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**Working Paper**

## Assessment of green jobs in Dubai

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EMPIRICAL ECONOMIC  
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GWS DISCUSSION PAPER 2016 / 11

## Assessment of Green Jobs in Dubai

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## LIST OF ABBREVIATIONS

<b>AED</b>	United Emirates Dirham
<b>CNG</b>	Compressed natural gas
<b>CO<sub>2</sub></b>	Carbon dioxide
<b>DEWA</b>	Dubai Electricity and Water Authority
<b>ENOC</b>	Emirates National Oil Company
<b>EPPCO</b>	Emirates Petroleum Products Company
<b>ESCO</b>	Energy Service Company
<b>Expo</b>	World's fair
<b>FTE</b>	Full time employment
<b>GDP</b>	Gross domestic product
<b>GHG</b>	Greenhouse gas
<b>ILO</b>	International Labour Organization
<b>IRENA</b>	International Renewable Energy Agency
<b>LEED</b>	Green building certification: "Leadership in Energy and Environmental Design"
<b>MIGD</b>	Million imperial gallons per day
<b>NO<sub>x</sub></b>	Mono-nitrogen oxides
<b>O&amp;M</b>	Operation and maintenance
<b>PV</b>	Photovoltaic
<b>RE</b>	Renewable energy
<b>RTA</b>	Roads and Transport Authority, Dubai
<b>RSB</b>	Regulatory & Supervisory Bureau, Dubai
<b>STP</b>	Sewage Treatment Plant
<b>TSE</b>	Treated sewage effluent
<b>UAE</b>	United Arab Emirates
<b>UNEP</b>	United Nations Environment Programme

## 1 INTRODUCTION AND OVERVIEW

Degradation of the environment, including the pollution of water, soil and air, the irreversible loss of biodiversity, and depletion of natural resources are global threats to sustainable development. The threats are enhanced by the impact of climate change already being experienced in many developing countries. These challenges have led to the postulate of making the way we produce, work and travel more compatible with the ecological limits and boundaries of our planet. On the social level, the challenges of large unemployment especially among young people, the questions of inclusion and participation of the population in a better, healthier and safer life seem equally unresolved in large parts of the world. Under the headline of “green economy”<sup>1</sup> suggestions have been made in the course of the RIO+20 conference on the question how these challenges can be addressed by a harmonized approach.

Currently, this is being translated into practice.<sup>2</sup> To develop the respective policies, legislation and support mechanisms, a rigorous framework of evaluation has to be established. Green employment is considered as one important indicator of a successful transition to a green economy. Therefore, the analysis of the status of green and decent employment and of the potential for the creation of green and decent jobs in the future is a necessary first step on the pathway to a green economy.

Environmental issues are among the defining challenges of this century. Climate change, water quality, biodiversity, pollution and the disposal of waste affect the health, quality of life and well-being of all of us today and of all future generations. However, future damages to our welfare are often neglected in the face of growth and development challenges today. The concepts of “green economy” (UNEP 2008) and “green jobs” (ILO 2012) try to solve the seeming dichotomy between economic growth and a sustainable development path.

Within UNEP, the “green economy” is defined as follows:<sup>3</sup>

### Text box 1: GREEN ECONOMY

**A green economy results in “improved human well-being and social equity, while significantly reducing environmental risks and ecological scarcities”. In its simplest expression, a green economy can be thought of as one which is low carbon, resource efficient and socially inclusive.**

**Practically speaking, a green economy is one whose growth in income and employment is driven by public and private investments that reduce carbon emissions and pollution, enhance energy and resource efficiency, and prevent the loss of biodiversity and ecosystem services.”**

<sup>1</sup> UNEP 2011.

<sup>2</sup> For an overview of the UNEP follow-up activities see UNEP 2016a.

<sup>3</sup> UNEP on Green Economy Initiative: UNEP 2016b.

According to ILO (2012) “green jobs” are defined as follows:

### Text box 2: GREEN JOBS

**“Jobs are green when they help reduce negative environmental impact ultimately leading to environmentally, economically and socially sustainable enterprises and economies. More precisely green jobs are decent jobs that:**

- **Reduce consumption of energy and raw materials**
- **Limit greenhouse gas emissions**
- **Minimize waste and pollution**
- **Protect and restore eco-systems” (ILO 2012)**

These definitions are general enough to capture the wide span of economic activities spurred by the transition to a green economy and to define employment springing from these activities. The quantification of both, the economic effects and green jobs, however, has to be specified for each region and country.

The literature on green jobs reaches from country case studies<sup>4</sup> on green jobs to the analysis of economic effects of the transition to a green economy around the world and from single environmental issues, such as green energy, to a bundle of policies for instance on climate change mitigation<sup>5</sup>.

Against this background, Dubai Carbon commissioned GWS to develop an assessment method for measuring green jobs in Dubai. The application of the method for first estimates and the results will be described in the following.

The remainder is organized as follows. Firstly, chapter 2 describes the economic structure of Dubai and identifies, which part of the economic sectors can be accounted for as green by international standards. Chapter 3 then describes the labor market in Dubai and assigns the green economy’s activities to the respective labor force. Chapter 4 concludes with a comparison with the literature and an outlook on future development.

## 2 IDENTIFICATION OF GREEN JOBS IN DUBAI

Data on green jobs rarely are collected by the respective statistical offices, mainly due to the cross-sectional nature of green sectors. The basic assumption is that any sector can be green to different degrees. Therefore green jobs can be found in all sectors and only careful analysis and application of the definition yields the attribution of the label green to selected sectors of an economy.

### 2.1 DUBAI’S ECONOMY

Dubai is the second largest of the seven Emirates in United Arab Emirates. In 2013 the

<sup>4</sup> For an overview see ILO 2016.

<sup>5</sup> A prominent example would be the Stern Report (Stern 2006).

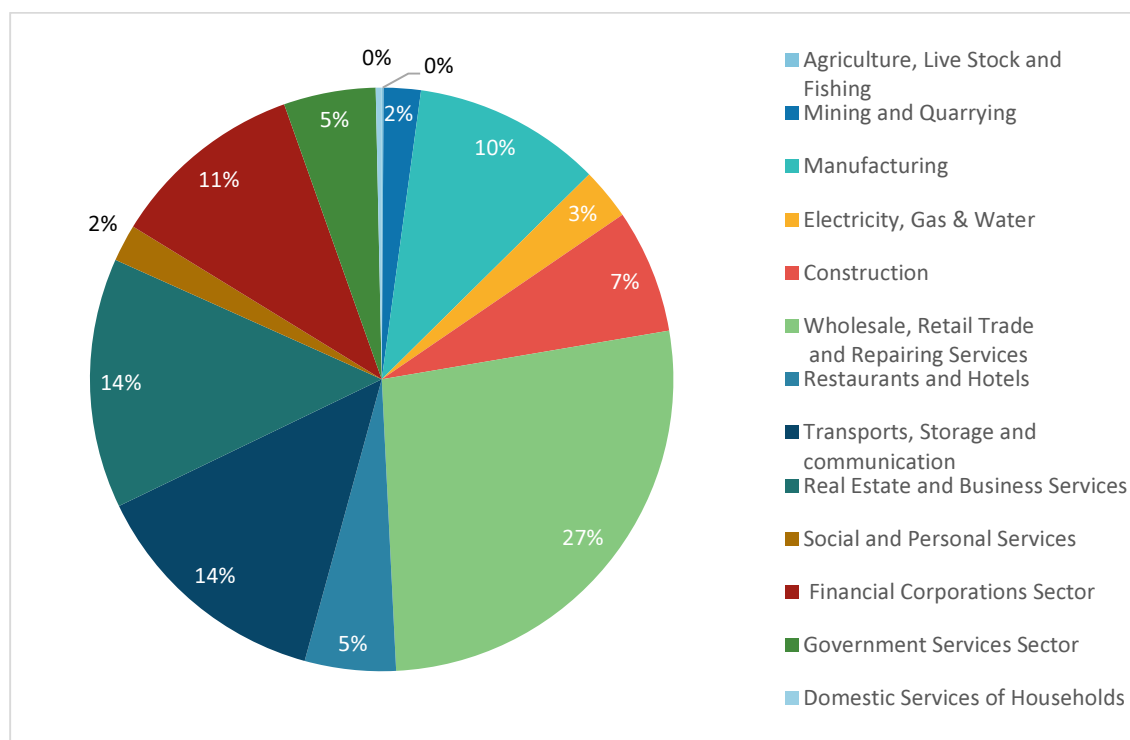


GDP of the Emirate is 340.4 billion AED or \$92.6 billion, in 2014 GDP reaches 352.2 billion AED, which translates into a 3.5% GDP growth rate (Dubai Statistics Center 2015).<sup>6</sup>

Dubai has a total population of 2.214 million in 2013 (Dubai Statistics Center 2013b), 1.677 million male and 0.537 female. The latest Labor Force Survey from 2011 shows, that most recently 1.331 million people in Dubai were in the age 15 and above. Out of this group, often called the economic active group, 1.325 million people are listed as employed in this survey. This yields an unemployment rate which is very low. Close to 4% of the working population are Emirati, 96% are Non Emirati.

The main sectors contributing to GDP (Figure 1) are wholesale, trade & repair leading with 27%, followed by real estate & business services and transport & communication each with 14%. The financial sector contributes 11% and manufacturing 10%. The overall picture is that of a service and trade oriented economic structure.

**Figure 1: Percentage contribution to GDP, 2014 data.**



Source: Dubai Statistics Center 2015, own graph.

Hotels and restaurants increase in relevance for the economy, especially after the recovery from the financial crisis in 2008/2009. The agriculture sector is very small. Although agriculture is often discussed when speaking about green jobs, for Dubai it is not of relevance. Dubai’s mining and quarrying sector is of low relevance for the economy and for the green jobs assessment as well. Construction and energy, gas & water contribute together 10% to GDP and will be shown to be relevant for the assessment of green jobs. Less important for green jobs but rather important for GDP are real estate & business services and the financial corporations sector which add to 25% of GDP.

<sup>6</sup> In 2006 prices, see Dubai Statistics Center 2015.

## 2.2 LABOR MARKET STATISTICS IN DUBAI

The starting point of any green jobs assessment are data on the labor market. Different publications by governmental bodies provide data on the labor market in Dubai. The statistical Bureau of Dubai provides the Labor Market Survey, the Statistical Yearbook and National Accounts. To get an overview of the data availability, Table 2 and Table 3 show for which year which data framework is available. The Statistical Yearbook (Table 1) gives percentages by economic sector of employment data.

**Table 1: Labor market data for 2011 from the Statistical Yearbook of Dubai**

<b>Percentage Distributions of Employed (15 Years and Above) by Main Economic Activity and Sex - Emirate of Dubai</b>	
Agriculture and hunting	1.5
Fishing	0.0
Mining	0.2
Supply of other transport equipment	1.8
Manufacturing	15.2
Construction	28.7
Wholesale and retail trade and repair of motor vehicles	14.2
Transport, storage and communications	8.1
Real estate and rental activities and the activities of businesses	9.0
Financial intermediation	2.5
Hotels and restaurants	4.4
Education	2.5
Health and social work	1.0
Public administration and defense	3.5
Community service activities social and other personal	2.3
Organizations and non-sectoral bodies	0.0
Private families who appoint individuals had to perform household chores	5.1
<b>Total</b>	<b>100.0</b>

Source: Dubai Statistics Center 2016.

**Table 2: Labor market data availability for different years 1/2**

	2014	2013	2012	2011	2010	2009	2008	2007	2006	2005	2000	1995	1993	1985	1980
Employed by economic activity (21 activities + total), percentages	SYB (xls) + LFS (pdf)														
Employed by economic activity (17 activities + total, in part: + not stated), absolute numbers				LFS (pdf)		LFS (pdf)	LFS (pdf)								
percentages		SYB (xls)	SYB (xls) + LFS (pdf)	SYB (xls+pdf)		SYB (xls+pdf)	SYB (pdf)								
Employment by economic activity (18 activities incl. others), percentages										Census (pdf)	Census (pdf)				
Employed by economic activity (9 activities + total, in part: + not stated or + unspecified or + activities not adequately defined), absolute numbers										SYB (pdf)	SYB (pdf)	SYB (pdf)	SYB (pdf)	SYB (pdf)	SYB (pdf)
Number of employed persons, total				SYB (pdf)		SYB (pdf)	SYB (pdf)			SYB (pdf)	SYB (pdf)	SYB (pdf)	SYB (pdf)	SYB (pdf)	SYB (pdf)
Worker by economic sector and activity (14 categories + total), absolute numbers			NA (pdf)	NA (pdf)	NA (pdf)	NA (pdf)	NA (pdf)	NA (pdf)	NA (pdf)						

LFS: Labor Force Survey

SYB: Statistical Yearbook

NA: National Accounts

Source: Own overview.

**Table 3: Labor market data availability for different years 2/2**

	2012	2011	2009	2008	2007	2006	2003	2002
Number of workers: Electricity, gas & water			X	X	X			
Number of employees: Recycling				X	X			
Number of workers: Construction sector	X	X	X	X	X			
Number of employees: 5 categories buildings				X	X			
Number of workers: Hotels & restaurants	X	X	X	X	X			
Number of employees: Hotels; camping sites and other provision of short-stay accommodation & restaurants, bars and canteens				X	X			
Number of workers: 7 econ. activities + total (Econ. Survey of Private Sector Est.)						X		
Number of employees: 17 econ. activities + total (Econ. Survey of Private Sector Est.)							X	

Source: Own overview.

Depending on the attribution of the nonfinancial cooperation sector different aggregates for total employment result. Green jobs do not depend on the business form, therefore we take the nonfinancial cooperation fully into account and use the data and structure from the Labor Force Survey in the following. The data are as follows.

**Table 4: Labor market data for 2011 from the Labor Force Survey**

<b>Employed (15 Years and Over) by Nationality, Sex and Economic Activity - Emirate of Dubai (Total Emirate)</b>		<b>Share</b>
Agriculture and hunting	19,309	1.5
Fishing	191	0.0
Mining	2,903	0.2
Supply of other transport equipment	23,519	1.8
Manufacturing	201,961	15.2
Construction	380,394	28.7
Wholesale and retail trade and repair of motor vehicles	188,402	14.2
Transport, storage and communications	107,694	8.1
Activities real estate and rental and the activities of businesses	119,670	9.0
Financial intermediation	33,462	2.5
Hotels and restaurants	57,919	4.4
Education	33,796	2.5
Health and social work	12,625	1.0
Public administration and defense	46,270	3.5
Community service activities social and other personal	29,874	2.3
Organizations and non-sectoral bodies	208	0.0
Private families who appoint individuals had to perform household chores	67,752	5.1
<b>Total</b>	<b>1,325,949</b>	<b>100.0</b>

Source: Dubai Statistics Center 2011.

### 2.3 IDENTIFICATION OF GREEN SECTORS IN DUBAI'S ECONOMY

Economic theory often defines direct and indirect jobs, or employment respectively. Direct employment is found in the sector's main activity, which satisfies final demand. Indirect employment is found in a sector's activity for other sectors, satisfying intermediate demand. The more integrated an economy the more important are indirect effects. The Dubai economy has not a high domestic production sector, manufacturing contributes around 10% to GDP. Therefore, most machines and technical inputs are imported. However, the construction sector provides several important inputs for other sectors, such as water treatment, waste management or electricity generation. It is important to think about the

contribution of the relevant sectors to the different phases of the value chain.

For an economic sector to be classified as green, following the ILO definition, it has to either reduce the consumption of energy and materials, limit GHG emissions, minimize waste or pollution and/or protect and/or restore ecosystems. The following sectors are identified as at least partly green.

Water treatment is 100% green because it improves public health, reduces pollution and health risks in the water. Water treatment plants are operated by Dubai Electricity and Water Authority. The Authority also is engaged in the development of brochures and information campaigns on energy and water conservation. Detailed information about the employers in the respective fields are less easily found.

Electric power generation from renewable energy (RE) sources is considered as green. To calculate green jobs we chose a bottom-up calculation for installed solar capacities.

Construction is highly relevant to a variety of green activities. Direct jobs are related to energy efficient buildings, indirect jobs can be found in the construction inputs of RE installations as well as in all other sectors mentioned in this list.

Waste treatment improves health and well-being of all citizens and is considered green.

District cooling is an important contribution to energy efficiency, we account all employment in this sector as green.

Energy service companies fully are accounted for as green.

Transport often is the source of emissions, CO<sub>2</sub>, particles and NOx. Fuel switches and transport mode changes therefore can be classified as activities, which mitigate emissions and pollution, and thus are green. Regarding Dubai, this is the case for the metro system and electric drive transport, be it public or commercial. Privately owned vehicles are not accounted for as an economic activity. The provision of infrastructure, however, is leading to green jobs.

Tourism is an important economic driver in the Emirate, in particular in the face of the Expo in the year 2020. However, green tourism and employment directly related to green tourism will be a rather small share in overall jobs in tourism in Dubai. Therefore, this sector has potential, but most people working in it do not have a green job.

Public transport is highly relevant in the growing metropolis of Dubai. The metro replaces transport by cars and saves on fuel and emissions. In particular during peak times, it helps to prevent pollution from exhaust fumes and thus contributes to public health.

E-Mobility has been incentivized by the authorities in Dubai. A support for hybrid cars, electric cars and hybrid and/or electric busses is in place and helps to improve air quality and energy efficiency as well as reduction of carbon emissions.

Services and administration play an important role in the greening of Dubai. Members of the respective authorities, consultant companies on energy, waste management, water management or efficiency use of any resource are accounted for as green jobs. These activities have indirect impacts on the publishing industry, on IT services and other mixed services. These jobs are accounted for in an overall estimate of indirect jobs from green activities.

**Table 5: Identification of relevant green sectors**

<b>Sector</b>	<b>Institutional</b>	<b>Description</b>	<b>Degree of green</b>	<b>Green products/services provided</b>	<b>Green effect</b>
<b>Water treatment</b>	Public	Waste water treatment and desalination	Fully	Clean water	Mitigating pollution; improving health
<b>Power, solar</b>	Public	Installation and O&M of solar power plants	Fully	Electricity from RE	Limiting GHG emissions
<b>Tourism</b>	Private	Hotel and restaurant services, sightseeing tours etc.	Partly <30%	Environmental friendly tours and hotels; preserving the national culture and way of life	Reducing waste and consumption of energy and materials; protecting local nature
<b>Construction</b>	Public	Structural and civil engineering	Partly <50%	Energy efficient buildings	Reducing consumption of energy and materials
<b>Waste treatment</b>	Public	Collecting waste, material and energy recovery of waste	Fully	Clean environment, clean water	Mitigating pollution, improving health
<b>Energy service companies</b>	Public	Contracting products	Fully	Aiming for efficient use of energy and materials	Lower consumption of energy and materials
<b>Metro, public transport</b>	Public	Providing the metro system	Fully	Low-emission transport	Less emissions and pollution
<b>E-mobility</b>	Mostly public	Providing transport services	Fully	Low-emission transport	Less emissions and pollution
<b>Services, public administration</b>	Mostly public	Public remits, superintendence	Partly <30%	Supporting green projects; providing information & statistics on green issues; reducing own emissions & energy consumption	Environmentally better educated population; more incentives for green projects; reduced emissions & energy consumptions

Source: Own compilation.

### 3 RESULTS: ESTIMATE OF GREEN JOBS IN DUBAI

#### 3.1 ELECTRICITY, GAS AND WATER

Although of utter importance to health and well-being of the people, few employees work in the electricity, gas and water sector. The statistics give 8,659 people in this sector. Since this includes the electricity sector and power generation from fossils, only parts of this employment can be considered green according to the ILO or UNEP definition. Water treatment is the one subsector which will be considered fully as green employment following studies commissioned by ILO.

##### 3.1.1 WATER TREATMENT

Water treatment in Dubai falls into generation of drinking water (desalination) and waste water treatment. Currently, Dubai has two large plants: The Jebel Ali Sewage Treatment Plant and the Jebel Ali Power and Desalination Plant.

##### JEBEL ALI SEWAGE TREATMENT PLANT

The Jebel Ali Sewage Treatment Plant is able to handle 300,000 cubic meter of wastewater per day (AECOM 2016). It was constructed by Dubai Municipality in the years 2007 to 2010 and serves the rapidly growing west Dubai area. Meanwhile the sewerage plant provides its service for more than half of Dubai's population.

The plant treats trucked wastewater from unsewered areas as well as domestic wastewater from the sewer network or industrial wastes. The Jebel Ali STP is an advanced biological nutrient removal facility. It possesses deep bed filtration and UV disinfection. Treated sewage effluent (TSE) achieves full urban water reuse quality, so that the TSE can be pumped into Dubai's TSE network. Using employment factors from Germany<sup>7</sup> or Tunisia<sup>8</sup> yields:

**Table 6: Employment from waste water treatment under different labor intensities**

	Employment from operation and maintenance
→ with Tunisian data	500
→ with German data:	454

Source: Own calculation.

##### JEBEL ALI DESALINATION PLANT

The Jebel Ali Power and Desalination Plant on Dubai's coast produces 470 million imperial gallons per day (MIGD) of desalinated water. Officially opened April 8, 2013, the plant is operated by DEWA. From international data on the Victoria Desalination Project in Australia we obtain an employment factor in the operation and maintenance phase of 0.333

<sup>7</sup> Destatis 2016.

<sup>8</sup> Lehr et al. 2012.



jobs (full time employment equivalents) per billion liter and year.<sup>9</sup> The Poseidon Plant<sup>10</sup> in Carlsbad, United States of America, is operated on 0.36 FTE/billion liter. Supposing economies of scale also in operation and maintenance, the 780 billion liter per year of the Jebel Ali plant require 250 FTE for operation and maintenance.

In total, water treatment and waste water treatment directly employ up to 750 people (FTE). The Poseidon Plant's 25 direct employees launch 175 indirect jobs during operation and maintenance. This is a ratio of direct:indirect jobs of 1:7. Assuming a significantly lower integration factor for Dubai, the estimate of indirect jobs from desalination is 250 FTE. For waste water treatment the factor is assumed similar, which yields an additional 450 jobs.

### 3.1.2 ENERGY SERVICE COMPANIES

In the energy sector, energy service companies are provide green jobs. Dubai has set ambitious targets to improve the efficiency of energy use in the Emirate, aiming for a 30% improvement by 2030. ESCOs, or Energy Service Companies, are seen as a potentially valuable way of delivering energy savings. The distinctive feature of ESCOs is that they offer "performance contracting", that is they assume some risk for the delivery of the energy saving measures they propose to a client.

The RSB has developed a regulatory framework intended to support the ESCO market, comprising an accreditation scheme for ESCOs, standard contracts for use by ESCOs and their clients, a protocol for measuring and verifying energy and water savings, and a tailored approach to resolving disputes.<sup>11</sup> The list of accredited ESCOs can be seen below.

**Table 7: List of accredited ESCOs by RSB in Dubai**

ESCO Name	Accreditation Type	Expiry Date
Zamil Coolcare MRO	Provisional	August 22, 2017
Smart 4 Power	Provisional	April 28, 2017
Siemens	Full	February 24, 2019
AW Rostamani Technical Works	Provisional	February 24, 2017
Bahri & Mazroei Technical Systems Co. (LLC)	Provisional	September 02, 2016
Pactive Sustainable Solutions	Provisional	June 14, 2017
Proliance Energy Solutions LLC	Provisional	June 29, 2017
Honeywell International ME Ltd (Dubai Branch)	Full	January 28, 2018
Philips Lighting Export B.V	Full	June 29, 2019

<sup>9</sup> Victoria State Government 2016.

<sup>10</sup> See Homepage of Poseidon Water 2016.

<sup>11</sup> RSB 2016b.

Green Technologies	Provisional	December 13, 2016
Al Arsh Facilities Management	Provisional	May 26, 2017
Johnson Controls Air-Conditioning & Refrigeration Inc. (Dubai Branch)	Full	May 15, 2017
Energy Management Services Emirates LLC	Full	May 04, 2017
Enova Facilities Management Services LLC	Full	April 01, 2017
Smart Automation Energy	Provisional	June 29, 2017

Source: RSB 2016a.

### 3.2 DISTRICT COOLING

70% of peak electricity demand is demand for cooling. Centralized cooling can be much more efficient than individual units. In analogy to the well-established district heating concepts in cold countries, one speaks about district cooling. The claim of district cooling is that it is twice as efficient as individual air conditioning. There are already over 70 district cooling plants operating in Dubai with a combined cooling capacity in excess of 1 million refrigeration tons. From the data of one of the companies, which offer district cooling and publish employment data, employment factors are obtained. The Abu Dhabi based company, among other projects, operates the cooling of the Dubai metro. With an average of 10 FTE/cooling plant; or 0.73 FTE/1000 refrigeration tons, total employment from district cooling amounts to an estimated 700 FTE.

### 3.3 WASTE TREATMENT

The amount of waste piling up in Dubai had almost doubled, from 6,000 tons in 2008 to 11,500 tons in 2011. According to Dubai Municipality, the rate is back down to the “normal” 7,000 tons per year in 2014.<sup>12</sup> In Dubai, where 2.2 million people live, the daily garbage output is 2.3 kg per person on average. Dubai Municipality estimates the city recycles 25 per cent of its refuse, but it aims to increase this to 75 per cent by 2021.<sup>13</sup>

Based upon estimates from the literature (Lehr et al. 2016), the employment factor for waste collection is 1 FTE/1000t and for operating the landfill 0.175 FTE/1000t. This brings green jobs in waste management to 320 in landfill operation and 1850 FTE in collection.

### 3.4 HOTELS

From the almost 120,000 people, who work in hotels and restaurants, how many actually have a green job? Dubai concentrates 66% of all tourists in the United Arab Emirates and generated almost AED 130 trillion in total value in tourism in 2014. Eco tourism features

<sup>12</sup> Masudi 2014.

<sup>13</sup> Al Bustani 2014.

very low in Dubai. Initiatives to reduce CO<sub>2</sub> emissions<sup>14</sup> by 20%, and to save water and reduce the hotel's eco-footprint exist. But this creates jobs in other economic sectors: a better building standard creates jobs in the construction sector, better waste management in the waste sector and the services. Green jobs in tourism in general are jobs concerned with wildlife management, eco-tour guides and presentations about nature conservation. We estimate these jobs currently at 0.5 to 1%, yielding 600 to 1,200 jobs.

### 3.5 RENEWABLE ENERGY

The UAE is an energy region. Lately, it stands increasingly not only for fossil fuels, but for a vast potential for generation of electricity and heat (cooling) from renewable energy sources. While Abu Dhabi is the most visible with its plans for the 100% renewable energy city Masdar, Dubai also has started activities in this area. Latest since 2013 this became visible, when the first phase of the Mohammed bin Rashid Al Maktoum Solar Park in Seih Al-Dahal, about 50 kilometers south of the city of Dubai, was installed. The 13-megawatt (DC) solar farm<sup>15</sup> has been constructed by First Solar in 2013. The second phase will be a 260 MWp photovoltaic plant, which will be built by ACWA Power, a Riyadh-based company. It is expected to be completed in April 2017 (Meza 2015). In 2015, Dubai Electricity and Water Authority (DEWA) announced the third phase of 800 MWp. Employment from these plans can be derived with the help of employment factors (Greenpeace et al. 2015, Rutovitz & Harris 2012).

**Table 8: Data for the calculation of employment from PV**

		Until 2013	2013-2017	2015-2020
<b>MWp</b>		13	260	800
	<b>Jobs/MW</b>	<b>Person Years</b>		
Production	6.9	-	-	-
Installation	10.9	141.7	2,834	8,720
O&M	0.3	3.9	78	240

Source: Own estimation.

To derive an estimate for Dubai, we need to take the economic structure into consideration. We assume, that modules and cells will be imported also in the future. The first 13 MWp and the 260 MWp as well, were produced by First Solar. The planning and the design of the 260 MWp plant is done by ACWA Power, based in Saudi-Arabia. 75% of the installation jobs are in actually building the solar park. Therefore between 2015 and 2020, assuming productivity increases roughly, 8,720 person years will be spent on this green activity between 2015 and 2020. Depending on the time profile of the construction works this can be translated into several different green jobs impacts over time. Assuming a continuous activity, we find an average of 1,430 jobs each year for the six years building time.

<sup>14</sup> See Homepage of the Department of Tourism and Commerce Marketing (DTCM 2016).

<sup>15</sup> See Homepage of the Dubai Electricity and Water Authority (DEWA 2016).

Water heating from solar thermal collectors is also commercially available, but its use is currently limited to large installations (mainly hotels), Dubai (where it is required in new buildings), and government-funded housing for UAE nationals in Abu Dhabi. There is very significant untapped potential, but very limited data available.

Worth mentioning are the activities of the Dubai aluminum company. The company has run a successful pilot for over a year to convert process waste heat into on-site cooling using absorption chillers. While details are unavailable (Masdar Institute & IRENA 2015), expansion is believed to be commercial under future incremental gas prices. Employment effects cannot be estimated at this stage.

### 3.6 THE CONSTRUCTION SECTOR

The construction sector is one of the most important economic sectors in Dubai. 380,394 people were employed in this sector last. To identify the share of green jobs therein, one has to attribute these jobs to green activities. Direct jobs lie in the construction of green buildings. The following estimate is based upon an estimate of additional costs of energy efficient, green buildings, an estimated share of buildings as opposed to roads and infrastructure in total employment in construction and in turn-over and value added in the construction sector and an estimate of employment factors for green buildings.

The first Platinum LEED certified green building in Dubai was the Pacific Controls Headquarters in the TechnoPark with an initial investment of 25 million AED in 2005 for occupancy of over 400 employees<sup>16</sup>. Legislation has been in force to support green construction in Dubai starting in 2010. Other Platinum buildings were built afterwards such as the Dubai Chamber and DEWA Sustainable Building. The latest costing 75 million AED is the largest government building in the world with a Platinum rating for green buildings.<sup>17</sup> In May 2014, UAE ranked 9<sup>th</sup> on the list of green building nations according to the US Green Building Council with 1.82 million of gross square meters of LEED certified space. The UAE represents a green building success in the Middle East.<sup>18</sup>

The following table reflects current employment in Dubai and total turnover in the construction sector in the last 10 years according to the publicly available statistics from Dubai Statistics Center: From this table, an estimate of average turnover per worker can be obtained (employment factor).

**Table 9: Turnover and employees in the construction sector**

DIRECT EFFECTS	2007	2008	2009	2011	2012
employment	644,488	716,005	601,332	490,165	464,711
total turnover (million AED)	119,129.0	152,066.0	99,491.0	90,833.6	82,800.2

Source: Dubai Statistics Center 2009 & Dubai Statistics Center 2013a.

<sup>16</sup> Pacific Controls 2005.

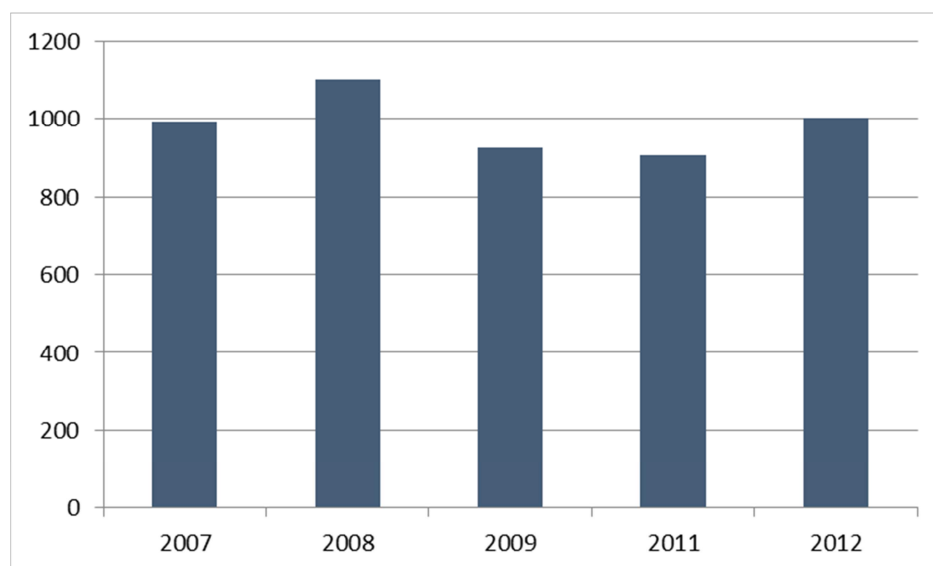
<sup>17</sup> Emirates 24|7 News 2013.

<sup>18</sup> Gulf News 2014.

The average turnover per worker is around 180.000 AED, this brings the employment factor to 5.5 FTE per million AED. The additional costs per building are 5% in most countries according to estimates in the literature. The above mentioned project with 75 million AED then yields 3.75 million additional costs and gives extra jobs to 20 people due to a more complex installation, higher quality of the material and therefore greater care in handling the materials.

If annually the share of buildings over other infrastructure lies in the realm of 8% (data from other countries in the region) and half of these buildings are built according to LEED standards, the additional employment from the green building sector amounts to 1000 people (see Figure 2). The share of buildings according to LEED standards rises over time, reflecting the success that LEED had in Dubai. Also, more demanding technologies and products require better skills inside the labor force. This is reflected in higher wages for the workers on an LEED construction site. Regarding the debate in international organizations on green jobs being characterized by decent work conditions, better building standards also help to improve the work conditions and the wages on the construction site.

**Figure 2: Green jobs from construction**



Source: Own calculation.

The construction sector delivers relevant inputs to other sectors, giving rise to indirect employment. For all sectors above, the proxy for the share of construction is an annual 2% of investment. Indirect employment induced in the construction sector therefore amounts to 250 jobs.

### 3.7 CROSS-SECTIONAL AND SERVICES

More than 130,000 people work in service activities for real estate, rental and the activities of businesses. More detailed data are not available. From international structural analysis we estimate the share of indirect jobs from the green turnover in the construction sector (1.55%), the renewable energy sector (2%) and the hotel sector (1.45%).

Indirect jobs in the service sector from the green activities yield up to 100 jobs.

Public administration, campaign development and the indirect employment from printing material, distributing information and organizing meetings should be estimated collectively on top of this. In total there are currently roughly 5,000 green jobs in Dubai.

### 3.8 GREEN JOBS IN THE TRANSPORT SECTOR

#### 3.8.1 HYBRID TAXI

Dubai's Roads and Transport Authority (RTA) plans to convert 50% of Dubai taxis into hybrid vehicles by 2021. In 2015, the fleet of taxis in Dubai had 147 hybrid cars. For the end of 2016, 791 taxis shall be reached and following an elaborate pathway to 2021, 4,750 hybrid taxis will be obtained. Hybrid taxis are in trial operation since 2008 and reports show that the hybrid fleet has 34% less emissions and 33% less fuel consumption (WAM 2016).

Dubai has a total number of taxis of 8,042 (2012 data, Dubai Statistics Center 2012), which offer 95,525,514 trips per year. With an average duration of a shift of 8 hours, each taxi needs at least 3 drivers per day. Day off, sick leave and other absences included leads to 3.6-4 drivers/car. Assuming that driving a hybrid taxi is a green job, the hybrid cars yielded 588 green jobs in 2015. If the plans for 2016 will be successful, this number will grow to 3,006 jobs.

#### 3.8.2 METRO

The Dubai Metro has a length of 52.1 kilometers on the Red Line and 19.917 kilometers on the Green Line. Both lines together had 137.76 million passengers per year in the year 2013, in 2014 164.307 million passengers compared with 109.491 million passengers in 2012. This translates into 377.5 to 450 thousand passengers per day on average. Given the length and the amount of passengers, the Dubai metro is about half the size of the Hamburg metro system. Assuming the same employment factors in relation to the length of the metro lines (7 employees/km) we obtain the estimate for employment from the metro currently as 500 to 550 jobs.

During its building time, it triggered large indirect employment in the construction sector, up to 10,000 people during the construction years. Between 2010 and 2011 RTA reduced employment by 1,500 people due to a reduction in busses and the completion of the metro project.

#### 3.8.3 GREEN JOBS AT RTA

Abras belong to the Dubai creek. Typically they are diesel powered, but RTA has launched the operation of CNG powered abras instead. In 2013, RTA also deployed seven electric-powered abras; meanwhile this small fleet grew to 17 abras. Additionally, this year (2016) RTA has started the trial run of a solar powered abra (WAM 2016). The drivers are estimated by the same driver/vehicle employment factor we used for taxis above: 3.6 to 4 drivers per boat. This yields 68 drivers of environmental friendly abras as of today. RTA also made the headlines when an electric powered bus was introduced last year. It is still in the trial phase.

Ascending e-mobility increases the need for charging stations. Emirates National Oil Company (ENOC), a wholly-owned entity of the government of Dubai, has installed seven electrical vehicle charging stations at ENOC/EPPCO service stations across Dubai. Building them includes indirect employment from construction, too. Also mainly as an impact to the construction sector serves the plan to replace street lighting with energy efficient LED bulbs.

### 3.9 GREEN JOBS AT OTHER GOVERNMENT BODIES

Dubai has a total of 74,872 employees in local government departments. Green jobs are assigned to the following departments: Roads and Transport Authority (partly, see above), Dubai Electricity and Water Authority (partly) and Dubai Statistics Center (partly). Including indirect effects this amounts to 5,000 green jobs.

## 4 CONCLUSIONS AND OUTLOOK

More than 12,000 people currently hold a green job in Dubai. The assessment above is based on assumptions, often taken from the literature and case studies in other countries. The following table gives an overview of the employment factors applied.

**Table 10: Employment Factors**

<b>District cooling</b>	10 FTE/cooling plant or 0.73 FTE/1,000 refrigeration tons
<b>Waste collection</b>	1 FTE/1,000t
<b>Operating the landfill</b>	0.175 FTE/1,000t
<b>PV installation</b>	10.9 Jobs/MW
<b>PV O&amp;M</b>	0.3 Jobs/MW
<b>Construction</b>	5.5 FTE/million AED
<b>Metro</b>	7 employees/km
<b>Taxis + abras</b>	3.6 to 4 drivers/taxi resp. abra

Source: Own compilation.

The statistics on physical quantities in most cases are more elaborate than the statistics on green jobs. Application of the employment factors to water treated, waste collected and buildings built yields a first data based estimate of the employment from economic activities, which

- reduce consumption of energy and raw materials,
- limit greenhouse gas emissions,
- minimize waste and pollution and
- protect and restore eco-systems.



The largest number of green jobs is found in the services, from campaigns, information design, providing information etc. by governmental bodies and supporting services. Construction is the second largest entry. Hotels and eco-tourism come in third in the ranking of sectors by number of green jobs. Both, construction and hotels & tourism will grow in the next couple of years due to the Dubai Expo.

**Table 11: Green jobs in Dubai – estimates of status quo**

	Between 2013 and 2015 [jobs/a]
<b>Desalination, indirect jobs</b>	500
<b>Waste water treatment</b>	900
<b>District cooling</b>	700
<b>Waste collection</b>	1,850
<b>Landfill operation</b>	320
<b>Hotels</b>	600 to 1,200
<b>PV production</b>	-
<b>PV installation</b>	100
<b>PV O&amp;M</b>	4
<b>Construction</b>	1,250
<b>Service sector, indirect jobs</b>	100
<b>Public administration, campaign development and the indirect employment from printing material, distributing information, organizing meetings</b>	5,000
<b>Transport: hybrid cars</b>	588
<b>Metro</b>	Currently: 500 to 550 <sup>19</sup>
<b>Abras</b>	68
<b>Sum</b>	<b>12,830</b>

Source: Own calculation.

If this estimate shall be extended to future activities, we need scenarios for the future development in terms of kilometers new metro, square meter of efficient buildings, liters of desalinated water, liters of water treated, tons of waste collected and so on. Assuming an increase in labor productivity from historic data, we find future employment by multiplication with the employment factors.

<sup>19</sup> During the metro's building time: 10,000 ind. jobs in construction.



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