or 10.5 million TR, can be met by district cooling, whereas around 3 million TR was provided by district cooling in 2017.<sup>68 69</sup>

A study by the German Institute of Economic Structures Research (GWS) indicates the employment factor of cooling is 0.73 job per 1,000 TR.<sup>70</sup> This translates the current jobs in this sector to around 2,190 and around 7,670 jobs per year in 2030.

Apart from district cooling, other efficient cooling technologies have been experimented in the UAE which also could provide additional green jobs in the future. For example, the Emirates Global Aluminum (EGA) introduced absorption chillers to cool the building by using waste heat from its plants in 2013, resulting in 60% reduction of electricity requirement for cooling. In 2010, a Swedish industrial company, ESAB, installed six absorption chillers with a 10-kilowatt (kW) cooling capacity in Jebel Ali Free Zone, where heat is provided by vacuum tube solar collectors.

### Nuclear power

The UAE has embarked on a peaceful nuclear power program as the first Arab nation in close consultation with the International Atomic Energy Agency (IAEA) to meet the rising energy demand with cleaner sources. In 2009, the Emirates Nuclear Energy Corporation (ENEC) was established as the entity responsible for the deployment, ownership and operation of nuclear energy plants in the country, while the Federal Authority for Nuclear Regulation (FANR) was set up as the national regulator.

Four APR-1400 nuclear reactors are under development by a coalition led by Korea Electric Power Corporation (KEPCO) in Barakah in the western region of Abu Dhabi, with a total capacity of 5.6 GW. The construction of the first reactor (Barakah Unit 1) is complete and is planned for operation between the end of 2019 and early 2020.<sup>71</sup> Nawah Energy Company was established in 2016 as a subsidiary of ENEC tasked for O&M of Barakah Units 1 to 4.

The construction of nuclear power plants involves thousands of workers, while O&M requires fewer number of jobs, but they need to be long-term

and highly skilled. The US-based Nuclear Energy Institute (NEI) estimates that 3,500 workers are required for the construction of each reactor at peak time, and each reactor provides 500-1,000 O&M jobs together with significant local business and employment opportunities.<sup>72</sup> This is translated into 14,000 construction workers and 2,000-4,000 O&M jobs for the four reactors of the Bakarah nuclear plant.

Most importantly, the UAE takes the new nuclear industry as a great opportunity to provide young and talented Emiratis with long-term, sustainable and skilled jobs. ENEC already employs hundreds of national nuclear specialists, including 120 Emirati engineers who have worked directly on the construction and commissioning of Unit 1. They are working alongside international experts to gain knowledge and expertise that ensure the nuclear plants to be developed and operated in adherence to the highest international standards of safety, quality and security.<sup>73</sup> ENEC also launched the Energy Pioneers Scholarship in 2010 which aims to develop and train UAE nationals to operate the plants (now managed by Nawah). 195 young engineers graduated from the program in 2018.<sup>74</sup>

the United Nations' System of Environmental-Economic Accounting include waste management as a whole as part of their scope (see Table 3 in Section 3.1).<sup>75</sup>

Greenhouse gas (GHG) emissions from waste account for 6% of the UAE's total emissions, and the UAE Vision 2021 sets a goal of diverting 75% of municipal solid waste from landfill by 2021 as one of national key performance indicators. Each

emirate is striving to improve waste management by establishing a competent authority or public company such as the Centre of Waste Management - Abu Dhabi (Tadweer), Bee'ah (Sharjah Environment Company), and the Ras Al Khaima Waste Management Authority.

### Recycling

Some public and private waste companies are building recycling facilities in the last few years to allow diverse types of recyclables to be treated within the country (see Section 4.3). Enviroserve UAE is building the world's largest, renewable energy-powered electronic waste recycling plant at Dubai Industrial Park, which also includes the country's only dedicated refrigerant reclamation facility.<sup>77</sup>

Food waste is rapidly becoming one of the country's most serious concerns as around 90% of food is imported and a third is estimated to end up in landfill. In January 2017, the UAE Food Bank was launched as part of an effort to achieve zero food waste as well as the Year of Giving. A food bank collects surplus packaged and canned food from nearby supermarkets and food establishments and provide it to charity organizations which distribute to people in need. 15 food banks are set to open across Dubai by 2018.

The Ministry of Economy started recording recycling as an independent sector since 2015 in

In 2016, the UAE generated approximately 6.3 million tons of municipal solid waste. Using an employment factor of 1 job for waste collection and 0.175 job for landfill per 1,000 ton of waste,<sup>76</sup> non-treatment waste collection and landfilling in the UAE generates around 7,400 jobs. There should be additional jobs from collecting and disposing non-municipal waste from industry, construction, agriculture, hospitals, and wastewater treatment.

its annual statistical report. The number of jobs in the recycling industry was recorded 400 in 2016.<sup>78 79</sup> Generally, recycling generates more jobs per unit of waste than incineration and landfill.<sup>80 81</sup>

The employment factor for recycling is usually defined in terms of jobs per ton of recycled material. The factor is wide-ranging as it is partly dependent on the composition of materials. According to studies in parts of Australia and the US,<sup>82 83</sup> 1-2 jobs are generated per 1,000 tons of recycled material. Of the 6.3 million tons of municipal solid waste generated in 2016, around 957,433 tons (15.1%) were recycled and 24.2% were recovered from landfills (including composting and other methods). This can be translated into 1,436 recycling jobs, taking the average of the factors above.

If the national goal of 75% recovery is achieved by 2021 (50% recycling), without increasing the total amount of municipal waste, around 4,725 recycling jobs would be generated. If 100% recycling is realized by 2030, this could lead to up to 9,450 jobs. There would be additional employment from recovering non-municipal waste.

### Waste to energy

Waste-to-energy technologies started attracting attention as one of the most effective means to reduce landfills while acquiring a new source of energy production. Dubai Municipality announced in January 2018 the construction of the world's largest waste-to-energy plant with a total capacity to generate 185 MW of electricity that could treat 1.82 million tons of solid waste annually, while providing power to fulfill around 2% of the total electricity consumption in the emirate.

Sharjah also plans to build a 30-MW waste-to-energy facility by a joint venture between Bee'ah and Masdar, which can divert 300,000 tons of municipal waste away from landfills every year while generating electricity for up to 28,000 homes. The Ministry of Presidential Affairs and MOCCAЕ signed a contract to build a waste-to-energy plant in Umm Al Quwain by 2020 to convert a daily average of 1,000 tons of the municipal solid waste from Ajman and Umm Al Quwain into a refuse-derived fuel (RDF) which can be used in cement factories as an alternative to coal and other fuels.

While incineration generally does not produce as many jobs as other methods of waste disposal or treatment, building, operating and maintaining waste-to-energy facilities could lead to substantive job creation. The World Energy Council estimates 6 to 18 jobs are created for a typical 50,000 ton-per-year waste-to-energy facility.<sup>84</sup> This translates to around 215-650 jobs in Dubai, 36-108 jobs in Sharjah, and 44-131 jobs in Umm Al Quwain. Taking the average of the estimated jobs created, this comes to 590 green jobs.

### Wastewater treatment

92 public wastewater treatment plants exist in the UAE by the end of 2017, with a total capacity of 2.4 million cubic meters (m<sup>3</sup>) per day. The total volume inflow in these plants in 2017 was 752 million m<sup>3</sup>, around two thirds of which was reused for irrigation after treatment. A quarter of the sludge generated from the treatment process was also reused.

The GWS study indicates that the number of jobs required per million m<sup>3</sup> of wastewater treatment capacity is 1,583.<sup>85</sup> This translates to a total of 3,800 jobs in the UAE.

### 4.3. MANUFACTURING

Over the last few decades, the UAE has been pursuing its economic diversification through large-scale investments in the manufacturing sector. The country has taken advantage of the abundance of energy sources and feedstock as petrochemicals and metals along with ceramics and cement have dominated this sector. Recently, downstream industries such as automotive, aerospace, chemicals, electrical machinery, power equipment, and food processing are also gaining momentum. Consequently, the manufacturing sector has been among the highest contributors to the UAE's non-oil GDP (after wholesale and retail, and financial services), accounting for 11.3% in 2017 (8.8% of the total GDP). In 2017, 9% of the UAE's labor force belonged to the manufacturing sector. The total work force in the UAE in 2017 was reported as 7.2 million workers, 648,000 of whom were found in manufacturing.

Some manufacturing activities are among the major GHG emitters, particularly metals and cement production. The GHG emissions from the industrial process (excluding electricity use) were recorded in 2015 at nearly 24.5 million tons of carbon dioxide equivalent (tCO<sub>2</sub>e), 12.2% of the total GHG emissions. To turn the tide, MOCCAЕ is developing the National Sustainable Consumption and Production Plan which addresses the entire lifecycle of materials and products instead of focusing on single stages so as to enable reducing overall environmental impacts in more innovative ways. Such practices are already taking place –

for example, a partnership between EGA and cement companies across the country resulted in arranging spent pot lining (waste generated from aluminum production processes) to be utilized in cement factories as an alternative energy source. This not only saved fuel but radically reduced the nitrogen oxides (NO<sub>x</sub>) emissions while cutting CO<sub>2</sub> emissions by 10% as well.

The local production of green products is also rapidly catching up as consumer interest is rising. For example, a Dubai-based company Green Touches produces household and commercial cleaning products made from non-chemical, natural botanical material.<sup>86</sup> AVANI is another example of local green businesses, selling biodegradable cups, bowls, cutlery, and plastic bag replacements.<sup>87</sup>

Establishment surveys among over 11,000 manufacturing facilities registered in the UAE are required to properly estimate green jobs in this sector as each facility has unique processes. Focusing only on around 1,000 registered manufacturing facilities in the major industries (glass, cement, plastics, metals, chemicals, etc.), and very crudely assuming that each of them has an average of three dedicated environment, health and safety (EHS) or sustainability specialists, the number of direct green jobs is estimated at around 3,000 jobs per year. Based on the number of manufacturing jobs in the economy, this translates in to a 0.4% green jobs rate in this sector.



#### 4.4. BUILDINGS & CONSTRUCTION

As the UAE's cities are expanding in an extraordinary pace, the real estate sector is one of the major economic drivers that generated 8.2% of the country's non-oil GDP (6.4% of total GDP) in 2017. In the meantime, the UAE became the first country in the Middle East to enact green building codes and standards with an aim to reduce the consumption of energy, water and materials, improving public health, safety and welfare in buildings.

Abu Dhabi introduced the region's first sustainable building framework Estidama in 2010, which includes the five-level Pearl Rating System for the design, construction and operation of buildings, villas and communities. Dubai Municipality introduced green building regulations and specifications in 2010. The regulations became mandatory for all developments in 2014, requiring the adherence to 79 specifications. Dubai also launched Al Sa'fat system in 2017 which rates buildings' sustainability in four classifications – platinum, gold, silver, and bronze. Furthermore, the emirate requires all constructors to apply eco-friendly concrete materials in building construction. Ras Al Khaimah is also planning to introduce its green building codes in 2019.

In addition, there have been several experimental eco-city developments which can minimize energy and water consumption even under extreme summer temperatures. The most notable example is Masdar City in Abu Dhabi which combines a number of efficiency measures in the building and community design, such as passive solar design to reduce the electricity need for cooling. The Sustainable City in Dubai is being developed as the first net-zero energy city in the country where all

electricity comes from solar panels installed across the community.

The US Green Building Council (USGBC) ranked the UAE tenth outside the US in terms of the floor area certified by its Leadership in Energy and Environmental Design (LEED) program by the end of 2017.<sup>88</sup> By the end of 2018, a total of 199 LEED certification activities covering 3.74 million square meters (m<sup>2</sup>) were recorded in the UAE, over two-thirds of which achieved the Gold or Platinum level. More than 800 houses have also attained LEED for Homes, and over 900 additional projects have also been registered for future LEED certification upon completion.<sup>89</sup>

Accounting for green jobs in the buildings and construction sector requires consolidation of green building practitioners (such as LEED-accredited professionals) and other jobs engaged in design, construction, O&M, and retrofitting of green buildings. A listing in the USGBC indicates a total of 132 accredited practitioners registered in the UAE,<sup>90</sup> while the number of the latter types of jobs is unknown.

According to an USGBC study of the US market, 1 million jobs were supported through LEED-related activities between 2011 and 2014, and 2.1 million jobs in the broader green construction market.<sup>vi 91</sup> During the same period, 22,331 LEED-related activities were recorded. If the number of US jobs supported per LEED activity is assumed to be comparable in the UAE, this translates to around 13,434 jobs supported in the UAE up to 2018 based on over 300 LEED-related activities.<sup>92</sup> This yields an average of 2,687 jobs per year.

#### 4.5. AGRICULTURE, FORESTRY, AND FISHERIES

Some of the employment in the primary industry such as agriculture, forestry, and fisheries can be considered as green when environmentally sustainable practices have been applied.<sup>93</sup> In agriculture, organic and hydroponic farming techniques are considered sustainable as they avoid the use of harmful chemicals and/or conserve water. The United Nations Food and Agriculture Organization (FAO) predicts that the transition to more sustainable agricultural practices can create over 200 million full-time jobs around the world by 2030.<sup>94</sup>

In the UAE, there are over 40 organic farms and 87 commercial farms using hydroponic techniques,<sup>95</sup> and 20 traditional farms are planned to be converted into organic each year in Abu Dhabi, with a target of 100 farms, starting in 2019.<sup>96</sup> Roughly assuming that the average number of employees in the 127 organic and hydroponic farms is 10, green jobs in this sector amount to 1,270 today, 1,870 by 2021, and 2,270 by 2023.

While the forest area is sparse and can be water-intensive in the UAE, mangroves in the coastal wetlands provide an important natural resource and carbon sinks to mitigate climate change as assessed under the National Blue Carbon Project conducted by MOCCA and the Abu Dhabi Global Environmental Data Initiative (AGEDI).<sup>97</sup> The restoration, plantation and management of mangroves, which currently extend around 3,000 hectares, could thus provide green jobs.<sup>98 99</sup>

Accounting for jobs related only to mangroves is challenging. Public-sector employees working on mangrove restoration and research and tourism companies providing services around mangrove

forests are accounted for in their respective sectors.

Globally, fisheries are facing a significant decline in fish stocks due to over-fishing and pollution. Sustainable methods of fishing are increasingly being pursued to tackle the challenges as international bodies like the Marine Stewardship Council (MSC) monitor practices and provide certificates to allow consumers to make sustainable choices.<sup>100</sup> Aquaculture is another mean to address dwindling fish stocks and it can also become the source of green jobs as far as sustainable practices are implemented.<sup>101</sup> The UAE's aquaculture production is rapidly increasing since the establishment of the Sheikh Khalifa Marine Research Center in 2014 and has reached 1,240 tons in 2016, whereas its total catch of fish from the Arabian Gulf and the Gulf of Oman was recorded at 71,203 tons.<sup>102</sup> Commercial aquaculture production focuses on five types: seabream, seabass, shrimp, tilapia, and sturgeon. The world's largest aquaculture farm (56,000 m<sup>2</sup>) was opened by Emirates AquaTech Caviar Farm in 2013 in Abu Dhabi to produce premium caviar and sturgeon meat. The UAE's aquaculture production is expected to rise rapidly in the coming years as private-sector investment and consumer demand increase.

FAO estimated that 144 jobs existed in the aquaculture industry in the UAE in 2013 when around 800 tons were produced.<sup>103</sup> If it is assumed that the factor of jobs per ton produced is consistent, the number of aquaculture jobs in 2016 is estimated at 223. Using a growth rate in tonnage equal to that of the period 2013-2016, and assuming constant jobs per ton in that period, green jobs in this industry would rise to around 600 jobs in 2030.

<sup>vi</sup>The green construction market is defined in this study as that which "incorporates numerous green building elements across five category areas: energy efficiency, water efficiency, resource efficiency, responsible site management and improved indoor air quality."

#### 4.6. TRANSPORT

The UAE has built a major industrial pillar in transport and logistics by strategically positioning itself as a global hub. The government has focused on the expansion of transport infrastructure such as ports, airports and roads. In the last decade, the expansion of efficient public transportation systems has been among the UAE's key investment priorities to manage the future demand for traffic and resulting emissions, as well as to improve air quality and public health.

Dubai Metro was launched in 2009 as the world's longest fully automated metro network. By August 2017, the total number of riders had reached 1 billion. Dubai's share of public transport in the mobility of people (including taxis) reached 15% by 2015, rising from less than 6% in 2006. The emirate's Road and Transport Authority (RTA) aims to increase this share to 20% by 2020 and 30% by 2030. Nationally, the development of a 1,200-km railway network is underway by Etihad Rail. In air transport, a consortium including Etihad Airways, Boeing, and Khalifa University launched the BIOjet Abu Dhabi project for sustainable production of aviation biofuels in the UAE, based on an integrated seawater energy and agriculture system.

To promote greener fuels and vehicles, the Emirates Authority for Standardization and Metrology (ESMA) is developing fuel efficiency standards of light duty vehicles, while it introduced a ban on importing damaged used vehicles and made Euro 5 standard "green diesel" mandatory. The private sector is increasingly playing an active role in this area. A Dubai-based venture, Neutral Fuels, works with restaurants and hotels, including McDonald's, to convert the waste cooking oil into European quality standard biodiesel. Several taxi companies in Abu Dhabi and Dubai are accelerating the introduction of hybrid cars in their fleet. The Abu

Dhabi National Oil Company (ADNOC) and the Emirates National Oil Company (ENOC) are both working to support compressed natural gas (CNG) as an automotive fuel, providing fueling stations and workshops to convert petrol vehicles into CNG-powered.

There is also an interesting development of shared mobility as an alternative to personal ownership of vehicles. RTA recently introduced the Smart Rental Service which allows residents to rent cars for short periods via mobile apps. The rise of ride-hailing service such as Uber and Careem is also changing people's perception about shared transport as it provides convenience.

The UAE has also been active in experimenting with cutting-edge transport technologies. DEWA is introducing over 100 electric vehicle charging stations across the city. RTA is working on the deployment of autonomous vehicles, Hyperloop bullet trains and flying taxis. The Dubai Autonomous Transportation Strategy aims to switch 25% of total mobility in the emirate to driverless journeys by 2030.

It is not easy to determine the scope of green transport (where green jobs can be generated) since there is no common definition. Furthermore, capturing the employment from diverse modes of transport is a difficult task. Here, all types of public transportation are assumed to be green, so are the jobs related to them. According to Dubai Metro operator Serco, a total of 2,000 staff are employed on the 75 km lines including those for both operations and safety.<sup>104</sup> With an extension planned for the Expo 2020 route and other lines around the city totaling up to 421 km and 195 stations by 2030,<sup>105</sup> 11,230 jobs can be expected after completion. Dubai Tram, with 10.6 km line,

employs 80 certified drivers.<sup>106</sup>

RTA also offers extensive public bus services with 119 routes and over 1,500 fleet, covering 82% of Dubai's urban area.<sup>107</sup> The number of bus drivers

employed by RTA was 2,917 in 2017.<sup>108</sup> Abu Dhabi operated around 650 buses in 2011,<sup>109</sup> and using the same employment factor as Dubai, 334 jobs are estimated to exist.

#### 4.7. SERVICES

##### Financial services

Financial services have served as a backbone of the rapidly growing the UAE economy as the sector contributed to 12.3% of non-oil GDP (8.6% of total GDP) in 2017, steadily increasing from 6.8% in 2001. 2.5% of the country's total workforce are employed in this sector in 2017.

Investment in the independent power producers of government-backed mega solar power projects is recently rising in the UAE underpinned by long-term power purchase agreements. Much more private-sector projects – not only renewable energy but also all kinds of green businesses – are required to have green economy made possible. To stimulate the trend, the Central Bank of the UAE and MOCCA launched the Dubai Declaration on Sustainable Finance with support from the UN Environment Finance Initiative (UNEP FI) in October 2016. As of the end of 2018, 32 firms including most major local and international banks have signed up with the Declaration and are being engaged in knowledge exchange and learning of global best practices on sustainable management of internal operations, integration of environmental, social and governance (ESG) risks, and sustainable innovation in financial products such as green bonds. Other authorities and financial markets including the Securities and Commodities Authority (SCA), the Dubai Financial Market (DFM), and the Abu Dhabi Global Market (ADGM) are also keen on promoting sustainable finance practices.

Since the Declaration was launched, interesting initiatives have been emerging especially among its signatories. Most notable is the commitment of National Bank of Abu Dhabi (now part of First Abu Dhabi Bank) to financing USD 10 billion for green businesses in 10 years. In 2017, the bank issued a 587 million US dollar 5-year green bond, the first in the Middle East. HSBC Middle East, Emirates NBD, Dunia Finance, and the National Bank of Fujairah have introduced green auto loans to promote hybrid or electric vehicles. The National Bonds Corporation is financing the energy and water retrofit project of Dubai's Jebel Ali Free Zone. Standard Chartered arranged a green loan with a global port operator DP World, where the loan pricing is linked to the lender's carbon emission intensity.

Dubai is supporting the development of sustainable finance by setting up a financial vehicle, the Dubai Green Fund, which was announced in November 2016 by His Highness Sheikh Mohammed bin Rashid Al Maktoum, Vice President and Prime Minister of the UAE and Ruler of Dubai. The Fund aims to secure AED 100 billion (USD 27 billion) to provide financing to various green projects, and the National Bonds Corporation has already committed to investing AED 2.4 billion (USD 650 million) as the first financier.

According to MOCCA's 2015 survey of 79 financial firms, nearly half already provided some green finance products or services, and the cumulative investment in 75 domestic green

projects amounted 0.27% of the annual GDP.<sup>110</sup> As the development of Dubai's 5-GW Mohammed bin Rashid Solar Park alone requires about AED 50 billion (USD 13.6 billion) of investment, the development of sustainable finance and related jobs looks promising.

Accounting for financial analysts and bankers who are dedicated to green investment and thus can be considered as holding green jobs is challenging, due to the fact that these jobs may also cover normal non-green investment or overlap with other functions, especially in a nascent green finance market like the UAE.<sup>111</sup> Other countries' green jobs surveys indicate that the number of these jobs are significantly lower than other sectors or are not accounted for separately.<sup>112 113</sup> In the US, the number of green jobs in the financial sector was estimated 475 in 2011, compared with 238,755 in the transport sector.<sup>114</sup>

Assuming that each signatory of the Dubai Declaration has an average of two staff members responsible for green finance, the number of green jobs in the sector amounts to 64. This is expected to increase in the coming years as more green investment opportunities are coming up in the country. Applying the rate of growth in global renewable energy-related finance, which saw a 10% rise between 2013 and 2016 according to a report by IRENA and the Climate Policy Initiative,<sup>115</sup> and assuming a similar growth in finance in the UAE can be translated into growth in green finance jobs, the total number of jobs will reach around 100 by 2030.<sup>vii</sup>

### Professional services

Professional and consultancy services targeting environmental fields are rapidly emerging in the UAE in recent years following the government's

strategy and policies to promote a green economy. Those include technical advice for developing corporate sustainability strategies, auditing businesses or facilities for resource use or emissions, helping green start-ups, advising green investment strategies, drafting relevant public policies, conducting background studies, and so on. The providers of such advisory services range from freelance consultants and boutique specialty firms to dedicated departments within well-known multinational engineering and management consultancy firms.

A specialized online business directory lists around 60 UAE-based consultancies working on advising sustainable practices for diverse sectors.<sup>116</sup> However, without establishment surveys, it is challenging to estimate the number of green jobs in these consultancies since not all are specialized green firms and no public information is published as to the number of staff they employ. Assuming that the average business hires five experts dedicated to green services, around 300 jobs exist in this category.

Not-for-profit organizations have also been doing their part in providing environmental research, advisory services, and volunteering opportunities to the public and private sectors in the UAE. Those include conservation groups such as the Emirates Environmental Group and Emirates Nature-WWF, as well as international organizations like the International Renewable Energy Agency (IRENA) and the Global Green Growth Institute (GGGI), of which the UAE government hosts the headquarters and regional office, respectively. The current number of jobs in this category is estimated at around 150.

### Wholesale and retail

Dubai has a long history of serving as the region's trading hub, and recently, a number of mega-size shopping malls have been built throughout the country including Dubai Mall, the world's second largest by total land area. The wholesale and retail sector has been the largest non-oil sector in the UAE, providing 15.8% of non-oil GDP (12.3% of total GDP) and 13% of the total workforce (including motor repair services).

In the last several years, shops and restaurants specialized in selling and serving local and/or sustainable produce have been burgeoning in the UAE as consumer interest and demand is rising. Ripe Organic and Baker & Spice have been regularly organizing farmers' markets where local organic farmers and green entrepreneurs can sell their products directly to consumers. Ethical fashion is also becoming the latest trend and homegrown brands are emerging. Major supermarkets such as Lulu Hypermarket, Carrefour, and Spinney's are following suit as they started providing sections for organic products in stores. In April 2017, a major retail and leisure developer Majid Al Futtaim has adopted a "net positive" sustainability strategy, which aims to significantly reduce the company's water use and carbon emissions to the extent that it puts more back into the environment than it takes out by 2040.<sup>117</sup>

From the government side, ESMA is supporting consumers' sustainable choices in retail through the introduction of a mandatory efficiency rating and labeling scheme since 2011, which covers domestic electrical appliances and water fixtures. The authority also introduced an organic food certification in 2012, while a vehicle fuel efficiency rating and labeling scheme was rolled out in 2017, following the regional standards set by the GCC Standardization Organization (GSO).

According to another popular online directory, around 80 companies in the UAE specialize in providing environmental technology products that help solve issues like wastewater, air quality, and chemical spillage.<sup>118</sup> Assuming that each of them employs five staff members to advise, sell and service those products, 400 green jobs currently exist in this category.

### Tourism

It is expected that the tourism sector will be one of the most important sectors for UAE's economic diversification as it will stimulate the development of related sectors such as air transport, retail and construction. The number of tourists visiting the UAE is rapidly rising as the Dubai International Airport has become the world's largest airport in terms of the number of international passengers and tExpo 2020 is expected to attract 25 million visitors.

According to the World Travel and Tourism Council (WTTC), the direct economic contribution of the travel and tourism sector was AED 69.1 billion (USD 18.8 billion), 5.1% of total GDP in 2017, and is forecast to rise by 4.1% per annum for the next ten years, to AED 108.4 billion (USD 29.5 billion), 4.9% of total GDP in 2028. In 2017, it is estimated that the sector directly supported 300,000 jobs (4.9% of total employment). This is expected to rise by 2.4% per annum to 396,000 jobs (5.6% of total employment) in 2028.<sup>119</sup>

However, as the sector grows, the impact on local environment and resource consumption is expected to become a serious concern. Meanwhile, overseas tourists are increasingly looking at sustainability aspects when choosing destinations, while many of them are seeking more nature-oriented and authentic experiences in the name of eco-tourism.

<sup>vii</sup>An assumption is made that all debt, equity and other financial instruments used to finance green projects in the UAE are generated within the country. Also assumed is that renewable energy is the dominant driver of green finance.

In 2016, the Dubai Department of Tourism and Commerce Marketing (DTCM) launched the Dubai Sustainable Tourism initiative to enhance the sustainability of the tourism sector and contribute to the broader clean energy and sustainable development targets that Dubai has set out to achieve. The initiative developed an implementation roadmap, along with a variety of practical initiatives for hotels and tour operators including guidelines, carbon calculator, the annual Dubai Sustainable Tourism Awards, and plans to develop sustainable tourism standards.<sup>120</sup> The Emirates Green Building Council (EGBC) hosts the Green Key labeling scheme for the country, which is the world's largest eco-label for accommodation recognized by the UN World Tourism Organisation (UNWTO) and the UN Environment. As of June 2018, 33 hotels in the UAE are Green Key-certified.<sup>121</sup>

#### 4.8. ACADEMIA

For a country to advance into a green economy and create green jobs, one of the prerequisites is to foster educational services in the areas of sustainable development, particularly in higher education and technical vocational education and training (TVET), to equip future generations for the knowledge and skills to take the growing opportunities and contribute to innovating solutions. The establishment of new degree programs in related fields and upgrading existing courses would also strengthen the country's standpoint as a regional knowledge hub.

For the last few years, the Ministry of Education (MoE) has been actively working to accredit academic programs on environmental and energy studies in public and private higher education institutions. At least seventeen UAE educational institutions are currently providing environment-related courses, most of which belong to scientific disciplines (Annex 1). Among them, the Masdar

In 2018, MOCCAЕ launched a multi-phase national project The UAE's Natural Wonders to promote eco-tourism across the seven emirates. In its initial phase, the project focuses on raising awareness about the country's 43 nature reserves, providing an extensive collection of information materials, photos and videos through its website, e-book, and mobile apps.<sup>122</sup>

Tourism jobs generally involve tourist guides, hotel managers and workers, resort operators, clerks in tourist information offices, etc.<sup>123</sup> As a reference, the share of sustainable tourism jobs in Mexico, which include those of green-certified hotels, eco-tourism and adventure tourism, was around 2% of all tourism jobs in 2011.<sup>124</sup> This could be translated into 6,000 direct jobs in 2017 and 7,900 jobs in 2028 in the UAE.

Institute of Science and Technology (now part of Khalifa University) acts as a research-driven, graduate-level university exclusively focused on advanced energy and sustainable technologies. It offers master's and PhD degree programs based on the US graduate education system, aiming to integrate theory and practice to incubate a culture of innovation and entrepreneurship (see more discussions in Section 5.2).

Provided by these institutions are several degree programs at the levels of undergraduate (ten programs) and postgraduate (fifteen master's and three doctorate programs). Faculty dedicated to teaching and supervising students in environmental subjects can be considered to hold green jobs. Assuming 7 faculty members per undergraduate degree, 5 per master's degree and 3 per doctorate degree, the total number of green jobs in academia is estimated at 154 jobs.

#### 4.9. PUBLIC SECTOR

Some public administration jobs can be considered as green if they support reducing pollution and waste and protecting natural resources through legislation, implementation of policies, and provision of public services. The majority of such jobs may belong to those of environmental authorities and service entities, but other competent authorities also dedicate some tasks to environmental and sustainability mandates. Public-sector jobs provide a significant share of green jobs in many countries. In Spain, it is estimated that 10% of all identified green jobs belong to the public sector.<sup>125</sup>

In the UAE, MOCCAЕ is the federal entity responsible for environmental policy, while each emirate has its own environmental agency (Abu Dhabi, Ras Al Khaimah, Sharjah) or an environmental department within the municipality (Dubai, Ajman, Umm Al Quwain, Fujairah). MOCCAЕ employs 501 staff as of December 2018 (including agriculture, animal welfare and fisheries), while the Environment Agency – Abu Dhabi (EAD) has about 1,000 staff (including animal welfare), the largest among all environmental agencies. Dubai and Sharjah hire around 250 staff each and the other four emirates have 50-100 employees each, totaling around 2,300.

Federal and local entities specialized in other areas such as energy and transport also conduct

environmental initiatives extensively, some of which are highlighted in this report. However, accounting for green jobs in other agencies is not straightforward. Public-sector jobs in utilities, wastewater treatment, public transport, etc. might be already counted as part of green jobs in specific sectors and ought not be counted twice.

Nationally, 10.1% of the total workforce belonged to the public sector in 2017 (excluding armed forces). However, if looking only at UAE nationals, 83.2% of their employment is provided by the public sector (local and federal). Thus, the development of green jobs in the public sector will be ever more important in the UAE to help improve the employment rate of Emiratis as well as to support the transition toward a green economy. At the moment, a relatively small portion of the whole range of public-sector jobs are considered to be green. 4% of all public-sector jobs were estimated as green in the US in 2010,<sup>126</sup> and 1.9% in Mexico in 2011.<sup>127</sup>

The total work force in the UAE in 2017 stood at nearly 7.2 million workers, which means around 727,000 were employed in the public sector. Assuming that a conservative rate of 1.9% of all jobs in public administration are green in the UAE, the estimated number of green jobs is approximately 13,750.

#### 4.10. SYNTHESIS

Table 8 below summarizes the estimated number of current and prospective green jobs in the UAE across the sectors discussed. An attempt has been made to include only direct jobs in each sector without accounting for the wider employment effect in the economy.

Table 8: Preliminary estimation of green jobs (per year) in the UAE

Species	2018	2021	2030
<b>Energy</b>			
Renewable energy*	1,120	9,634	5,712
Energy efficiency	200	850	2,400
District cooling	2,190	4,000	7,670
<b>Waste management</b>			
Collection	7,400	(7,400)	(7,400)
Recycling	1,436	4,725	9,450
Waste to energy	-	590	758
Wastewater	3,800	(3,800)	(3,800)
<b>Manufacturing</b>	3,000	3,050	3,108
<b>Buildings &amp; construction</b>	2,687	2,700	2,750
<b>Agriculture</b>	1,270	1,520	2,270
<b>Forestry</b>	-	-	-
<b>Fisheries</b>	223	370	600
<b>Transport</b>	5,376	7,719	14,750
<b>Services</b>			
Financial services	64	70	100
Professional	450	(450)	(450)
Wholesale & retail	400	(400)	(400)
Tourism	6,000	6,475	7,900
<b>Academia</b>	154	(154)	(154)
<b>Public sector</b>	13,750	(13,750)	(13,750)
<b>TOTAL</b>	<b>49,520</b>	<b>67,657</b>	<b>83,422</b>
[Nuclear power]		17,000	

\*Without manufacturing. Construction jobs counted as up to 2018 no longer exist. Construction jobs counted for 2021 and 2030 will also cease after completion. ( ): Assumed no growth due to lack of projections

Some interesting points to note from the table:

- The public sector is currently the largest source of green jobs with 27.8% of the total, followed by waste management at 25.5%, tourism at 12.1%, transport at 10.9% and energy at 7.1%
- By 2021 and onto 2030, a shift occurs and sectors that witness planned investments materialize will begin creating more green jobs. While the public sector remains an important source of green employment, sectors such as renewables, waste management and transport begin to dominate: in 2021 and 2030, respectively, waste management's share rises to 24.4% and 25.7%, energy's to 21.4% and 18.9%, and transport to 11.4% and 17.7%
- The total share of green jobs in the economy as of 2017 is 0.7%

It is worth noting again that these estimates are based on secondary data, published information, and employment factors developed in other countries, and inherently contain a range of

assumptions and simplifications. The purpose is to provide a starting point for future investigation. The estimation will undergo continuous revisions as the concept of green jobs evolves in the UAE and more occupations are categorized as green and as jobs develop in new and burgeoning green industries. Modeling was not included as part of this methodology. However, as data improves in employment and other areas, economic modeling may be undertaken to provide more accurate projections for green jobs figures (see more discussions in Section 6.3).

Nuclear energy is part of the clean energy mix in the UAE. However, jobs in nuclear power generation have not been counted as part of the total number of green jobs in this study. Most of the literature reviewed for this report does not put nuclear energy in the green category, but nuclear power generation jobs have been included separately for purposes of illustration.

## 5. UAE POLICIES FOR GREEN JOBS

In the UAE, there has been no single policy specifically targeting the promotion of green jobs to date. Chapter 4 showed that of the types of policies available for the promotion of green jobs, many “demand-side” policies as categorized by ILO (see Section 1.5) have been implemented in the UAE as part of either national green agendas or sectoral target setting. These include R&D policies (Khalifa University; R&D Center at Mohammed bin Rashid Solar Park), green investment policies (deployment of solar energy technologies), and supporting measures (incentives for green transport, new environmental standards in waste collection, and certification schemes such as Estidama).

### 5.1. LABOR POLICY

#### Emiratization

Foreigners comprise over 95% of the UAE workforce, with the largest communities coming from South Asia and a substantial presence from the Middle East and North Africa (MENA) region. The government is working to ensure that the imbalance of workforce is addressed with active “Emiratization” efforts, aiming to achieve 8% of the total workforce coming from UAE nationals by 2021. Public bodies such as the Ministry of Human Resources and Emiratization (MoHRE) and the National Human Resource Development and Employment Authority (Tanmia) are working to develop the skills and competitiveness of Emirati citizens.

Emiratization in the private sector is considered a policy priority as employment of UAE nationals is heavily skewed toward the public sector due to better pay and security. The availability of required skills among nationals may also be an issue. Quotas for filling certain types of private-sector jobs with Emiratis have been introduced, stipulating that

This chapter hence focuses on “supply-side” policies targeting labor market and education, which could support the development of knowledge and skills required for the emerging professions as well as the transition of the existing workforce. Following the policy review, opportunities to more explicitly accommodate the need for green jobs in those policy areas are explored, especially by synchronizing labor and education policies to better link the labor market demand with educational curricula.

businesses over a certain size must fill 2-5% of jobs with nationals.

To improve the employability of nationals, more information and studies are required on which sectors attract the most nationals, what type of education and training is needed, and what policies can be implemented to incentivize both private-sector employers and potential employees. The creation of green jobs, along with policies supporting the participation of Emirati females in the job market, could play an important role in improving the employment opportunities for UAE nationals.

A National Human Resources Development Fund has been proposed to help increase employment of Emiratis by focusing on their competitiveness in the private sector and training them to hold senior leadership roles in companies. The fund would go toward programs that support unemployed Emiratis and those supporting those who are new to the jobs market as well as entrepreneurs keen to establish new commercial projects.

#### Migration

Most private-sector jobs in the UAE are occupied by non-nationals. Since more green jobs are likely to be found and created in the private sector than the public sector, migration is a salient issue for the issue of employment and jobs.

The UAE supports businesses through periodic review of working visa laws and facilitating ease of employment and talent retention. In June 2018, the UAE Cabinet introduced a package of visa reforms aimed to help foreign employees who have left their jobs stay in the country for six months under a ‘job seeker visa.’<sup>128</sup> Furthermore, recognizing the importance of talent mobility and to encourage investment and entrepreneurship in the UAE, the Cabinet approved an additional set of measures in November 2018 to grant 10-year residence visas to

specialists in the medical, scientific, research and technical fields, as well as scientists and creative talents in culture and the arts.<sup>129</sup>

The majority of the jobs that are expected to emerge in the environmental goods and services sector such as renewable energy may be temporary and lower-skilled (e.g., construction and installation) and are likely to be filled by a transient workforce. More stable, higher-skilled green jobs may also require bringing in international expertise and skills which have not been previously developed in the UAE or have not reached sufficient levels of capacity. Further studies are needed to assess what types of green jobs can be localized and what skillsets may already exist in the local labor market or have the potential to be developed locally.

### 5.2. EDUCATION POLICY

#### Higher education

The education sector continues to grow in the UAE, bolstered by expanding local and migrant populations, excellent geographic location and ongoing investment by international education providers. Particularly, Dubai has become a regional education hub, attracting students from many surrounding countries whose tuition and years-long presence contribute to the local economy. This trend is set to continue as more education providers are created or enlarged to meet rising demand, both domestically and from overseas.

The UAE Labor Force Survey of 2016 revealed that 32.1% of the country’s workforce received tertiary education; 48.8% of the UAE nationals. As

reviewed in Section 4.8, both public and private higher education institutions provide an increasing number of environment-related degrees and courses. In government institutions, 5.1% of non-nationals pursue environmental and health sciences against 3.6% of nationals. 7.3% of non-nationals pursue them compared to 2.1% of nationals in private institutions.

Some universities also provide training courses on environmental skills, targeting non-students. The British University in Dubai has partnered with an international training provider to deliver short-term courses to be accredited as Certified Energy Manager (CEM), Certified Energy Auditor (CEA) and LEED professionals.



### Vocational education

The UAE's technical vocational education and training (TVET) curricula cover areas of business, jewelry design, tourism, accounting, human resources, banking, retail, information technology, media, logistics and project management, but have not included a green component. Some countries such as Slovenia, Denmark and Brazil have included green modules in traditional TVET curricula. They include training on sustainable materials, energy efficiency, water use, green standards, solar thermal installations, etc.<sup>130</sup>

Meanwhile, there is a move to make TVET curricula aligned with industry needs in the UAE. Dubai's Knowledge and Human Development Authority (KHDA) is currently working with the National Qualifications Authority (NQA) on the emirate's TVET strategy. KHDA screens the establishment of new schools and courses according to market demands, although comprehensive research on skill needs has yet to be conducted.

For the rest of the UAE, a board overseeing the Institute of Applied Technology (IAT) and the Abu Dhabi Centre for Technical and Vocational Education (ACTVET), which is headed by the Minister of Education, aims to identify future jobs and match them with educational curricula. Six groups have been set up where educational and industry experts sit together to determine the curricula development, in the areas of nuclear energy, semiconductor, mechanical engineering, cyber security, aviation, and health science.

### Training for green skills

On the other hand, some non-educational, competent authorities started addressing the skill gaps in emerging green jobs by designing and operating training courses themselves. For example, as already outlined in Section 4.1, DEWA provides a 5-day solar PV training course to certify engineers as junior or senior PV experts for its Shams Dubai initiative to ensure quality installation of solar panels on rooftops. Similarly, the Abu Dhabi Quality and Conformity Council (ADQCC) is developing personnel certification schemes in the areas of renewable energy and heating, ventilation, and air conditioning (HVAC).

In the area of green buildings, Abu Dhabi's Estidama green building scheme requires at least one Pearl Qualified Professional (PQP) per project planned in the emirate. The Department of Urban Planning and Municipalities (DPM) provides an "Applying the Pearl Rating System" training course to assist individuals in obtaining the PQP certification. Similar short-term learning programs on green buildings are delivered by the industry association Emirates Green Building Council (EGBC).

### 5.3. CREATING GREEN JOBS POLICY

The concept of matching education with labor market is gaining traction among policymakers in the UAE. In December 2017, the Ministry of Education (MoE) launched the Higher Education Strategy 2030 which highlights the need of alignment of educational curricula with labor market requirements and the importance of R&D for stimulating innovation.

Recognizing that education and training is fundamental to building domestic capacities, a cross-ministerial Education and Human Resources Council was established in 2016. Chaired by His Highness Sheikh Abdullah bin Zayed Al Nahyan, Minister of Foreign Affairs and International Cooperation, the Council is committed to ensuring that the nation's education and human resources policies are aligned and compatible with the needs of an ever-changing labor market.

In his speech at the 2018 World Government Summit, Sheikh Abdullah emphasized that an education system is required whereby anticipation of future needs becomes the norm, stating: "We need a new system of education that looks into the future. Educational institutes need to have new models to follow, that are constantly evolving and adaptable to changes around them."<sup>131</sup>

In January 2019, MoE published a study report Majors in Demand on preferred study areas and top workplace destinations in the UAE. The survey sampled more than 13,000 students graduating from government and private institutions in 2017 and found that engineering was the highest ranked study area in terms of employment opportunities based on the number of those who secured a job against the overall number of graduates. This was followed by business administration, medical sciences, and information technology.

In terms of the speed to find employment after graduation, students graduating with education

degrees came out on top, followed by business administration, information technology, engineering, and environmental and health sciences. MoE further plans to conduct a survey of employers on satisfaction with hiring graduates, skills required, and which courses universities should provide.

In order to make the alignment between education and labor policies relevant to the promotion of green jobs, the following measures can be considered:

- Skills development strategy: To reduce supply and demand mismatches of green jobs, an in-depth analysis on prospective green skills, domestic workforce requirements, and retraining needs should be conducted, based on which a comprehensive green skills development strategy can be developed, particularly targeting UAE nationals.
- Training for workforce supply: Policies to influence the supply of workers willing, able and suited to undertake green jobs should be introduced. Those include green training policies for TVET and other levels of education, promoting entrepreneurial skills, empowering women and youth with career orientation, and grants for environmental courses.
- Recruitment services: A labor market intermediation for green jobs can be provided, for example, by supporting public employment services and/or private recruitment agencies in offering green career guidance and matchmaking events and online platform.
- Financial incentives: The demand for green jobs can be stimulated by various financial incentives, including, for example, VAT exemptions for green companies, low-interest credits or guarantees for green entrepreneurs and cleaner production processes, and subsidies for hiring Emirati green skilled workers.

## 6. MONITORING GREEN JOBS IN THE UAE

Quantifying the number of green jobs over time would help policymakers to monitor the progress of a country’s green economy transition in particular sectors, identify the effects of policy interventions on employment, and elaborate further measures to boost green jobs. While Section 4 made a first attempt at estimating the current and future numbers of green jobs in the UAE, they should

be considered as highly speculative as calculated using employment factors from other countries or crude assumptions. This chapter therefore provides a discussion on methodology for more solid estimation of green jobs to inform future green jobs policy formulation, including improvement in labor and environmental statistics at the national and local levels.

### 6.1. IDENTIFYING POLICY QUESTIONS

In order to have the green jobs data and analysis that help elaborate appropriate policy interventions, policymakers firstly need to set clear policy questions which would define the scope of green jobs and measurements specific to the country.

Policymakers may be interested in the potential job generation from a certain investment, e.g., a new CSP plant project. In such a case, the interest would lay in capturing both direct and indirect employment, including non-green jobs to be created by CSP technologies such as administrative workers in the CSP sector. In another case, policymakers may be interested in identifying what green skills are in shortage that could hold back the transition to a green economy. In this instance, the focus would be on purely green jobs, be they in green sectors or non-green sectors.

Typical policy questions that decision-makers may wish to clarify include:

- How many and what types of jobs will be created by a certain investment or policy?
- In the transition to a green economy, will the overall employment effects be positive and what extent?
- What will be the employment shifts across and within sectors as industries get greener?
- What occupations will become redundant and how many people need to be retrained in what skills, in a green economy?
- Are there bottlenecks in green skills, and if so, in which sectors and occupations?

Such policy questions need to be elaborated and defined collectively among different ministries as the same data and analysis will be utilized for various policymaking. The questions should be in line with the national and sectoral strategies and priorities such as the UAE Centennial 2071 and the UAE Green Agenda.

### 6.2. DEFINING GREEN JOBS

Once policy questions have become clear, the next step is to develop a specific definition and scope of green jobs for the UAE that fits the questions and helps generate relevant statistics. It is important to note that there is no agreed definition of green jobs globally as reviewed in Section 1.1, and therefore the definition need to be established according

to the country’s context. Table 9 below provides a model template to help set practical boundaries which would lead to a concrete definition. The definition may change over time to adapt to new market conditions and requirements as well as the UAE’s policy directions.

Table 9: Template to define the scope of green jobs

		Included in/excluded from the scope of green jobs?
Employment in green industries	Jobs with a green component (e.g., solar panel installation)	
	Jobs without a green component but created thanks to greening (e.g., administrative staff in a renewable energy company)	
Employment in non-green industries	Jobs with a green component (e.g., energy managers of production processes)	
	Jobs without a green component but created thanks to greening (e.g., workers in making steel used for wind turbines)	
Are non-private sector jobs (government, NGOs, etc.) part of the scope?		
Are freelancers and part-time job holders to be considered for counting green jobs?		

Naturally, questions arise when performing the above exercise: What are green industries and non-green industries? What are green components in jobs? Statistically, the International Standard Industrial Classification (ISIC) and the International Standard Classification of Occupations (ISCO) do not generally distinguish between green and non-green activities.<sup>132</sup> Even if using the Eurostat definition of the environmental goods and services sector (see Section 3.1), the disaggregation of industries and labor in the UAE’s national statistics

is made only at the 1-digit level and is not enough to distinguish industries or jobs to be used for setting the scope of green jobs.

For the purposes of analysis, therefore, the definitions of green industries and jobs with a green component should be set by looking into specific technologies or product categories, such as solar, wind and biomass energy, heating and cooling efficiency, fuel efficient and alternative fuel vehicles, and mass transit systems.<sup>133</sup>

### 6.3. DATA SOURCES

Depending on the policy questions and the desired scope of measurement, the data sources and methodologies to be used for analysis can differ. Each policy question must be developed by looking at certain types of data from various sources to arrive at a result. For example, when attempting to measure the number of green jobs, it is critical to gather data from both qualitative sources, such as literature reviews and sectoral consultations, and quantitative sources, such as labor force surveys and employment factors. This combination will ensure that the most recent factors can be

checked against information collected directly from employers. These sources will not be useful for a purely quantitative exercise such as estimating jobs via input-output (I-O) tables, where national-level statistics are needed. For classification of occupations and skills requirements for different jobs, qualitative information from surveys and consultations is needed to agree on definitions and boundaries. The data sources for each type of inquiry are summarized in Table 10 (see also Section 3.2):

Table 10: Data sources required to estimate green jobs

Policy question/scope	Data sources
Direct jobs	<ul style="list-style-type: none"> <li>Literature review</li> <li>Sectoral consultations</li> <li>Labor force surveys</li> <li>Enterprise surveys</li> <li>Employment factors</li> </ul>
Direct and indirect jobs	<ul style="list-style-type: none"> <li>Input-output table</li> </ul>
Job losses and shifts	<ul style="list-style-type: none"> <li>Input-output table</li> </ul>
Occupations	<ul style="list-style-type: none"> <li>Sectoral consultations</li> <li>Labor force surveys</li> <li>Enterprise surveys</li> </ul>
Skills	<ul style="list-style-type: none"> <li>Sectoral consultations</li> <li>Enterprise surveys</li> </ul>

The current availability of data to be used for estimating green jobs in the UAE is as follows:

- **Labor force surveys:** The most recent labor force survey at the national level was conducted by the Federal Competitiveness and Statistics Authority (FCSA) for 2017 (and 2009 before that by the then National Bureau of Statistics). This survey disaggregated occupations only at the ISCO 1-digit level which is too coarse to

obtain any relevant information for green jobs. The statistics centers of Abu Dhabi and Dubai have conducted labor force surveys annually.

- **Input-output table:** To conduct macroeconomic analyses such as the overall effects of a green economy policy on job creation and losses across sectors, an input-output (I-O) table is an essential data source to conduct modeling (see Section 3.2). There is no reliable national I-O

table generated to date. However, the Dubai Department of Economic Development is currently developing an emirate-level I-O table.

- **Enterprise surveys:** FCSA conducted an establishment survey in 2017, focusing on economic aspects. The only question related to employment in this survey is the number of employees per establishment. In personal communications with FCSA, it was highlighted that an environment-related question was proposed to be included in the survey during its questionnaire design process but it was dropped due to concerns with lowering the response rate. FCSA instead suggested that an independent green jobs survey could be designed as it can ask the details on the types

and nature of jobs in each establishment.

- **Other data sources:** There may be data from government or industry reports which could help sector-specific estimation of existing and prospective green jobs as partly attempted in Chapter 4. Following are examples of relevant data that may be available in the UAE:
  - 1 Statistics on the stock of existing buildings by age, purpose and quality;
  - 2 Projections of future building requirements;
  - 3 Statistics on energy production by technology and energy consumption by sector;
  - 4 Statistics on waste by source and type, and on waste recovery by method; and
  - 5 Statistics on international trade of products.<sup>134</sup>

### 6.4. IMPROVING DATA COLLECTION

In estimating the trends of green jobs, hybrid methods have been adopted in other countries, which link a top-down macroeconomic modeling with bottom-up quantification at the sectoral level, where strong socio-economic data and detailed industry and occupational information are available from the national statistics agency.

As reviewed above, the UAE has not developed a national I-O table and not conducted a national labor force survey, whereas the enterprise survey runs at the level of disaggregation not usable for green jobs. Hence, it is recommended to take a bottom-up sectoral approach for green jobs quantification and focus only on direct jobs as the first step. The following practical steps can be pursued (Figure 7):

- **Phase 1:** A stand-alone nationwide green jobs survey can be conducted with enterprises, where samples are extracted

from registration records of each emirate's department of economic development. A well-constructed questionnaire may include specific questions on core and supporting functions, occupational information, job titles, skills in need and gaps, wages, gender, educational attainment, certifications required, types of contract, nationality, etc. Individual sector-specific surveys can be also conducted to yield a more detailed picture of the country's green economy. These surveys allow determining the current state and number of green jobs. Given the fact that the topic is new in the UAE, face-to-face interviews are recommended to resolve doubts and answer questions from respondents directly. This process needs to be repeated with regular intervals.

- **Phase 2:** To enable the prediction of future green jobs development, adequate employment factors need to be determined for each green

technology or sector. This exercise can be based on the data obtained from the above enterprise and sectoral surveys, combined with literature reviews of domestic and international factors. Where conclusive information cannot be obtained, a survey or interviews with some companies and consultations with industry experts may help determine an approximate range of factors.

- **Phase 3:** Periodic sectoral workshops and focus group discussions can be organized to draw a comprehensive skills picture throughout the value chain and address gaps and shortages in a targeted manner. The meetings can also address policy aspects by discussing employment trends, job profiles, educational needs, and additional courses required to avoid shortages in green skills and facilitate a transfer from redundant jobs.

Figure 7: Recommended steps to quantify green jobs in the UAE



As the quality of socio-economic data evolves in the UAE, other options for estimating green jobs can be pursued. For example, should labor and industry statistics include more detailed classifications, the data in the environmental goods and services sector can be extracted. If a I-O table becomes available, a top-down estimate and modelling of green jobs can be conducted and matched with

the bottom-up estimation. As the UAE Green Jobs Program evolves, more emphasis may be placed on integrating green jobs in national statistics, making them part of a broader effort to quantify employment. As data will become more accurate based on a systematic process, more sophisticated analysis and modeling can be made in the future.

## 7. WAY FORWARD

The UAE is transforming its economy at a high speed by heavily investing in green fields such as renewable energy, energy efficiency, public transport and cleaner vehicles, and green building and eco-cities. Many green jobs have been created in the country in recent years, and the number may increase radically given the government’s announced plans and objectives.

The labor market needs to catch up with these investments if the pace is to be maintained. If no coordinated, coherent green jobs strategy will be envisioned, opportunities might be lost. Other challenges include the lack of detailed statistics on employment, limited green jobs studies, insufficient provision of training relevant to green jobs in formal education and vocational training, and few incentives for Emiratization of green jobs.

Green jobs policies cannot be created in isolation. By their nature, employment issues touch upon different policy areas and must take into account the targets and priorities in other fields. Moving the UAE Green Jobs Program forward, a collaborative approach across the sector is essential to effectively address skills and occupational needs for the forthcoming green economy and harness the full potential of green jobs.

As a next step of the Program, the establishment of two working groups tasked with the following items is proposed:

### Working Group 1: Policy coordination and research

- Identify and enhance relevant sectors and initiatives with potential for green jobs

- Develop relevant policies for promoting green jobs
- Collaborative work on skills needs assessment and provision of relevant curricula at all levels of educational attainment

### Working Group 2: Measurement and monitoring

- Set a scope and a definition of green jobs applicable to the UAE
- Undertake quantification and forecasting of job numbers
- Establish a monitoring mechanism

Along with academic experts in labor, education and environmental policies and economics, the following stakeholders can be engaged in the working groups:

- Federal and local authorities in charge of the environment, energy and water, economy and industry, human resources, education, and statistics;
- Industry associations and leading businesses;
- Education providers: higher education and TVET; and
- Civil society organizations.

The working groups can meet on a regular basis and assign specific tasks and set timelines, keeping up-to-date with ongoing domestic and international efforts for green jobs, conducting relevant studies and analyses, and monitoring and reviewing progress. The working groups can also serve as a platform for multi-stakeholder partnerships which collectively elaborate green jobs policies and educational and training curricula and implement relevant initiatives.

**ANNEX 1. ENVIRONMENT-RELATED HIGHER EDUCATION DEGREES OFFERED IN THE UAE**

Institution	Short Courses	Undergraduate	Masters	PhD
<b>Abu Dhabi University</b>		BSc Environmental Health and Safety BSc Environmental Science	MSc Sustainable Architecture	
<b>Abu Dhabi Vocational Education and Training Institute</b>	Diploma in Environment, Health and Safety			
<b>American University of Sharjah</b>		BSc Environmental Sciences - Minor in Environmental Policy - Minor in Environmental and Water Engineering - Minor in Environmental Sciences - Minor in Renewable Energy		
<b>Amity University</b>		BSc Solar and Alternative Energy		
<b>British University in Dubai</b>	Postgraduate Certificate in Sustainable Design of the Built Environment Postgraduate Diploma in Sustainable Design of the Built Environment Certified Energy Manager Certified Energy Auditor LEED professionals		MSc Sustainable Design of the Built Environment	PhD Architecture and Sustainable Built Environment
<b>Canadian University of Dubai</b>		BSc Environmental Health Management		
<b>Dubai Police Academy</b>			Master in Law and Environment	
<b>École Polytechnique Fédérale de Lausanne Middle East</b>			Master in Energy Management and Sustainability	

<b>Heriot Watt University Dubai</b>		BSc Chemical Engineering	MSc Renewable Energy Engineering	PhD Engineering and Physical Sciences PhD Energy, Geoscience, Infrastructure and Society
<b>Jumeira University</b>		BSc Environmental Health		
<b>Hamdan bin Mohammed Smart University</b>	Designing and Developing Smart Cities		MSc Excellence in Environmental Management	
<b>Khalifa University (formerly Masdar Institute and Petroleum Institute)</b>			MSc Health, Safety and Environmental Engineering MSc Sustainable Critical Infrastructure MSc Water and Environmental Engineering MSc Water and Environmental Technologies MSc Water and Environmental Resources MEng Health, Safety and Environment Engineering	
<b>MODUL University Dubai</b>			MSc Sustainable Development, Management, and Policy	
<b>New York University Abu Dhabi</b>		The Environment Minor		
<b>Paris-Sorbonne University Abu Dhabi</b>			MA Environment MA Geography, Planning and Environment	
<b>University of Sharjah</b>	Diploma in Environmental Health and Safety	BSc Sustainable and Renewable Energy Engineering		
<b>Zayed University</b>		BSc Environmental Science and Sustainability		

## ANNEX 2. PRECEDENT STUDIES ON GREEN JOBS IN THE UAE

### IRENA: Renewable energy jobs in the GCC

In January 2019, the International Renewable Energy Agency (IRENA) published a market analysis of the Gulf Cooperation Council (GCC) region. The report analyzed energy resources in each of the six GCC countries, trends in renewable energy deployment, institutional landscape, renewable energy costs, and socio-economic benefits of renewables for the region.<sup>135</sup>

The latter part of the analysis included a discussion on job creation. Noting the encouraging policy signs coming from GCC countries, especially the UAE and Saudi Arabia, the report found that achieving the overall renewables targets in the region can create up to 136,000 direct jobs every year, %41 of which in the UAE, or 55,760 jobs. Job creation would continue into 2030, reaching 223,000 jobs in 2030, or 91,430 jobs in the UAE. Large-scale solar photovoltaic (PV) is the driving technology behind these positive results, creating an estimated 120,000 jobs in 2030, followed concentrated solar power (CSP) with 59,000 jobs, and rooftop PV with 20,000 jobs.

It is also worth noting that the report sees potential in job creation along the renewables value chain. Relevant industries in this case would include manufacturing as the main beneficiary of renewables

deployment as well as source of secondary jobs. Countries such as the UAE have already witnessed the arrival of the PV manufacturing industry, albeit on a smaller scale. Issues of cost competitiveness, local content requirements, and international trade agreements were identified as potential barriers to truly transform the GCC countries into markets with the full integration of the renewable energy value chain.

### GWS: Quantifying green jobs in Dubai

In 2016, the German Institute of Economic Structures Research (GWS) was commissioned to conduct a study to count the number of green jobs in Dubai.<sup>136</sup> The calculation showed that a total of 12,830 green jobs per year existed in Dubai between 2013 and 2015. This means that the ratio of green jobs in Dubai for 2014 was %0.84 of total labor force.

This estimation was made based on employment factors from Germany, Tunisia, Australia and the United States. Some sectors were not analyzed due to lack of the factors or employment statistics or difficulties in distinguishing green jobs with other jobs. Such is the case of the construction sector where numbers were based on the construction of new LEED-certified buildings only.

Table 11: Number of green jobs in Dubai

Sector/Activity	Green jobs in 15-2013 (jobs/year)
Desalination, indirect jobs	500
Wastewater treatment	900
District cooling	700
Waste collection	1,850
Landfill operation	320
Hotels	600 - 1,200
PV production	-
PV installation	100
PV operation and maintenance (O&M)	4
Construction	1,250
Service sector, indirect jobs	100
Public administration, campaign development, and indirect employment from printing material, distributing information, organizing meetings	5,000
Transport: hybrid cars	588
Metro	500 - 550
Abras (ferries)	68
<b>TOTAL</b>	<b>12,830</b>

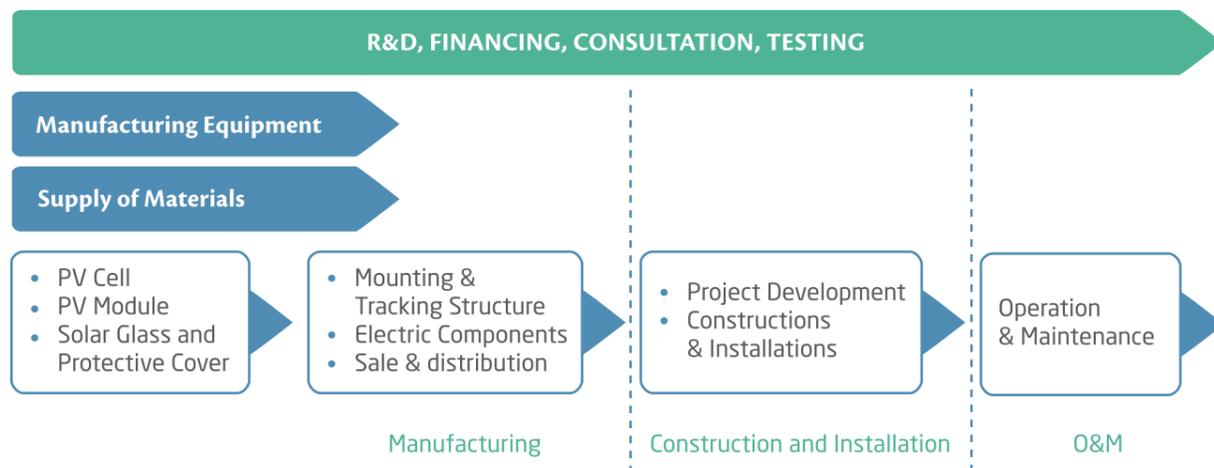
### MASDAR INSTITUTE: ANALYZING VALUE CHAIN

Researchers at the Masdar Institute of Science and Technology (now part of Khalifa University) conducted analysis of the value chains of renewable energy and energy efficiency technologies to identify which stages of those technologies can generate green jobs in the UAE and the region (Figure 7 illustrates the value chain and stages of deploying solar PV technologies as an example).<sup>137</sup>

The analysis shows that jobs in research and development (R&D) and manufacturing stages are likely to be stable but go overseas, whereas installation jobs are likely to be more local but

temporary, and operation and maintenance (O&M) jobs would be local and stable. For example, the researchers looked into the case of the 100-MW Shams 1 CSP plant that has been in operation since 2013. As of late 2017, the plant employs almost 90 professionals (not including construction workers) ranging from “core green” occupations such as Health, Safety and Environment (HSE) Manager, Plant Manager, Commissioning Engineer, Site Manager and a design review team to more generic jobs including Finance Manager and Project Control Manager.

Figure 7: Recommended steps to quantify green jobs in the UAE



### DUBAI CARBON: GREEN JOBS SURVEY AND DISCUSSION

A pilot green jobs survey was undertaken in 2014 as part of Dubai Carbon Centre of Excellence’s (DCCE) Green Jobs program, where 59 companies based in Dubai responded to a questionnaire. The survey intended to obtain a general idea of skill gaps and shortages observed in the ongoing transition to a

green economy. It was found that skills for green jobs fall into two categories: technical skills that are specialized in a particular area; and core skills that are generic. As Table 10 outlines, some skills are in high demand, while others are not at the moment.<sup>138</sup>

Table 12: Green skills gaps and shortages in Dubai

Technical skills	Core skills
<p><b>Most difficult to find:</b></p> <ul style="list-style-type: none"> <li>• Environmental sciences</li> <li>• Waste management</li> <li>• Manufacturing &amp; assembly</li> <li>• Environmental Impact Assessment</li> <li>• Solar PV installation &amp; maintenance</li> <li>• Urban planning</li> </ul> <p><b>Not in demand:</b></p> <ul style="list-style-type: none"> <li>• Scientific; R&amp;D</li> <li>• Carbon calculation</li> <li>• Vehicle energy efficiency design</li> <li>• Environmental law</li> </ul>	<p><b>Most difficult to find:</b></p> <ul style="list-style-type: none"> <li>• Language skills</li> <li>• IT</li> <li>• Coordination skills</li> <li>• Networking, communication &amp; negotiation</li> <li>• Environmental awareness</li> <li>• Report writing</li> <li>• Problem solving</li> </ul> <p><b>Not in demand:</b></p> <ul style="list-style-type: none"> <li>• Leadership</li> <li>• Entrepreneurship</li> <li>• Innovation</li> </ul>

Also, the following “star green jobs” (most sought-after jobs in the market) were indicated by the respondents:

- HSE manager
- Business development manager (green products and services)
- Environmental manager
- Energy efficiency engineer/consultant
- Sustainability manager/officer
- Renewable energy engineer
- Project manager

In December 2014, the Green Jobs program organized a high-level panel discussion on green economy and green jobs. The panelists ranged from Dubai public entities to local industries, consulting firms, international organizations, and universities. They agreed that energy efficiency was potentially the highest generator of green jobs in the UAE and that the country would require the implementation of new vocational training programs and the update of existing programs to address probable skill gaps.<sup>139</sup>



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