International Labour Organization

PAGE PARTNERSHIP FOR ACTION ON GREEN ECONOMY

Green jobs and employment impacts of a green and low carbon strategy in Mauritius

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Geneva: International Labour Office, [2022]

ISBN: 9789220385579 (web PDF)

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This research is coordinated by the ILO with the Green Jobs Assessment Institutions Network (GAIN) as part of the Partnership for Action on Green Economy (PAGE)– an initiative by the United Nations Environment Programme (UNEP), the International Labour Organization (ILO), the United Nations Development Programme (UNDP), the United Nations Industrial Development Organization (UNIDO) and the United Nations Institute for Training and Research (UNITAR).

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Background

Mauritius' Climate Change Act entered into force in April 2021 and the National Determined Contributions (NDC) were submitted to the Climate Secretariat in October 2021, stepping up the island's long-term commitment to sustainable development. Mauritius aims to reduce overall Greenhouse Gas (GHG) emissions by 40% in 2030 compared to the Business-as-Usual (BAU) scenario, levelling up existing green strategies and climate policies.

At the same time, Mauritius aspires to further economic growth and job creation while addressing the increasing socio-economic expectations of a growing high-income country, as which Mauritius was identified in 2019. There is a strong commitment to develop both the economy and society whilst subduing the adverse impact on the living environment. Following consultations with and assistance from institutions at both national and international levels such as through the ILO and the Partnership for Action on Green Economy, several policies and programmes have been implemented in Mauritius to help the island to make the transition to a greener economy and to promote green jobs. With the new and ambitious climate target and socio-economic expectations, the key question is which type of policies and strategies would maximize employment creation and economic growth while at the same time reaching the climate target? This research finds that economic sectors having a potential for green jobs directly offer opportunities to reduce GHG emissions. While the link between the creation of green jobs and a transition to a green/low carbon economy seems evident, there is a need to establish their mutual benefits and possible pathways.

This report sets out to quantify the impact of climate policies (as reflected in the NDC strategy) on the social, economic and labour market outcomes. It will contribute to answer key questions as regard to societal and employment implications a 40 % reduction would entail. Notably, it will answer the questions about employment and GDP effects by sector, as some sectors will incur benefits while others will incur loss. How do emissions vary in a Business-as-usual scenario versus in an implemented Green and Low Carbon Strategy (GLCS)? Lastly, what kind of labour market policies are required to skill the workforce while enabling and protecting job conversions from declining to growing sectors? Quantitative estimates of potential labour market implications will help the Department of Climate Change (responsible to coordinate the implementation) and the Inter-Ministerial Council on Climate Change to set evidence-based national objectives, strategies and policies with a view to maximize employment gains and ensuring a just transition to a climate resilient and low emission country. For a just transition strategy which supports Mauritius' development to a high-income state.

Objectives

Several pertinent questions remain: can Mauritius make the transition to a Green/Low Carbon economy and create jobs at the same time? What are the relative indirect output and employment impacts? How are GHGs likely to change in a no-action scenario versus one with a Green/Low Carbon Strategy? Most importantly, what are the implications with regard to human resource and skills development? Answers to these questions are the core objectives of this report. Four sectors which have the potential to reduce GHGs are analysed: Agriculture, Manufacturing Textile, Lodging and Accommodation and Electricity. The Waste sector having a potential for GHGs reduction is not within the scope of this report given that the estimates on specific waste management options (compost, anaerobic digestion) are yet to be defined.

Methodology

The analytical framework is based on five pillars: (i) an assessment of green jobs across economic sectors, (ii) the calculation of sectoral GHGs, (iii) the relationship between green jobs and low-carbon

transition through inter-industry linkages and economic wide impacts, (iv) a 'What if' analysis, (v) and finally an estimation of the human resource and skill development requirements. The analysis is based on the 2019 data corresponding to the pre-COVID19 pandemic. However, it assumes a recovery for the period 2021-2023 and growth scenarios up to 2030.

Establishing the scale of green jobs in Mauritius: Given the challenging nature of a complete mapping of Green Jobs, this report follows the internationally agreed framework of the System of Environmental Economic Accounting (SEEA) and its definition of Employment in Environmental Goods and Service Sector (EGSS), i.e., employment in resource management and environmental protection activities, the two categories defined by the SEEA guidelines. The report categorises green jobs in terms of employment in resource management, where the resource efficiency criteria can be clearly identified such as in the Agricultural, Manufacturing Textile, Lodging and Accommodation, and Electricity sector. It also identifies green jobs in environmental protection activities sector in terms of sustainable processes, and several sectors whose practices and output are linked to improving the environment (e.g., as identified in waste management, sustainable fishing, land and ocean recreations, among others). It does not, however, add the Decent Work concept to the analysis, as per 2013 Guidelines of the International Conference of Labour Statisticians (ICLS). While this report recognises that Mauritius is a welfare state which has established a comprehensive system of non-contributory social security as well as national labour legislation, prescribing minimum terms and conditions of employment, which is observed by the majority of establishments, there still exist certain segments of the Labour Market, within the informal sector, whereby the application of the existing legislations proves to be difficult, thus warranting a subsequent report to fully map the Decent Work conditions

GHGs emissions: Using information from the National GHGs Inventory Report, and data from fossil fuel consumption in enterprises-related surveys and Census, the GHGs in terms of carbon emission equivalent (CO_2 eq.) are calculated. The process- and transport-related emissions are calculated separately.

Inter-industry linkages and economy-wide impact: Direct impacts are those that result from the green sectors specifically while indirect impacts relate to the rest of the sectors of the economy due to increased demand for goods and services as a result of growth in green industries. Induced impacts result in all industries due to a growth or decline in income which boosts or lowers household consumption. The direct/indirect/induced impact of green/low carbon sectors on GHGs and green jobs are calculated through the concepts of multipliers, using an Input-Output (IO) approach. The IO table, constructed specifically for this study, subdivides the economy into 79 sectors or industries (the statistical term for economic activities, including the green/low carbon). The production linkages of the green industries have been worked out using both secondary and primary data.

'What If' analysis: a What If analysis is conducted by comparing a Business-as-Usual (BAU) Scenario with a Green/Low Carbon Strategy Scenario (GLCS) for Mauritius for the period 2022-2030. The BAU Scenario assumes that the economy, with its current structure, continues to grow at 4% annually for the period 2024-2030, based on a no-action historic trend of the economy, green jobs and CO^2 emission. The economic shocks of the COVID-19 led to a decline of GDP by 14.9% for Mauritius in 2020. Both the BAU and GLCS scenarios assume a full economic recovery of sectors impacted by the COVID-19 pandemic by 2024 to reach the initial 2019 GDP level. Onwards, sectoral growth rates corresponding to their long-term trends (based on the last 5 years of performance prior to the COVID-19 pandemic and likely changes in emerging sectors) are applied. The GLCS projects an increase of green/low carbon output by 2030 in the agricultural sector (50% of the total output), manufacturing textile (35% for Yarn and Threads, and 70% for Knitted and Crocheted Fabrics), Lodging and Accommodation (50% of the industry output), and renewable source of energy in the Electricity sector (60% of the total electricity output). The analysis compares both Scenarios in terms the output, employment, and CO_2 eq. (direct, indirect and total).

Human resource and skill development: finally, employment generated through the GLCS is further examined in terms of the types of occupations and skills requirements. The International

Standard Classification of Occupations (ISCO) is used to further assess the required skills.

Findings

The total direct employment in the Environmental Goods and Service Sector stood at 10.3% in 2019. This is an increase to the Green Jobs Assessment for Mauritius in 2012 which showed that 6.3% of total employment (excluding the public sector) were classified as green, an improvement over the 7 year period of 55.6%.

Green Jobs in the non-sugar and sugar cane agricultural sector, high seas and fish aggregating devices (FAD) fisheries, and aquaculture sectors, represent 16% of employment in the Agricultural sector. In the Manufacturing sector, 20% jobs are classified as green, observed: in sugar milling, partly in textile sector, and fish processing (given the assessment to EU standards). In the Services sector, the Lodging and Accommodation shows 13% of employment as green. Around 24% jobs are classified as Green in renewable electricity generation. Remaining activities comprising green jobs include cleaning and landscaping, sewage and refuse disposal, water and waste management, land-based and ocean-based sports and recreation activities and public transport. The number of green jobs, in 2019, was approximately around 60,000.

An assessment of inter-industry linkages shows that green agriculture tends to produce more jobs as compared to conventional agriculture, mostly due to the higher direct, indirect, and induced output multiplier, linked to the greater use of domestic resources in the supply chain as opposed to chemical imports. The Employment multiplier stands around 3.00 for the green component as compared to 2.69 for the conventional one. This implies that for each 10 million of growth in final demand, 30 jobs are created in green agriculture as compared to 27 jobs in the conventional production system. In contrast, the direct CO_2 eq. emission for the green agriculture is 1.65 as compared to 6.13 for conventional one. In turn, for each Rs10 million growth in final demand, only 16.5 tonnes of CO_2 eq. are emitted in the green production system as compared to 6.1 tonnes in the conventional counterpart.

The green Textile industries and green Lodging and Accommodation have lower indirect output multipliers (0.48 vs. 0.58 and 0.39 vs. 0.43 respectively) due to resource efficiency which, in turn, leads to higher employment multipliers as efficiency measures require more jobs in service and maintenance. Due to the efficiency gains, the carbon emission per output is significantly lower for the green Manufacturing Textile sector, but slightly lesser in the Lodging and Accommodation.

The output multiplier for renewable source of electricity is slightly higher than that of fossil fuels (0.30 and 0.29). The employment multiplier is also higher with 0.14 versus 0.11 for fossil fuel electricity. The direct emission coefficient, as expected, is zero for renewable electricity, however the indirect emission multiplier is 4.296 as compared to 4.198 for fossil fuel due to domestic supply chain linkages.

Green/Low Carbon Strategy Scenario versus Business-as-Usual (no-action) (BAU) Scenario: The BAU Scenario leads to a total of 21,831 green jobs by 2030, across the four sectors, thus representing 3.1% of employment in those sectors. The Green/Low Carbon Scenario, in turn, leads to an increase of up to 66,974 in Green Jobs by 2030 (207%). Importantly, total employment for the entire economy is higher in the Green as compared to the BAU scenario, adding more than 5000 jobs across the economy. As the economy is growing at the same rate as in the BAU scenario, there is a fall in CO_2 eq. in the Green scenario with an associated rise in overall employment.

In the BAU scenario, a full recovery by 2023 and an annual 4% GDP growth onwards will lead to a 31% increase in tCO_2 eq. for Mauritius by 2030, while the Green/Low Carbon Strategy, reflecting the NDC strategy, would lead less CO_2 emission by 32% as compared to BAU situation. Energy consumption in Manufacturing Textile is around 14% lower than BAU. The CO_2 eq. related to the energy sector (processes and transportation) is 40% lower than the BAU. These results exclude waste management strategy and transport policy for Mauritius. The transition towards a low carbon economy and the creation of green jobs lead to an absolute decoupling of the CO_2 eq. from GDP growth.

Finally, the report estimates the human resource requirements in terms of employees in different

occupational groups (managers, professionals/ technicians, clerical, services, craft workers, plant and machineries operators and elementary jobs) and discusses the required skill development to spearhead the transition towards a green/low carbon economy. The analysis suggests that skill upgrade is needed for all occupational groups, ranging from managers to professionals, technicians, to plant and machinery operators, and elementary employees. In terms of Production and Specialized Services Managers green skills are required across economic sectors. Different aspects of skill development include knowledge, expertise and working practices geared towards sustainability, efficient reporting, novel marketing approaches (branding, packaging, eco-design), and climate change adaptation and mitigation strategies. At Professional and Technicians level, skills in relation to the manufacturing sector and Lodging and Accommodation include the implementation of ISO14000, Life Cycle Assessments, carbon footprint assessment, energy auditing, eco-friendly processes with minimum environmental impacts. Two main jobs at clerical level occupations that would require green skill upgrade are General and Keyboards Clerks, and Numerical and Material Recording. Craft and Related Trades Workers and Plant and Machinery Operators may need to operate different green and energy efficient machineries and equipment and would also require training and enhanced skills in green practices.

Conclusion

In order to reach the 40% emission reduction target, this report concludes that key sectors of the Mauritian economy, notably energy, including transport, agriculture, manufacturing and tourism require significant additional capital and human resource investments in green technology and skills development. The current strategies and individual sector targets are not sufficient and would result in an economy wide reduction of 32%, with a remaining gap of 8%. This is due to the indirect and induced emissions which result even in the Green scenario from a growing economy. To incentivize extra private sector investment and greener business practices a progressive price on carbon while offsetting energy cost increases for low-income households, green tax rebates and concessional loans, green technology standards and regulations should be further enacted.

A positive conclusion from this analysis is, however, that increased climate ambition, higher sector targets and additional green investments will accelerate the transition towards a low carbon economy for the period 2022-2030 and thereby contribute to further GDP growth and more net job creation as compared to a Business-as-Usual scenario.

As a significant number of green jobs is required in main economic sectors to spearhead this transition, it is a pre-requisite to prepare the labour force to enable them to match the capital investments in the green sectors of Mauritius. The move towards energy and resource efficient enterprises will require initial training as well as varying skilling and an up-skilling of the personnel at different levels on green practices. Green skills are likely to be essential for different occupational groups, ranging from managers to professionals, technicians, to plant and machinery operators, and elementary employees. There is a need for a coordinated approach between public and private sector. A Green Skill Development Plan is the way forward, which must be adopted holistically by relevant stakeholders, including training centres and educational institutions. In addition to skills policies, well designed macro-economic, industrial, enterprise and social protection policies could further maximise employment gains, accelerate the transition, and make it just for all Mauritian men and women.

1. Introduction

Mauritius' Climate Change Act[1] entered into force in April 2021 and the National Determined Contributions (NDC) [2] were submitted to the Climate Secretariat in October 2021[3], stepping up the island's long-term commitment to sustainable development. In line with the Paris Agreement on Climate Change (2015), these denote a higher commitment to develop a global framework to combat climate change and a build a low-carbon and climate-resilient economy. With the updated NDC, Mauritius aims to reduce overall GHG emissions by 40% by 2030 as compared to the Business as Usual (BAU) scenario.[4] The Government Programme 2020-2024 further reaffirmed the commitment to adopting more responsible environmental friendly policies, with more investment devoted to clean energy so as to transition to a cleaner and greener Mauritius, thereby reducing risks associated with climate change[5]. Eventually, in the 2021-2022 Budget Speech[6], the Government sets the target of producing 60% of the country's energy needs from green sources to completely phase out the use of coal by 2030.

At the same time, Mauritius aspires to further economic growth and job creation to address the increasing socio-economic expectations of a growing high-income country, as which Mauritius was identified in 2019. Conforming to the Paris Agreement, which unconditionally advocates the creation of employment and promotion of decent and quality jobs, Mauritius seeks to achieve a shared objectives to improve human well-being by 2030 and beyond for a development that ensures the creation of jobs, a fair sharing of wealth and fosters environmental resilience. A just transition strategy would also support Mauritius' greater expectation in terms of socio-economic development for the next decade as it is currently facing a persistent skills mismatch in the labour market, which is contributing to a high level of youth and female unemployment[7]. There is thus a search for pathways that would bring about economic growth, low-carbon economy, and jobs creation.

In 2020, the COVID-19 Pandemic changed the entire landscape. Being a small island economy, with strong ties to the global economy, Mauritian economy suffered the brunt of shocks with a fall of 14.9% in GDP in 2020. The Pandemic changed priorities towards response and recovery measures. Yet, Mauritius further continues to pursue its environment resilience trajectory with a set of Green Recovery activities aiming towards a sustainable

1 The Climate Change Bill (No. XIV of 2020) Minister of Environment, Solid Waste Management and Climate Change, Government of Mauritius. [https://mauritiusassembly.govmu.org/Documents/Bills/intro/2020/bill142020.pdf] Accessed on 15/07/2022.

2 Republic of Mauritius (2021). Update of the Nationally Determined Contribution of the Republic of Mauritius, pp. 31.

3 The 'Intended Nationally Determined Contribution for the Republic of Mauritius' (INDC) was submitted on 28th September 2015'. The Update of the Nationally Determined Contribution was submitted on 1st October 2021 and the First Biennial Update Report (BUR1) to the UNFCCC was submitted in December 2021. [https://unfccc.int/sites/default/files/NDC/2022-06/Final%20INDC%20for%20Mauritius%2028%20Sept%202015.pdf] [https://unfccc.int/sites/default/files/resource/First%20Biennial%20Update%20Report%20-%20Republic%20of%20Mauritius.pdf]

4 The INDC previously sets a target of 30%.

5 Government of Mauritius (2020). Government Programme 2020-2024. Towards An Inclusive, High Income And Green Mauritius, Forging Ahead Together Address by The President of the Republic of Mauritius https://foreign.govmu.org/Documents/2020%20-%20migrated%20data/Gov%20Program%2020-24/govt-programme-2020-2024.pdf.

6 Budget Speech 2021-2022 https://www.mauritiusbudget.com/wp-content/uploads/2022/02/2021_22budgetspeech_english.pdf

7 Bank of Mauritius. 2016. Annual Report, Port Louis.

agro-food industry and the expansion of small and medium-sized enterprises in that sector[8].

With the new and ambitious climate target and socio-economic expectations, the key question is which type of policies and strategies would maximize the creation of employment and economic growth while at the same time reaching the target of the NDC? While the link between the creation of green jobs and a transition to a green/low carbon economy seems evident, there is a need to establish their concurrence, benefits and possible pathways. . The key question is which type of policies and strategies would maximize employment creation and economic growth while at the same time reaching the 40% reduction target?

This report sets out to quantify the impact of climate policies (as reflected in the NDC strategy) on the social, economic and labour market outcomes. It will contribute to answer key questions as regard to societal and employment implications a 40 % reduction would entail. Notably, it will answer the questions about employment and GDP effects by sector, as some sectors will incur benefits while others will incur loss. What are indirect output and employment impacts? How do emissions vary in a Business-as-usual scenario versus in an implemented Green and Low Carbon Strategy (GLCS)? Lastly, what kind of labour market policies are required to skill development while enabling and protecting job conversions from declining in growing sectors? Quantitative estimates of potential labour market implications would help the relevant Ministries and departments to set evidence-based national objectives, strategies and policies with a view to maximize employment gains and to ensure a just transition to a climate resilient and low emission country.

The analytical framework is based on five pillars:

Establishing the scale of green jobs in Mauritius: An update on the status of green jobs in the Mauritian economy from the primary, secondary to tertiary sector is provided. The year 2019 is selected for the analysis as it corresponds to the pre-pandemic period. Various criteria have been applied for the identification and quantification of the scale of green jobs based on the methodologies developed by the ILO and the Green Jobs Assessment Institutions Network GAIN[9]. The range of green jobs is very broad but is also complex given the links between the economy and environment. A complete mapping of the links is challenging. Therefore, this report considers only productive sectors where criteria can be clearly identified. For instance, the Wholesale and Retail Trade Sector, Public Administration, Education among others are not within the scope of identification of green jobs. Emphasis has rather been laid on the agricultural, manufacturing textile, Lodging and Accommodation, and electricity sector in terms of sustainable processes, and several sectors whose goods and services are directly linked to improving the environment (e.g. waste management, sustainable fishing, land and ocean recreations, among others).

GHGs emissions: Using information from the national GHGs Inventory Report and environmental indicators published by Statistics Mauritius, the GHGs in terms of carbon emission equivalent (CO_2 eq.,) for 67 industries in Mauritius are calculated. The process- and transport-related emissions are calculated separately.

Inter-industry linkages and economy-wide impact: further insights are provided regarding the indirect impact of green/low carbon sectors on GHGs and green jobs through the concepts of multipliers – direct, indirect and induced. Multipliers are calculated using an Input-Output approach and the IO table was constructed specifically for this study. The IO table subdivides the economy into 79 industries (including the green/low carbon) and the production linkages have been worked out using both secondary and primary data.

8 https://www.un-page.org/mauritius-officially-launches-green-recovery-activities-targeting-agro-food-sector

9 ILO 2013. Methodologies for assessing green jobs – Policy Brief. International Labour Office, Geneva.

ILO 2017. GAIN Training Guidebook How to measure and model social and employment outcomes of climate and sustainable development policies. International Labour Office.

'What If' analysis: To systematically describe the medium to long term impacts of a 40 % emission reduction and green jobs strategy, a What If analysis is conducted by comparing a Baseline (no-action) Scenario with a Green/Low Carbon Strategy Scenario (GLCS) for Mauritius for the period 2021-2030. The Baseline Scenario assumes a business as usual GDP growth of 4% annually for 2023-2030. The Green/Low Carbon Strategy (GLCS) assumes a 40% reduction of emissions is achieved by 2030. This is accomplished by policies which significantly incentivizes and increases investment into green technology and skills development and which thereby would alter the production structure of Mauritius towards a green and low carbon economy.

Human and skill development: finally, green jobs generated through the GLCS are further examined in terms of the types of occupations and skills requirements. The International Standard Classification of Occupations (ISCO) is used to further classify green jobs and consequently, an assessment of required skills is conducted.

2. The scale of green jobs

Green jobs are created in the quest to preserve and restore a sustainable environment through transformative growth both in traditional economic sectors (manufacturing and construction) as well as in new, emerging green sectors (e.g. renewable energy). Green jobs include **direct jobs** created in green economic sectors and industries as defined by the Environmental Goods and Service Sector (EGSS) in the System of Environment and Economic Accounting (SEEA), and they create other **indirect jobs** in the rest of economy due to demand for goods and services as a result of growth in green industries, and **induced jobs** created in all industries due to growth of income which boost household consumption.

In 2012, the International Labour Office (ILO) conducted the first assessment on the prevalence and potential of green jobs in Mauritius. It was found that 35,000 jobs (representing 6.3% of total employment) could be classified as direct green jobs: those jobs which add value to products and services in a sustainable manner[10]. Since the publication of the ILO report and subsequent consultations with and assistance from institutions at national and international levels (e.g. UNEP, PAGE)[11], various policies and programmes were implemented to help the island to make the transition to a greener economy and promote green jobs. This section conducts an assessment of direct green jobs following progress made since the publication of the first green jobs assessment report.

2.1 Assessment of direct green jobs

Methodology and data issues

The United Nations Environment Programme (UNEP) in 2008 report describes the concept of green jobs as "those that contribute appreciably to maintaining or restoring environmental quality and avoiding future damage to the Earth's ecosystem"[12]. According to the UNEP/ILO, green jobs are defined as the direct employment created in different sectors of the economy and through related activities, which reduces the environmental impact of those sectors and activities, and ultimately brings it down to sustainable levels. These jobs are sustained by economic activities that are more environmentally sustainable than the conventional alternatives and which are also

10 Van der Ree, K. 2019. Promoting Green Jobs: Decent Work in the Transition to Low-Carbon, Green Economies International Development Policy | Revue Internationale de politique de Développement, vol. 11, pp. 248-271. https://journals.openedition.org/poldev/3107.

ILO. 2015, ILO' s assessments on green jobs potential, 15 January, http://www.ilo.org/global/topics/green-jobs/publications/WCMS_190963/lang--en/index.htm

11 The International Labour Office (ILO) has been supporting the Mauritian government and social partners in designing the strategy and policies towards the creation of green jobs since 2011. Reference is made to the ILO report on green jobs assessment **for** Mauritius (ILO 2012) where a number of sectors were identified as potential for green jobs. The UNEP has also assisted through the development of a Green Economy Model for Mauritius. Following a multi-stakeholder consultation workshop in 2013 organised by the UNEP to define the sectors for transition towards a green economy, seven sectors were identified to drive the green economy: agriculture, energy, waste, water, tourism, manufacturing and transport. Both reports are available respectively at http://www.ilo.org/wcmsp5/groups/public/---ed_emp/---emp_ent/documents/ publication/wcms_317238.pdf (accessed on the 9th August 2017) and http://www.un-page.org/files/public/mauritius_ green_economy_assessment_2.pdf (accessed on the 9th August 2017)

12 United Nations Environmental Program (UNEP). Green Jobs: Towards Decent Work in a Sustainable, Low-Carbon World; UNEP: Nairobi, Kenya, 2008

▶ **Table 2.1. Jobs in the Environmental Good and Services Public Sector**

Environment Goods and Services	Department/division	2021/2022	2020/2021
Maritime Zones Administration	Prime Minister's Office: Continental Shelf and Maritime Zones Administration and Exploration	21	21
Ocean management	Fisheries	344	344
	Blue Economy, Marine Resources and Shipping	147	131
Agriculture, forestry and biodiversity	General	274	264
	Competitiveness of the Sugar Cane Sector	30	35
	Development of Non Sugar (Crop) Sector	873	815
	Livestock Production and Development	280	294
	Forests	520	491
	National Parks and Conservation Service	125	126
Environment and Climate Change	General	104	91
	Environmental Protection, Conservation and Monitoring	115	111
	Climate Change Resilience, Greening and Embellishment	615	615
	Solid & Hazardous Waste and Beach Management	79	67
	National Disaster Risk Reduction	16	14
	Mauritius Fire and Rescue Service	1169	1188
	Mauritius Meteorological Services	143	136
Land planning – local Government	Field Services, Inspectors, etc.	8	7
Tourism	Tourism management	12	12
Housing and Land Use Planning	Land Management and Physical Planning	290	269
Public Utilities	Energy efficiency Services	13	12
	Water services	82	82
	Waste water Services	4	4
Heritage management	Preservation and Promotion of Heritage	44	40
Total		**5308**	**5169**

Source: Expenditure by Votes - Budget 2020-2022

decent in social terms.[13] In the initial conceptualisation of green jobs by the Eurostat, green jobs correspond to jobs involved in production in the Environmental Goods and Service Sector (EGSS) and refers to the output approach. This concept of green jobs has been applied by some countries such as Austria, Japan, and South Korea[14]. In the U.S., the Bureau of Labour Statistics (BLS) adopts an additional approach, referred to as the process approach. The latter deals with the jobs related to environmentally friendly production processes and practices. Germany and the EU considers this process approach together with the EGSS sector[15].

While the definition of green jobs varies from country to country, the main focus is the environmental goal of low carbon growth. In this perspective, the Mauritian study adopts both the output and process approach to identify green jobs, in line with the 2012 ILO report and the EGSS. The definitions are applied consequently to the public sector as well as in productive sectors, agriculture, manufacturing and services.

Public sector employment towards environmental goods and services

Over the years, the public sector has strengthened its interventions to build a climate resilient and environmental sustainable economy. Ministries and departments have been specifically established to initiate and implement policies and measures towards climate mitigation and adaptation as well as natural resource management. Green jobs in the public sector are identified using the 'output' approach, i.e., those related to the reduction of ecological risks, restoration and protection of ecosystem services, and implementation of adaptation and mitigation measures against climate change, among others (table 2.1). The data are published for the period 2020-2022, with a minor difference between the years.

Green jobs in the agricultural sector

The agricultural sector in Mauritius comprises of non-sugar activities, sugar-cane cultivation, forestry, fisheries and aquaculture. Over the years, its contribution to GDP and employment has been decreasing. The contribution of agriculture in the economy was 3.3% in 2019, with an employment level of 40,300 representing 7% of total employment. It is still a key sector for food security and social livelihoods of farmers. Its contribution to food security has been mostly recognised during the lockdown during the COVID-19 pandemic.

Non-Sugar Agriculture: Non-sugar agriculture includes tea cultivation, food crops, fruits and flowers. Over the years, the sector has become heavily dependent on chemical inputs such as fertilisers, herbicides and pesticides. Around 52,000 tonne of fertilisers and 2,200 tonne of pesticides are used on average every year. The identification of green jobs in this sub-sector is based on sustainable practices and processes. The use of organic fertilisers is one major criteria for green/sustainable agriculture. The Census of Agricultural Activities shows that 56.5% of farmers used organic fertilisers together with chemicals. However, the proportion mix of its use is not revealed and hence, may not reflect a green component. In contrast, the *World of Organic Agriculture Statistics & Emerging Trends 2019* reported that the share of organic land in Mauritius stands at 0.02% (14ha). In the foodcrops sector, the share represents is 0.1%. These figures have been classified as wild collection since there was no accurate collection of data. In order to have a better insight of the share to be classified as green, focus group discussion and interviews with stakeholders were used and it was reported that around 5% of farmers practised completely organic. This mostly reflects the development regarding sustainable farming initiatives during recent years. For instance, the Zero Budget Natural Farming – a practice of 100% organic agriculture –is being practiced by *Le Vélo*

13 Jarvis, A., Varma, Adarsh., & Justin, Ram. 2011. Assessing green jobs in development countries – A partitioner's guide. International Labour Office. Geneva.

14 Song, K., Kim, H., Cha, J., and Lee, Y. 2021. Matching and Mismatching of Green Jobs: A Big Data Analysis of Job Recruiting and Searching. Sustainability, 13, 4074. https://doi.org/10.3390/su13074074

15 Song et al. 2021, ibid.

▶ **Table 2.2. Green jobs in the agricultural sector**

Sector	Sub-sector/ industry	Criteria	Source	Greenjobs
Agricultural sector	Non-sugar agriculture	Process: use of organic fertilisers/ bio-farming, smart agriculture	Census from Statistics Mauritius; Survey and interviews; World of Organic Agriculture Statistics & Emerging Trends; MauriGAP cerrtification	5.9% of non-sugar agriculture
	Sugar cane cultivation		Bonsucro standards; Fairtrade Labelled Sugars; VIVE Sustainable Supply Programme Sustainable Development Programme (SDP)	9.8% of sugar cane sector
	Forestry	Output: protection and conservation	Employment Statistics	80
	Fisheries	Process: Sustainable fishing	High seas and FAD fishing vs. lagoon and coastal fishing	69% of fisheries sector
	Aquaculture	Process: sustainable practices and low ecological risks	Guidelines for aquaculture	410

Source: computed (ILO)

Vert[16], certified under the *Fondation Ressources et Nature* (FORENA). The latter is an association which promotes organic farming since 2010. In 2020, around 20 farmers have been certified B*io-Ecocert* by FORENA in Mauritius[17]. From primary information collected through surveys and interviews, it is estimated that around 5.9% of jobs in that sector can be classified as green.

Sugar cane agriculture: The sugar cane sector employed 9,000 people in 2019. A declining trend in employment is also observed as compared to 12100 in 2018. Certification standards are used to identify the green component of the sugar cane agriculture. One of the certification standard is *Bonsucro*, global multi-stakeholder non-profit organisation which promotes sustainable sugarcane production, processing and trade around the world. In Mauritius, 225,000 tonnes from Omnicane's farm were certified under the *Bonsucro* Standard (Omnicane is the leading African producer and processor of sugarcane[18]). The *Fairtrade Labelled Sugars* is another certification of sustainable practices. In 2019, Mauritius Sugar Syndicate (MSS) supplied 16,520mt (as compared to 19,630mt in 2018) of sugar from 21

16 La Gazette (2016) Les agriculteurs bio demandent une certification reconnue.

17 Vaghjee, M. (2019). Interview. http://www.r1.mu/actu/societe/-seule-une-vingtaine-de-producteurs-mauriciens-et-rodriguais-sont-certifies-bio-a-ce-jour--p901953

18 https://www.bonsucro.com/what-is-bonsucro/

certified groups on Fairtrade terms[19]. Another initiative is the VIVE Sustainable Supply Programme; the MSS has successfully been accredited to the programme and supplied 10,117 metric tonnes of sugar from Alteo and Omnicane refineries. The sugar was supplied to European and East African industrial users committed to sustainable sourcing. There is also a Sustainable Development Programme (SDP) which was initiated by Ctm Altromercato in Mauritius on behalf of Ferrero in partnership with the MSS under a five-year agreement. The 25 participating cooperatives observed an increase in cane production from 34,351 tonnes in 2018 to 36,311 tonnes in 2019. The programme encourages the adoption of Good Agricultural Practices (GAP) in sugar cane farming. 12 cooperatives which opted for the programme have recorded sucrose extraction rates above the national average by 9.73%. The MSS has supplied 4,000 tonnes of white refined sugar to Ferrero through Ctm Altromercato under the five-year agreement. Considering the amount of sugar produced and supplied under the above mentioned sustainable initiatives, the green component of the industry is estimated at 9.8% of the gross output of the sugarcane cultivation sector.

Forestry sector: The Forestry Service within the Ministry of Agro-Industry is entrusted with the responsibility for the management, protection, rational use and diversification of forest resources in Mauritius, and protection of the Environmentally Sensitive Areas (ESAs) in forests so as to ensure a continuous supply of clean and fresh water for domestic and non-domestic purposes. Part of its responsibilities entail preservation of native species of plants, birds and animals; and development of facilities in forests for leisure and recreation. This component is already accounted for in the public sector green employment. Employment within the department has been stagnant for many years. The remaining employment are involved outside the public sector.

Fisheries: There are four main types of fisheries in Mauritius, namely, (i) artisanal fisheries; (ii) sport fisheries; (iii) banks fisheries: and (iv) tuna fisheries. Artisanal, sport and amateur fishing take place within the lagoon areas of Mauritius and Rodrigues. The inshore fish resources of Mauritius and Rodrigues are heavily exploited because of the open access nature of the fishery thus are unsustainable[20]. The off-lagoon fishery is based on Fish Aggregating Devices (FADs) established to ease the pressure of fishing within the inshore lagoon areas. The Banks fisheries exploit demersal species on the banks of the Mascarene plateau, from Saint Brandon to Saya de Malha. There are five boats and 25 semi-industrial fishing vessels engaged in banks fishing. The off-lagoon and Bank fisheries are considered as a sustainable option and employment is classified as green. Total employment in the fisheries sector stand at 5,808 and 31% is coastal fishers. The remaining 69% are classified as green jobs.

Aquaculture: Aquaculture is an emerging sector in Mauritius. The sector is still in its initial stages of development. But the Ministry of Ocean Economy has been working towards its development with various initiatives and reform programmes in the sector. Jobs within this sector are estimated at around 400 workers, classified as green given it reduces the pressure on the fisheries.

Green jobs in the manufacturing sector

The manufacturing sector is made up of four main industries: sugar milling, food (exc. sugar), textiles, and all remaining, classified as 'others'. Its contribution stood at 12.6% in 2019, with a slight declining trend over the years. The growth of the sector was 0.5 in 2019, averaging 0.62% annually over the last five years. One of the instruments for greening the manufacturing sector is ISO 14000 which is managed by the MSB. However, only a small number of firms have implemented formal environmental management systems. More advanced sustainable production concepts, such as Life Cycle Assessments and Eco-design, are not yet in the discussion. Yet, there are various measures both sector- and industry- wise and policies that have been initiated with varying degree of success.

19 MSS (2020). Annual Report 2019-2020.

20 Morgan, G., Shotton, R., & Russell, D.2011. Elaboration of a Fisheries Master Plan for Mauritius. Pescares Italia SRL. ACP Fish II.

Sugar milling: Sugar mills in Mauritius have co-generation bagasse plants annexed to them for electricity production and low-pressure steam. These plants are referred to as Independent Power Producers (IPPs) in Mauritius and they generate electricity all year round with bagasse during the cane harvest season. During intercrop season, coal is used. The use of bagasse for electricity generation provides an example of circular economic activity in the production of sugar. The production structure is highly energy efficient as the wastes from sugar cane are fully utilised as productive inputs. In this context, all jobs in the sugar milling process are classified as green.

Fish processing Fish processing is mainly for exports. The classification of jobs in the fish processing as green is based on the requirements to the European Union and the standards that have been set therein such as the HACCP system. The scope of operations are assessed by the EU. In an audit exercise carried by the EU in 2014, it concluded that '*In principle the current organisation of the competent authority and the control system implemented offer sufficient guarantees concerning the sanitary conditions of fishery products for European Union export*'[21]. Moreover, the activities in the fish processing originated from the high seas fishing, which is considered sustainable compared to coastal fishing.

Textile sector: The textiles sector has been part of the backbone of the Mauritian economy since the late 1970s. The most recent Census of Economic Activities reported 127 units for Knitted/crocheted fabrics and wearing apparels. The criteria for identifying green jobs is based on the 10% most energy efficient textile manufacturing units. Energy is used in the plant and machinery, including electricity, diesel, gasoline, LPG, fuel oil and coal. Using data on electricity consumption, and other fossil fuels, the 10% most efficient units produced 39.8% of total output, employing 44.9% of the industry. Small and medium enterprises contributed up to 6.7%. The sub-sector Yarn and Thread, Woven and Tufted Textile Fabrics had an employment of 7,246. The 10% most efficient units, using the same criteria as defined for Knitted/crocheted fabrics, employed 850 workers, representing 12% employment.

▶ **Table 2.3. Green jobs in the Manufacturing Sector**

Sector	Sub-sector/ industry	Criteria	Source	Greenjobs
Manufacturing sector	Sugar milling	Process: bagasse-based energy	Employment statistics	1600
	Fish processing	Process: 69% of the fishing industry	EU Standards	3119
	Yarn and thread textile	Process: 10% most efficient enterprise on electricity, fossil fuel energy and water	Census of economic activities and survey	12% Yarn and Thread textile
	Knitted or crocheted fabrics		Census of economic activities and survey	45% of Knitted or crocheted
	Recycling and composting	Output	Survey	203
	Ship building	Process	Employment statistics	1451

21 European Commission. 2014. Final Report Of An Audit Carried Out In Mauritius From 22 To 30 January 2014 In Order To Evaluate The Control Systems In Place Governing The Production Of Fishery Products Intended For Export To The European Union. European Commission Health and Consumers Directorate-General. DG(SANCO) 2014-7138 - MR FINAL. https://ec.europa.eu/food/audits-analysis/act_getPDF.cfm?PDF_ID=11092

Recycling sector: Recycling activities are very minimal in Mauritius. Nevertheless, there are some activities on small scale in relation to paper, PET, textile, tyre repairing, E-waste materials, oil waste and Glass recycling. Composting plants are also encouraged around the island. The survey reveals that around 200 people may be classified as green employment in those recycling firms.

Green jobs in the utility sector: electricity, water and transport

In this category, three industries are considered: electricity, transport and water. The Ministry of Energy and Public Utilities (MEPU) has the responsibility to formulate policies in the energy, water and wastewater sectors, and to maintain a responsive legal framework for governing the above-mentioned sectors. It hosts the Energy Efficiency Management Office and formulates the Small-Scale Distributed Generation (SSDG) scheme. The SSDG scheme allows households to produce electricity through the use of solar panels for domestic purposes and to commercialise the excess. The Government's drive to reduce the use of fossil fuel is reflected in the 2009-2025 Long-Term Energy Strategy to increase renewable energy to a minimum at least 35% of electricity production by 2025. The Government has taken the commitment in the Budget Speech 2020 that it will promote the extensive use of clean and renewable energy and will continue to encourage carbon-free energy generation by accelerating the development and use of renewable energy to reach 60% by 2030. It would also promote research on new renewable energy technologies and would introduce fiscal incentives and budgetary measures to ensure achievement of these targets. The development of renewable energy is a key mitigation action that will also enable Mauritius to reduce fuel imports. The employment in the electricity sector stood at 1,641 in 2019 and the renewable component employment was 15.7%, i.e., around 390 people.

Jobs in the water management sector are also classified as green as there is a quest to sustainably manage water resources. In 2019, employment stood at around 2,117. The public transport component of land transport is classified as green on the basis that the energy per passenger mobility is relatively low as compared to other transport modes. Direct employment in the public transport sector stands at 66% of total land transport sector.

▶ **Table 2.4. Green jobs in utility services: electricity, transport and water sector**

Sector	Sub-sector/ industry	Criteria	Source	Green jobs
Electricity	Renewable energy	Output: differentiated by revenue from bagasse-based electricity and sugar, molasses	Employment statistics	15.7% of electricity sector
		Output: Renewable sources of energy (solar, landfill gas, wind and hydro	Energy and employment statistics	8.1% of electricity sector
Transport	Public transport	Process: energy per passenger	Employment statistics	66% of land transport sector
Water	Sustainable water	Process: management	Employment statistics	2117

Green jobs in the services sector

The services sector contributed to 77% of GDP in 2019, with the accommodation and food service activities alone representing 7.3% to GDP. Implementation of sustainable practices in the hotel sector have been on the rise in recent years. The Mauritius Standard Bureau (MSB) implemented a certification of tourism businesses towards sustainable hotel management - the 'Mauritius Standard (MS) 165 for sustainable tourism'- in 2015, taking into account criteria reflecting local specificities and context as well as EcoMark Africa and the Global Sustainable Tourism Criteria (GSTC). Green jobs are identified from the most efficient Lodging and Accommodation activities. Using the efficiency approach of 10% most efficient, it is observed that 13% of its industry's output is classified as green with 14.9% employment identified as green jobs.

Green jobs are also identified in the cleaning and landscaping, sewage and refuse disposal, land based-sports and recreation activities and ocean-based sports and recreation activities.

Total direct green jobs in the economy

The total green jobs in the economy in 2019 is estimated at 59,651, that is, 10.3% of total employment.

2.2 Assessment of indirect and induced green jobs

The estimation of the indirect and induced green jobs is based on the Green Jobs Assessment Models and the Input-Output table which model inter-industry linkages with regard to output, employment, and CO_2 emission. Using the Input-Output Table, the indirect and induced employment multipliers are calculated as an indication of the green jobs.

Findings

In the agricultural sector, the total employment multiplier (direct, indirect and induced) stands at 2.999 for the green non-sugar sector compared

▶ **Table 2.5. Green jobs in the services sector**

Sector	Sub-sector/ industry	Criteria	Source	Greenjobs
Tourism Lodging and accommodation	Lodging and accommodation	Process: 10% most efficiency in electricity, fossil energy and water	Census of Economic Activities Employment statistics	14.9% of tourism sector
Cleaning and Landscaping		Output		2370
Public administration		Output (table 1.0)		11.7% of total public administration
Sewage and refuse disposal, waste water		Output		883
Recreational	Land-based Sports and Recreation activities	Output		53.8% of recreational sector
	Ocean-based sports and recreation activities	Output		26.1% of recreational sector

▶ **Table 2.6. Green jobs in the economy**

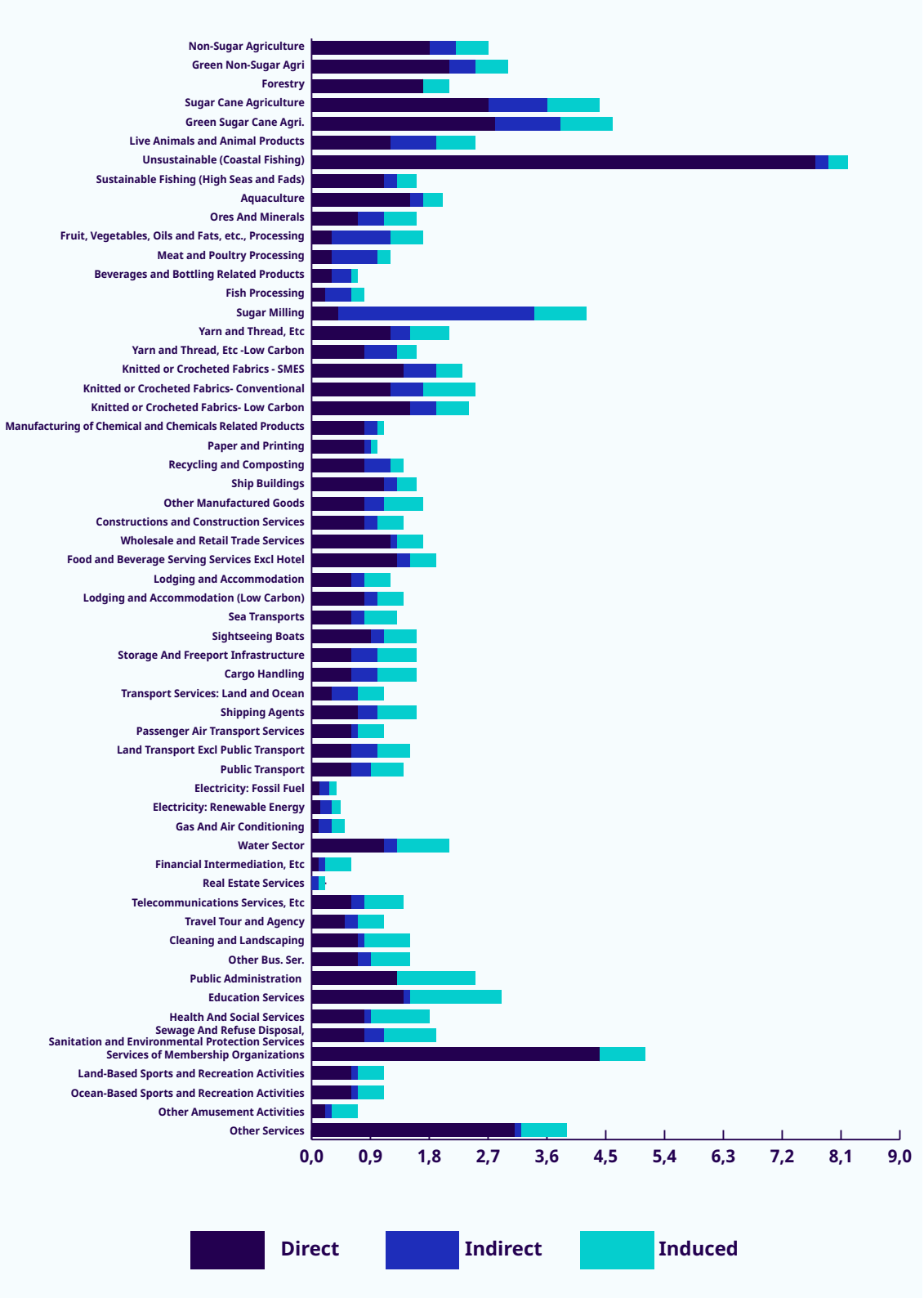
	Economic sectors/industries	Emp.		Economic sectors/industries	Emp.
1	Non-Sugar Agriculture	15500	30	Lodging and Accommodation (Low Carbon)	4200
2	Green Non-Sugar Agri	950	31	Sea Transports	396
3	Forestry	80	32	Sightseeing Boats	1980
4	Sugar Cane Agriculture	8120	33	Storage And Freeport Infrastructure	2772
5	Green Sugar Cane Agri.	880	34	Cargo Handling	3168
6	Live Animals and Animal Products	8000	35	Transport Services: Land and Ocean	11880
7	Unsustainable (Coastal Fishing)	1800	36	Shipping Agents	75
8	Sustainable Fishing (High Seas and Fads)	4008	37	Passenger Air Transport Services	11880
9	Aquaculture	410	38	Land Transport Excl Public Transport	3199
10	Ores And Minerals	2300	39	Public Transport	4261
11	Fruit, Vegetables, Oils and Fats, etc., Processing	10132	40	Electricity-fossil fuel	1252
12	Meat and Poultry Processing	1859	41	Electricity-renewable (solar, wind, biomass, etc)	390
13	Beverages and Bottling Related Products	4503	42	Gas And Air Conditioning	801
14	Fish Processing	3119	43	Water Sector	2117
15	Sugar Milling	1600	44	Financial Intermediation, Etc	13900
16	Yarn and Thread, Etc	6396	45	Real Estate Services	1500
17	Yarn and Thread, Etc -Low Carbon	850	46	Telecommunications Services, Etc	18200
18	Knitted or Crocheted Fabrics - SMES	2445	47	Travel Tour and Agency	2817
19	Knitted or Crocheted Fabrics-Conventional	16293	48	Cleaning and Landscaping	2370
20	Knitted or Crocheted Fabrics- Low Carbon	15299	49	Other Bus. Ser.	33313
21	Manufacturing of Chemical and Chemicals Related Products	3972	50	Public Administration	44300
22	Paper and Printing	2277	51	Education Services	31800
23	Recycling and Composting	204	52	Health And Social Services	20200
24	Ship Buildings	1451	53	Sewage And Refuse Disposal, Sanitation and Environmental Protection Services	883
25	Other Manufactured Goods	27096	54	Services of Membership Organizations	2000
26	Constructions and Construction Services	44000	55	Land-Based Sports and Recreation Activities	6325
27	Wholesale and Retail Trade Services	96200	56	Ocean-Based Sports and Recreation Activities	2711
28	Food and Beverage Serving Services Excl Hotel	16111	57	Other Amusement Activities	2711
29	Lodging and Accommodation	23963	58	Other Services	31000

to 2.686 for the conventional one (figure 2.1). Similarly, the green/low carbon sugar cane sector has a total employment multiplier of 4.627 versus 4.355 for the conventional sector. The higher employment multipliers for the green/low carbon are consistently higher for the direct, indirect and induced component. The high employment multiplier for the coastal fishing is a sign of unsustainable harvest on the lagoon ecosystem and therefore is not part of a green/low carbon sector. The sustainable counterpart, i.e. high sea and FADs fishing, has a total multiplier of 1.570. Aquaculture has a relatively higher employment multiplier than the latter at 2.017, reflecting the direct employment of 1.510 per Rs10M output.

In the manufacturing textile sector, there are mixed results regarding the three types of green jobs. The green/low carbon component in the Yarn and Thread industry has a lower direct and induced employment multipliers of 0.755 and 0.348 respectively compared to the conventional one at 1.156 and 0.588 per Rs10M output. Inversely, the indirect multiplier is higher for the green/lower carbon component (0.514 vs. 0.334). The total employment multipliers are consequently lower for the green/low carbon (2.078 vs. 2.333). Similarly, the green/low carbon component of the Knitted or Crocheted Fabrics has a total multiplier 2.481 as compared to 2.520 in the conventional one.

As opposed to the manufacturing textile industry, the green/low carbon Lodging and Accommodation has higher direct (0.762 vs. 0.639), indirect (0.247 vs. 0.245) and induced (0.447 vs. 1.296) employment multipliers as compared to conventional ones. This pattern is also observed for the renewable electricity sector versus electricity from fossil energy sources (0.447 vs. 0.405).

▶ **Figure 2.1: Direct, indirect and induced employment per output (RsM)**



3. Green jobs and low carbon economy

This section probes into the nexus between green jobs and a low carbon transition. The GJAM model is constructed by adding an additional dimension: GHG data. The GHG inventory[22] for Mauritius provides information on emissions of CO_2, CH4 and N2O according to broad and detailed activities described in the IPCC guidelines for GHG inventories. However, the IPCC sector classification does not match the International Standard Industrial Classification of all Economic Activities (ISIC) classification used in the IO table. Thus, necessitating an allocation of emissions to the IO economic sectors/SUT industries.

3.1 GHGs by economic sectors/industries

The Digest of Environmental Statistics follows the *IPCC Guidelines for National Greenhouse Gas Inventories 2006* and classified the GHGs for Mauritius into four sectors: Energy, Industrial Processes (IPPU) and Agriculture and Forestry and Other Land Use (AFOLU) and Waste. The total GHGs reported stands at 5,777.04 tonnes. The different categories of GHGs include carbon dioxide emission (CO_2), methane (CH4), nitrous oxide (N2O), and hydrofluorocarbons (HFCs). The National Inventory Report (NIR), published in October 2021, provides an update on the GHGs for each of the four sectors[23].

The GHGs from the energy sector require further disaggregation and hence necessitate specific data and information. Data on GHGs from the NIR in the energy sector is classified into four groups: 'electricity', 'manufacturing', construction', 'transport' and the remaining (residential, commercial and agriculture) categorised as 'others'. Statistics on energy is published annually in the Digest of Water and Energy Statistics, according to the 'manufacturing', 'commercial and distributive trade', 'agriculture', 'electricity', 'transport', and 'households' sector, in conformity to the energy balance, i.e., the supply through imports equals to the amount consumed. Except for transport, the remaining groups in the energy statistics are consistent with the Sections of the ISIC[24]. Transport energy is used by practically all economic sectors and households. The data published in the Digest is not in conformity to Section H (Transportation and Storage) of the ISIC nor the System of National Accounts (SNA). The latter corresponds only with transport services which are commercialised. For instance, fossil fuels used in the household will be recorded in the transport sector of the Digest, whereas in the SNA, it will be recorded under household consumption. It is therefore imperative to calculate transport-related fossil fuel consumption and GHGs according to the economic sectors/industries/activities and households, separately from process-related fossil fuel consumption. They need to be recorded in so called satellite accounts following the ISIC classification in order to harmonize GHG, Employment and Economic data to operationalise the GJAM. GHGs are therefore calculated at source according to the economic sectors/industries/activities.

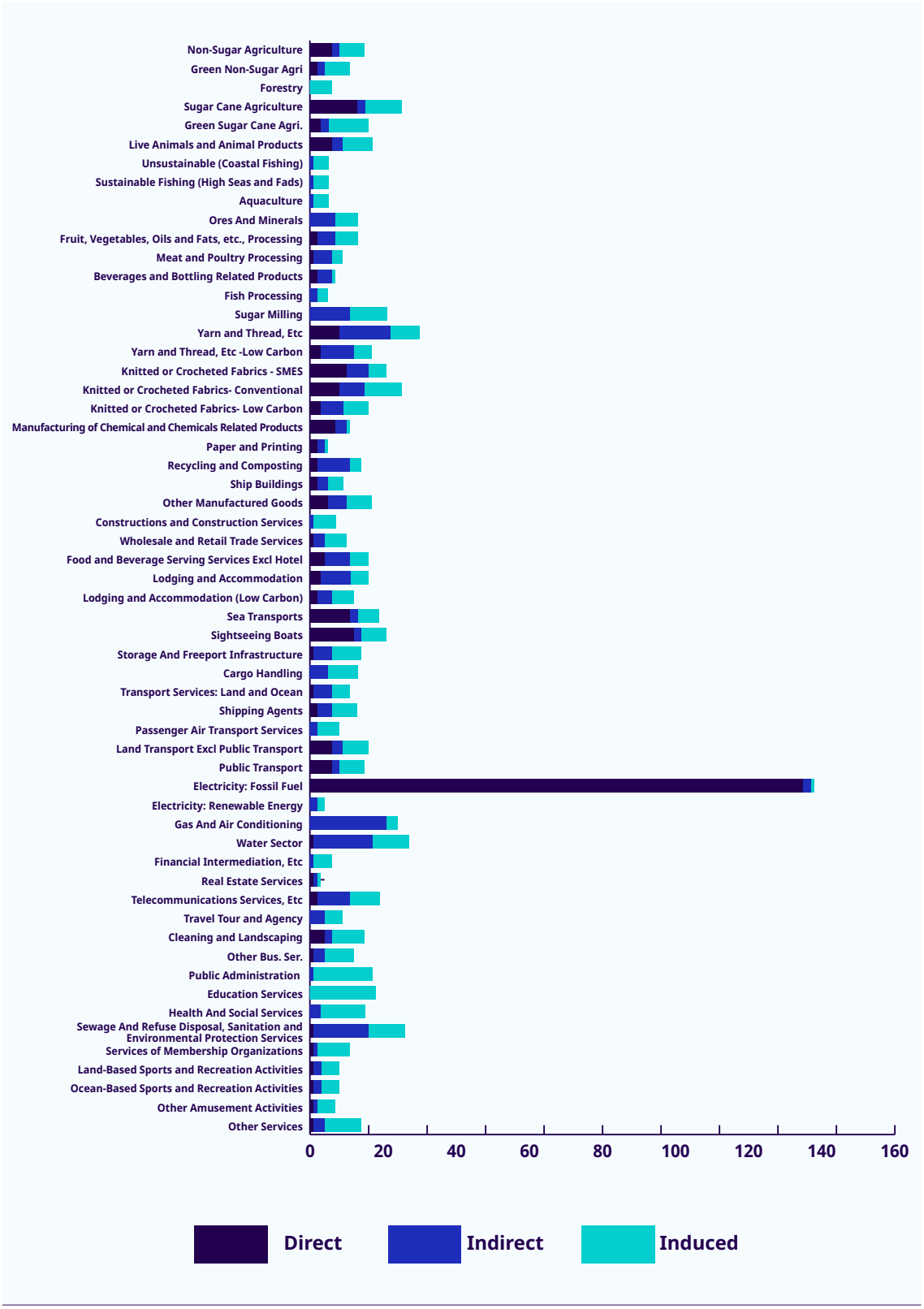
The electricity sector poses a similar issue since it uses energy (both fossil fuel and renewable) in the generation processes; however, once converted into electricity (measured in Kilowatts), its consumption is strictly intermediary, as an input in the productive sector and as final consumption by households. There are two ways to account for this aspect. Similar to transport energy, it may be

22 Ministry of Environment, Solid Waste Management and Climate Change 2021. National Inventory Report (NIR) to the United Nations framework Convention on Climate Change. Port-Louis, Mauritius.

23 'Economic Sectors' in this report refers to Sections A to U of the ISIC of the United Nations; Industries refer to the Division (two-digit classification) of the ISIC. Economic Activities refer to the Group (three-digits classification) of the ISIC.

24 United Nations. 2008. International Standard Industrial Classification of All Economic Activities (ISIC), Rev.4. Statistical papers Series M, No. 4/Rev.4. https://unstats.un.org/unsd/publication/seriesm/seriesm_4rev4e.pdf

▶ **Figure 3.1: Direct, indirect and induced CO2 eq. (kg) per output (RM000)**



appropriate to calculate electricity use at source as a satellite account. The second way is to consider the electricity sector according to the Section D of ISIC (Section D- Electricity, gas, steam and air conditioning supply, Div. 35, Group 351) as the supplier of electricity consumption to other economic activities and households. This information is provided in the IO table. In this study, a distribution electricity sector is introduced which purchases the electricity from different electricity generators and act as the supplier to other sector. This is in conformity to the current arrangement of the Central Electricity Board (CEB) in Mauritius.

3.2 Analysing Inter-industry linkages of Green/ Low Carbon Economy

Modelling inter-industry linkages provide insights on output, employment, and CO_2 emission impacts. Using the Input-Output Table, the direct, indirect, and induced multipliers are calculated to analyse the potential of a low carbon pathway for Mauritius. Appendix 2 show the calculated impact multipliers for output, employment, and CO_2 eq.

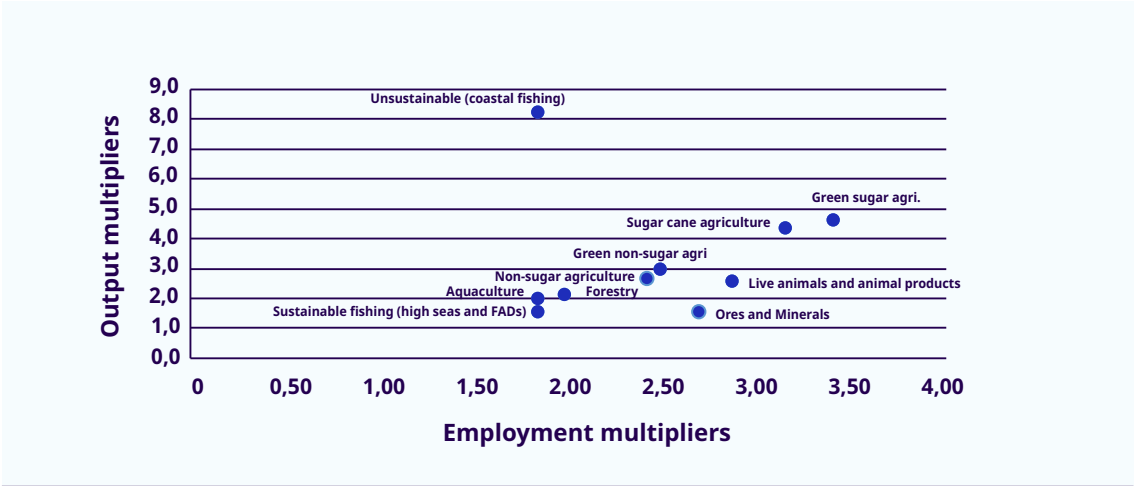
Agricultural sector

In the agricultural sector, there is a significant impact on output, employment, and CO_2 eq. emission when there is a rise in its final demand. The indirect output multiplier for the green non-sugar agriculture is relatively higher as compared to its conventional counterpart (0.258 vs. 0.241). Furthermore, it has also a bigger induced output multiplier of the order of 1.26 as compared to 1.204 in the conventional sector. The same conclusion is reached for the green sugar cane component as compared to conventional one. The use of inputs generated within the domestic economy eventually increases economic activities by a multiple factor which clearly increases employment within the economy.

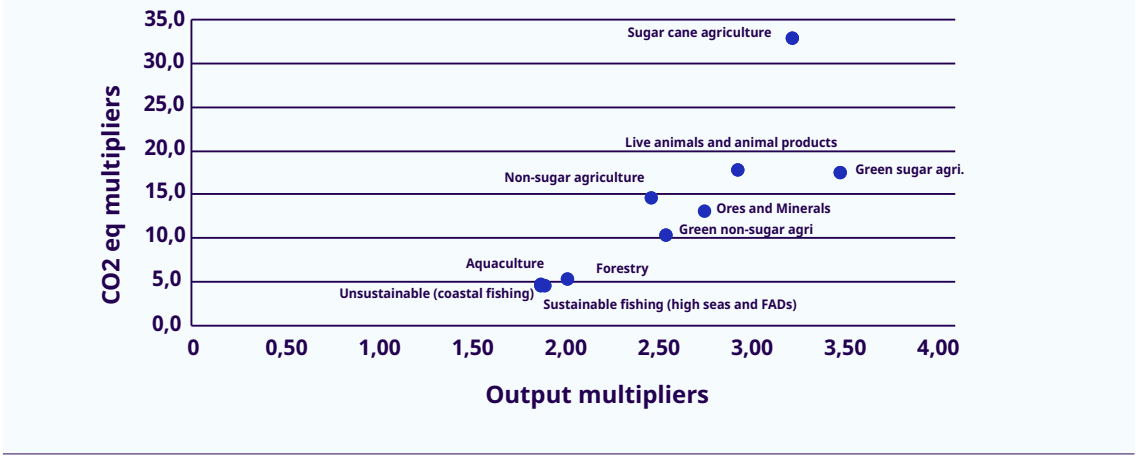
The direct employment multipliers are 2.062 and 2.719 for respectively the non-sugar and sugar agriculture as compared to 1.794 and 1.695 for their conventional counterparts. The indirect employment multiplier stands at 0.396 for the green non-sugar agriculture as compared to 0.375 for the conventional one. Similar finding is obtained from the green sugar cane versus conventional sugar cane (0.991 vs. 0.868).

The direct CO_2 eq. emission is 1.654 for green non-sugar agriculture and 6.133 for the conventional one. Likewise, it is 3.186 for green sugar cane

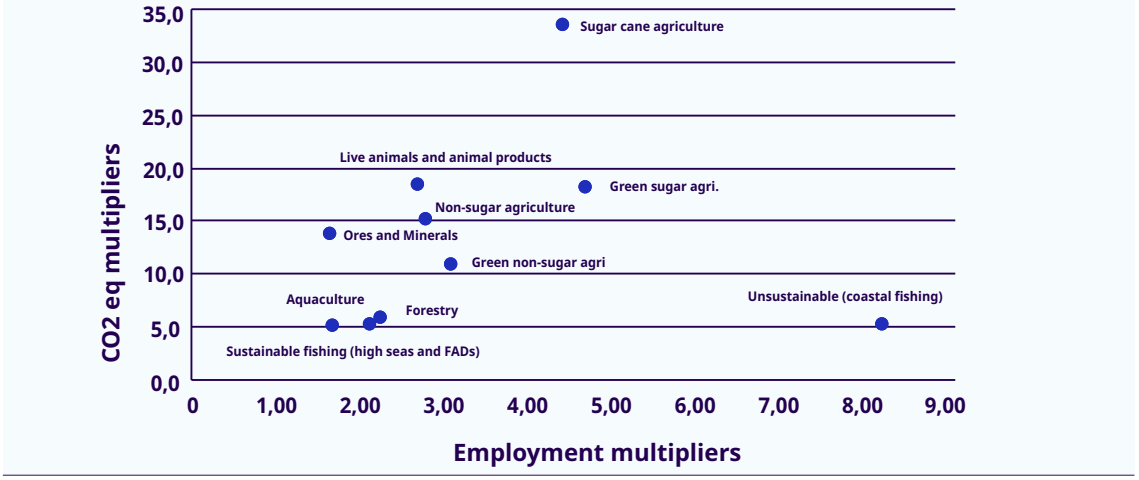
▶ **Figure 3.2: Output vs. employment multipliers: agricultural sector**



▶ **Figure 3.3: CO2 eq. vs. output multipliers : agricultural sector**



▶ **Figure 3.4: CO2 eq. vs. employment multipliers: agricultural sector**



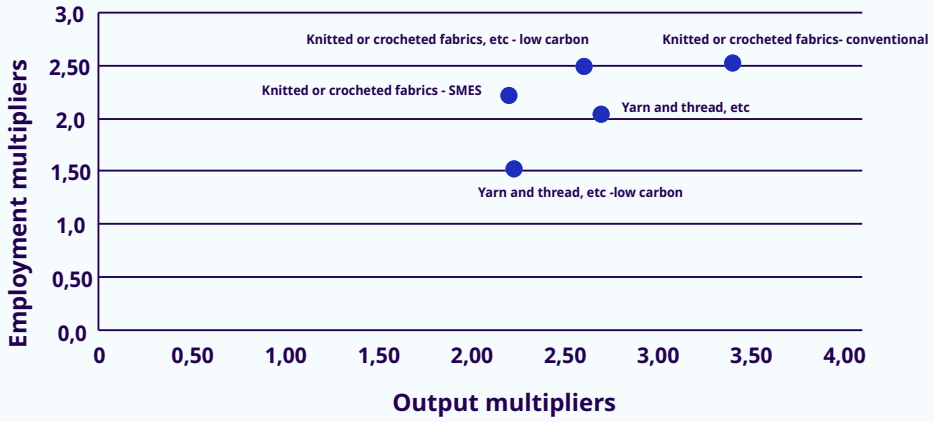
sector versus 13.499 for conventional one. In contrast, the indirect emission multipliers are higher for the green component as compared to conventional ones since the latter uses more inputs in the domestic economy - with higher local inputs, a green component is likely to emit more CO_2 eq. generated from the inter-industry linkages of livestock, organic fertilizer production and transport.

The relationship between the multipliers are provided in figures 3.2, 3.3 and 3.4. The green agriculture has higher output and employment impacts but lower environmental effects.

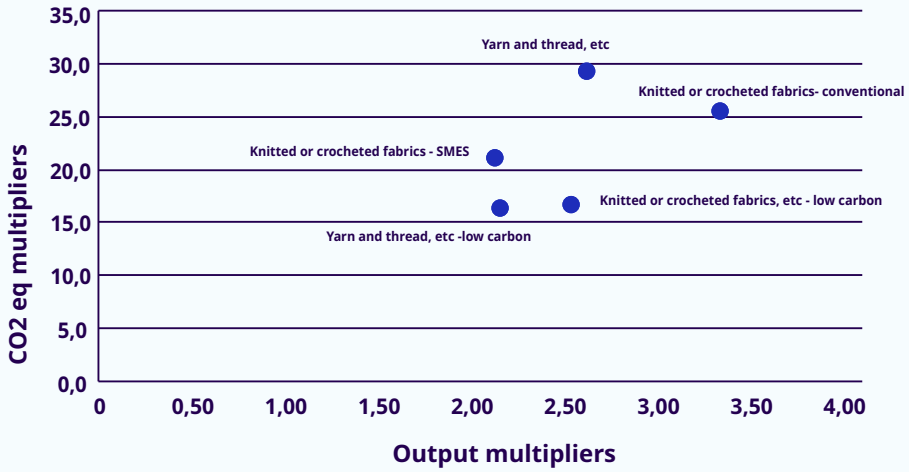
Manufacturing textile sector

The two textile activities (Yarn and Threads, and Knitted and Crocheted Fabrics) have differing output and employment multipliers. Green/low carbon Yarn and Threads industry has a higher output multiplier than its conventional counterpart (0.595 vs. 0.476); whereas the finding differs for Knitting and Crocheted Fabrics as the green component has lower multiplier than the conventional component (0.482 vs. 0.584). The efficient Yarn and Threads sector has significantly lower electricity cost (around 63% lower per unit of output) and it appears that there is significant

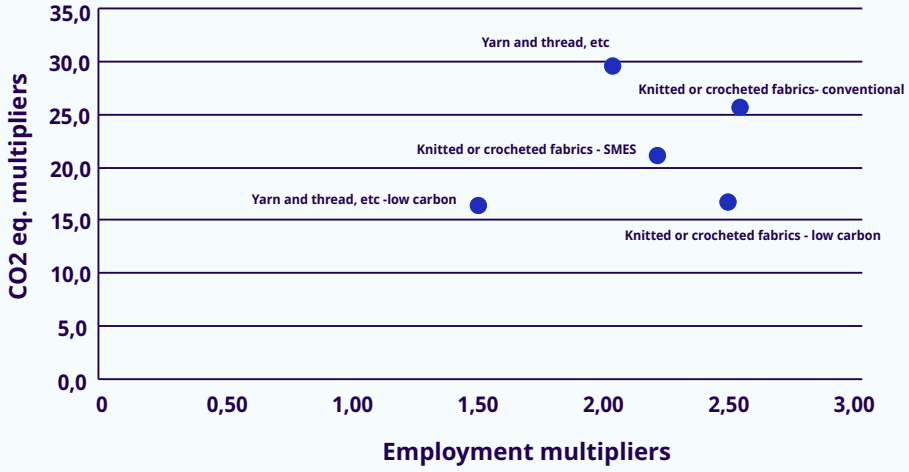
▶ **Figure 3.5: Output vs. employment multipliers: textile sector**



▶ **Figure 3.6: CO^2 eq. vs. output multipliers: textile sector**



▶ **Figure 3.7: CO_2 eq. vs. employment multipliers: textile sector**



increase in other inputs which lead to higher indirect output multiplier. The latter employs less workers per output, i.e., the direct employment multiplier is lower. The green Knitted and Crocheted Fabrics industry, in contrast, has lower indirect output multiplier (0.482 vs. 0.584), which is explained by its resource efficient production, but has also higher direct employment multiplier (1.523 vs. 1.214). Given the resource efficient production operations in both industries, the total CO_2 eq. multipliers are lower than their conventional counterparts. Figure 2.4 shows the relationship between the total multipliers for the two activities of the textile sector.

Lodging and Accommodation

The green component of Lodging and Accommodation also exhibits lower indirect output multiplier as it uses less energy (0.394 vs. 0.429). Direct, indirect and induced employment multipliers from the green component are relatively higher as compared to the conventional one (0.762 vs. 0.639, 0.247 vs.0.245, and 0.439 vs. 0.411, respectively). As expected, the direct emission multiplier is lower for the green at 2.244 as compared to 2.376 for conventional practices in that sector.

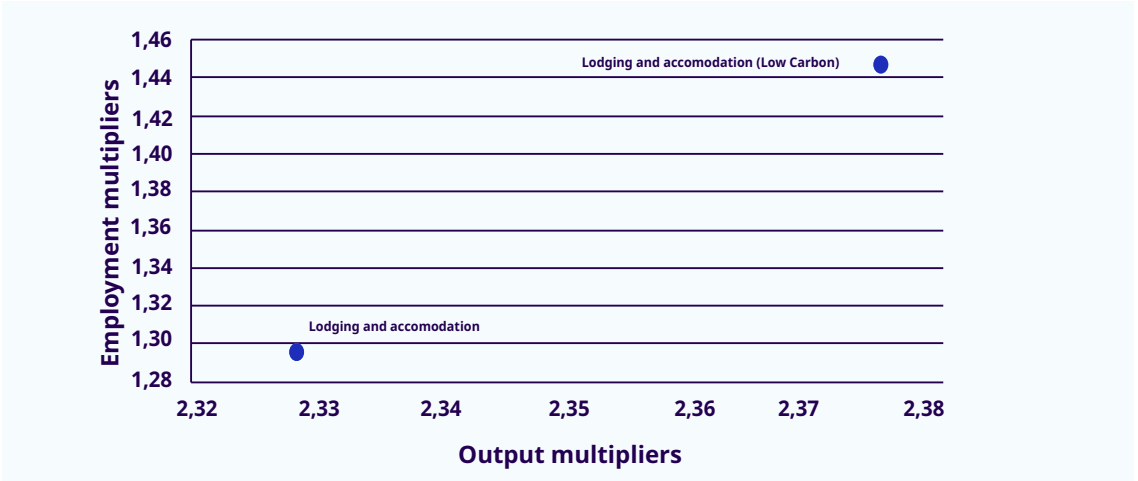
Figure 2.7 shows that a positive correlation between high output multiplier and employment impact for the low carbon component of the Lodging and Accommodation, while figure 2.8 and 2.9 picture the lower CO_2 eq. impact as a result of higher output and employment multipliers.

Electricity sector: renewable vs. fossil fuel sources

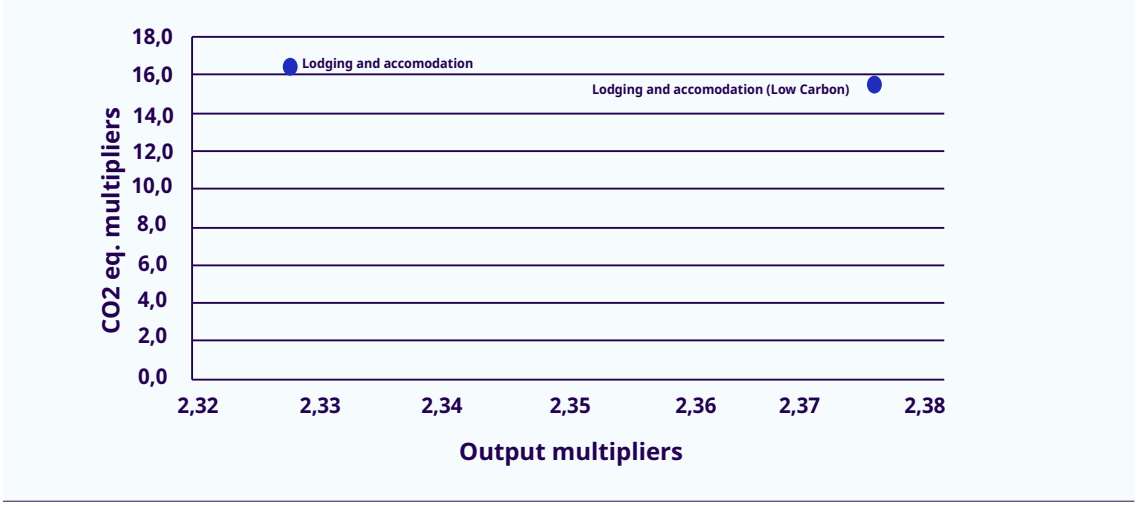
The renewable component of the electricity has a higher total output multiplier at 1.639 as compared to 1.530 from fossil fuel sources. This total impact emanates from the indirect and induced multiplier of 0.297 and 0.342 which are both higher than the fossil fuel counterpart at 0.286 and 0.244 respectively. The higher output impact was expected as renewable sources create more economic activities along the supply chain, in terms of installations, operations, and maintenance.

However, the direct employment multiplier from renewable sources stands at 0.132 vs. 0.114 for fossil fuel sources. With an indirect and induced multiplier of 0.167 and 0.147, the total employment impact is estimated at 0.446 per Rs10 Million output. In contrast, the direct emission coefficient from renewable sources is zero as compared to 146.878, 87.975 and 304.396 from fuel oil, diesel and coal energy respectively. However, the indirect emission multiplier is 1.993 as compared to 1.938 from fossil fuel.

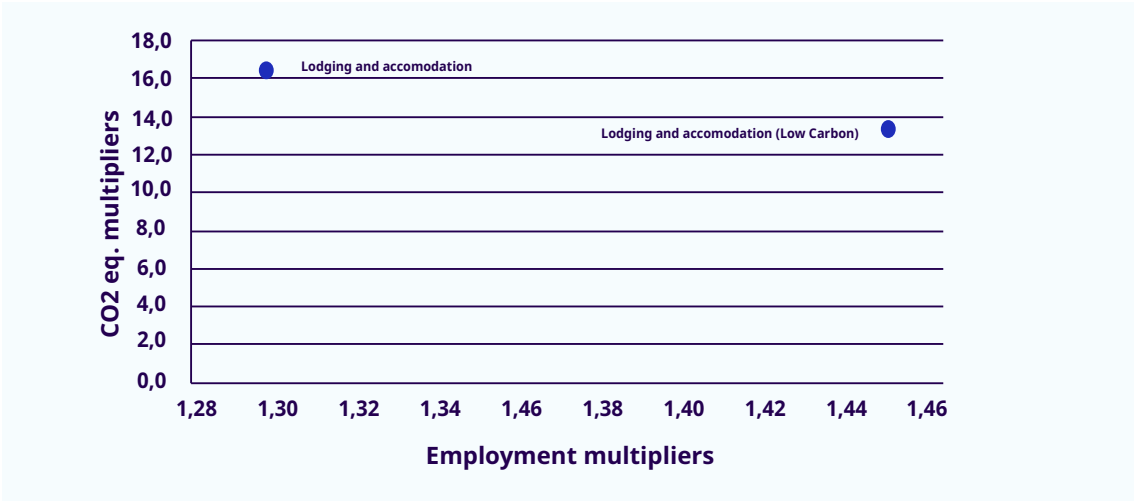
Figure 3.8: Output vs. employment multipliers: tourism sector



▶ **Figure 3.9: CO2 eq. vs. output multipliers: tourism sector**



▶ **Figure 3.10: CO2 eq. vs. employment multipliers: tourism sector**



4. Green jobs from a green/low carbon strategy

Mauritius ratified the Paris Agreement on climate change in 2016. Initially, the NDC proposed to reduce GHGs by 30% by the year 2030. In line with Article 4 (Paragraph 9), of the Paris Agreement, countries whose NDCs has a time frame of up to 2030, have to communicate or update their contributions to the UNFCCC Secretariat by 2022 and continually to do so every five years. The NDC time frame for Mauritius is up till 2030, hence the need to review the Mauritius' NDC. In its updated NDC, Mauritius elevated its ambition to reduce GHGs by 40% in 2030 as compared to business-as-usual (BAU), with 60% energy production from green sources by 2030, thereby phasing out the use of coal, and increasing energy efficiency by 10% based on the 2019 baseline. This section provides an estimate regarding the changes in jobs which are implied in a Green/Low Carbon Strategy (GLCS) in line with the NDC.

The Business as Usual (BAU) Scenario

A Business as Usual (BAU) scenario is assumed for each sector/industry for the period 2022-2030 which is then compared with the GCLS. The projected sectoral growth is calculated based on the average performance in terms of growth in value added and production over the last five years prior to the COVID-19 pandemic, i.e., 2014-2019. The growth rates were adjusted according to expert judgements on likely changes in the economic structure for the next 10 years. The baseline growth scenario results in a GDP (at basic prices) growth of 4 % annually. Box 3.1 provides a brief on the BAU scenario. The GLCS considers four (4) main sectors which offer green employment opportunities: agriculture (sugar and non-sugar), manufacturing textile sector, tourism and electricity. For each sector, a Green/Low Carbon scenario is constructed. The comparison allows the calculation of GHGs avoided and jobs created or lost.

The BAU shows an increase in CO_2 eq. to 7,190 kt by 2030, representing an increase of 31%. The CO2 eq. emanating from energy and its use in processes (manufacturing, tourism, etc) stands at 4,044 Gg CO_2 eq[25], while that from industry is 1,525 Gg CO_2 eq. with similar emissions from waste (figure 4.1) while the agriculture and land use pattern in Mauritius does not contribute significantly to total emissions.

In the BAU, direct green jobs in the four sectors are estimated as follows: 2,154 in the agricultural sector (1,452 in the non-sugar and 702 in the sugar industry), 12,783 in manufacturing textile sector (731 in yarn and thread and 12,053 in Knitted and crocheted fabrics), 6,393 in lodging and accommodation and 501 in renewable energy sector. The total direct green jobs created by 2030 stand at 21,831 under the BAU, representing 19.7% of total jobs across the four sectors in question. The total indirect and induced jobs are estimated at 7,278 and 9,414 respectively.

25 The NDC projection is 7193 kt with the energy sector (excluding transport) at 4316 kt CO^2 eq. The difference in the energy sector is attributed to the growth rates scenarios in the recovery period 2022-2024.

▶ Box 3.1. Business as Usual (BAU) Scenarios vs. GLCS

Business as Usual (BAU)

Over the last 5 years, declining trends in sugar production (averaging -9%) and falling value added (-averaging 2.7%) are observed reported data (e.g. National Accounts of Mauritius). Non-sugar agriculture sector showed a production growth of 5% on the 5-year average, while livestock increased by 2% on average; the associated rise in value added of the non-sugar sector is 3%. It is assumed the sugar sector will grow marginally by 0.2%. This also implied same growth rate for the sugar milling industry. The agricultural, forestry and fishing sector will therefore increase by 3.3% annually for 2021-2030. The projected rise in fish production is estimated at 10% annually for the period.

The value added of the food manufacturing industry grew at 1.8% on average from 2015-2019. A projected annual growth of 2.3% is assumed. The textile sector has recorded a negative growth of 4.6% over the last 5 years on average. A marginal increase of 1% is assumed annually to 2030. The remaining manufacturing activities grew by 3.8% from 2015-2019 on average but the recent growth averaged 4.5%. A projection of 5% is assumed. The construction sector depends to a large extent on public and private investment, driven exogenously by infrastructural, real estate and similar development. A 4% annual growth is assumed. The electricity, gas, steam and air conditioning supply industry increased by 3.8% on average in the last 5 years. The growth in electricity consumption stood at 2.7% over the last 10 years and 2.3% over the last 5 years. A projected growth of 4% is assumed. The 5-year annual growth averaged 2.6% for 'Water supply, sewerage, waste management, and remediation activities'. The analysis considers a 3% growth annually to 2030.

The remaining services sector, including 'Information and communication', 'Financial and insurance activities', business services (Professional, scientific and technical activities & Administrative and support service activities) recorded an average increase of 6% yearly during the last 5 years. The same growth level is assumed for 2023-2030. Public administration and education are both low growth industries: 1.5% and 1.7% are assumed respectively. The remaining sectors are as follows: health services industry - 3%, recreational services-4.6% and other services - 3.9%.

The recovery from the COVID19 pandemic to the 2019 GDP is assumed to be reached by 2024.

Green and Low Carbon Strategy (GLCS)

Agriculture - The current green non-sugar agriculture sector which stands at 5% aims at target attain 50% organic/climate resilient agriculture by 2030. In the sugar cane sector, the target is to reach 50% green/low carbon sugar cane cultivation by 2030.

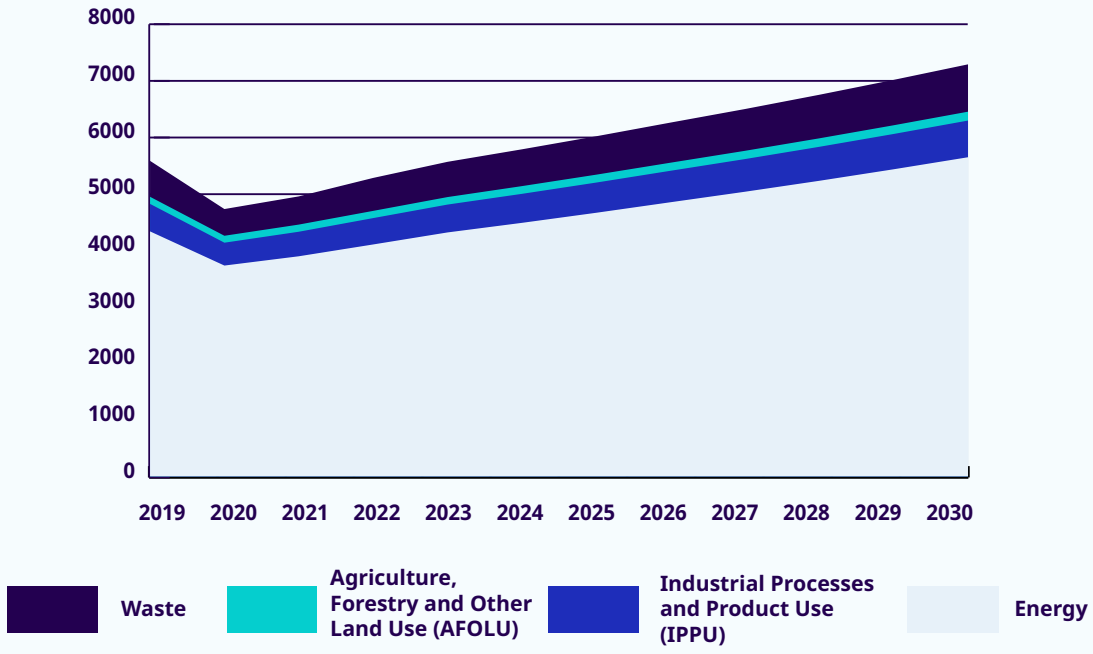
Manufacturing textile – Yarn and Threads Fabrics, etc.: The current green/low carbon output is estimated at 13%. The Green/Low Carbon Strategy sets a target of achieving 50% by 2030.

Manufacturing textile sector – Knitted and Threads, etc.: Currently, 43% of output is classified as green/low carbon. The target is to reach 75% in 2030.

Hotels and Accommodation sector: The target is to achieve 50% of output from a low carbon activity.

Electricity sector: the target is to reach 60% renewable electricity by 2030.

▶ Figure 4.1. CO_2 eq. 2019-2030 (Gg tonnes) BAU



The Green/Low Carbon Strategy

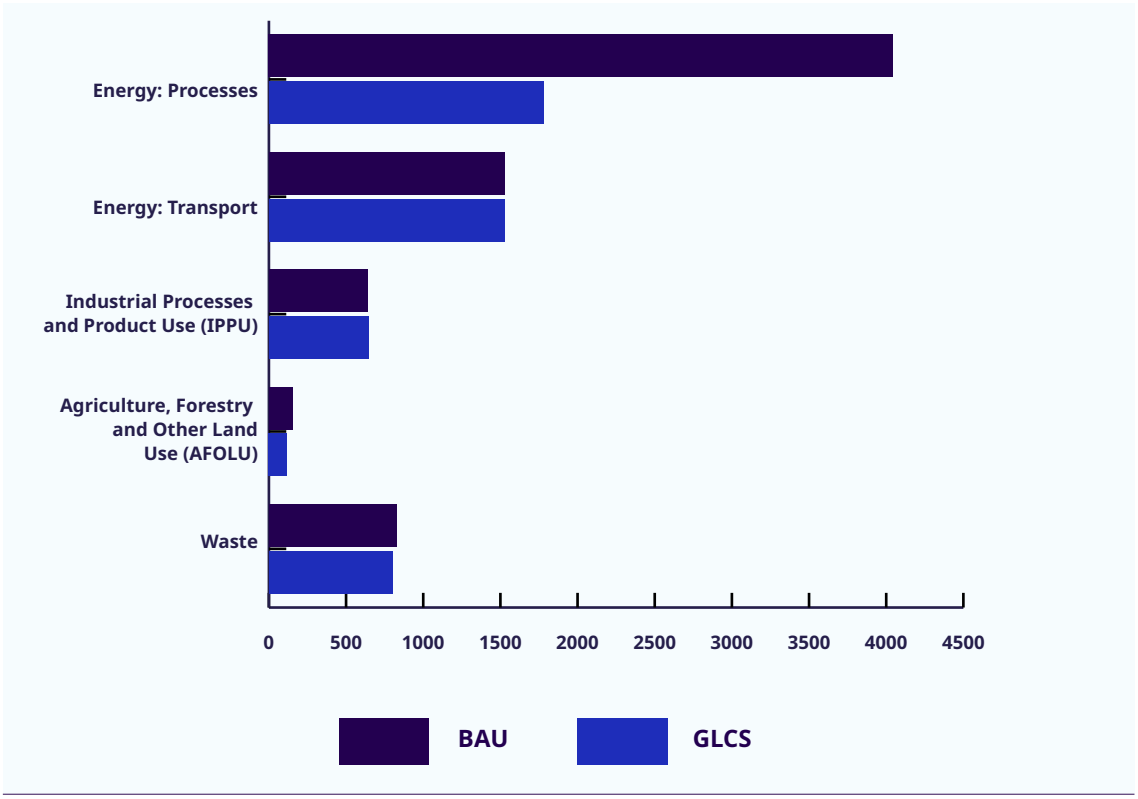
The GLCS leads to a total CO_2 eq. of 4870 Gg, representing 2320 of CO_2 eq. avoided (figure 4.2). Compared to the 2019 level, the GLCS shows a reduction of 11.6% in CO_2 eq. by 2030. This is a case of absolute decoupling of emissions from economic growth. i.e., economic growth accompanied by falling CO_2 emissions. Compared to the BAU, the total CO_2 eq. is 32% lower in the GLCS. This is not sufficient to reach the 40% reduction target as set out by the updated NDC. Although CO_2 eq. is relatively lower by 40.6% in the energy sector in comparison to the BAU; and emissions from energy in processes are 56% lower compared to the BAU, the overall target is not attained

Table 4.1 provides further details on CO_2 eq. by sectors and industries. Under the GLCS, the non-sugar agriculture shows a lower direct emission of 54,325 kt relative to the BAU, representing a fall by-34.3%. Similar findings were obtained for the sugar agriculture industry, with a fall of 33.1% in emissions from the BAU. In contrast, the indirect CO_2 eq. increases under the GLCS by 2.3 and 11.5% for the non-sugar and sugar agriculture respectively. The rising indirect emissions are caused by the higher indirect output multipliers given that the green/climate resilient agriculture generates more activities in the supply chain (e.g., the manufacturing and distribution organic fertiliser, green technologies, and equipment, etc.)

In the manufacturing textile sector, direct CO_2 eq., under the GLCS is lower by 12.2% and 21.5%, for yarn and thread, and knitted and crocheted fabrics, respectively. The adoption of energy efficient technologies and practices in the two industries also contribute to lower indirect emissions. Similar findings are observed for the Logging and Accommodation, where both the direct and indirect emission are lower.

The biggest change emanates from the electricity sector, with an emission level which is 65.7% lower in the GLCS in comparison to the BAU. The indirect emission is marginally higher under the GCLS since

▶ **Figure 4.2. Changes in CO_2 eq. (Gg tonnes) BAU vs. GLCS**



▶ **Table 4.1. CO_2 eq. (thousand tonnes) 2030– BAU vs. GLCS**

	Direct		Indirect		Induced		Total	
	BAU	GLCS	BAU	GLCS	BAU	GLCS	BAU	GLCS
Agriculture								
Non-sugar: conventional	81479	42694	21782	11413	89774	47040	103261	54107
Non-sugar: green/climate resilient	1164	11631	1210	12092	4757	47527	2375	23722
Sub-total	**82644**	**54325**	**22992**	**23505**	**94531**	**94567**	**105636**	**77830**
Sugar: conventional	31828	17689	3806	2115	15931	8854	35634	19804
Sugar: green/climate resilient	798	4136	523	2712	1692	8770	1322	6848
Sub-total	**32626**	**21824**	**4330**	**4827**	**17623**	**17623**	**36956**	**26652**
Manufacturing Textile								
Yarn and thread, etc	37851	30099	65431	52032	32125	25546	103282	82131
Yarn and thread, etc -low carbon	2676	5474	8372	17127	6536	13373	11047	22601
Sub-total	**40527**	**35574**	**73802**	**69159**	**38661**	**38919**	**114329**	**104732**
Knitted or crocheted fabrics - SMES	13659	13653	9218	9214	9612	9607	22878	22866
Knitted or crocheted fabrics- conventional	83165	37271	76212	34155	71489	32038	159377	71426
Knitted or crocheted fabrics- low carbon	26424	45886	46981	81582	53476	92860	73405	127468
Sub-total	**123249**	**96809**	**132411**	**124950**	**134576**	**134505**	**255660**	**221760**
Lodging and accommodation								
Conventional	192737	109801	447463	254917	385713	219739	640200	364719
Green/Low carbon	18834	73963	37669	147924	56714	222715	56503	221886
Sub-total	**211572**	**183764**	**485132**	**402841**	**442428**	**442454**	**696704**	**586605**
Electricity sector								
Fossil sources	3252695	1114295	28776	14853	100339	51791	3281471	1129148
Renewable sources	0	0	8186	22457	26900	76558	8186	22457
Sub-total	**3252695**	**1114295**	**36962**	**37310**	**127240**	**128349**	**3289656**	**1151605**
Total CO_2 eq.	**3743312**	**1506592**	**755629**	**662593**	**816398**	**817498**	**4498941**	**2169185**

▶ **Table 4.2. Green jobs – BAU vs. GLCS**

	Direct		Indirect		Induced		Total	
	BAU	GLCS	BAU	GLCS	BAU	GLCS	BAU	GLCS
Agriculture								
Non-sugar: conventional	23838	12491	4982	2610	6874	3602	35694	18703
Non-sugar: green/climate resilient	1452	14505	279	2784	381	3808	2112	21097
Sub-total	**25290**	**26996**	**5261**	**5394**	**7255**	**7410**	**37806**	**39800**
Sugar: conventional	6411	3563	2047	1138	1812	1007	10270	5708
Sugar: green/climate resilient	702	3637	248	1287	209	1083	1159	6007
Sub-total	**7113**	**7199**	**2295**	**2424**	**2021**	**2090**	**11429**	**11714**
Manufacturing Textile								
Yarn and thread, etc	5497	4371	1587	1262	2789	2218	9873	7851
Yarn and thread, etc -low carbon	731	1495	497	1016	335	686	1563	3197
Sub-total	**6228**	**5866**	**2084**	**2279**	**3124**	**2904**	**11436**	**11048**
Knitted or crocheted fabrics - SMES	2000	1999	662	662	513	513	3175	3174
Knitted or crocheted fabrics- conventional	12840	5754	5475	2453	8347	3741	26661	11948
Knitted or crocheted fabrics- low carbon	12053	20929	3375	5860	4205	7302	19632	34091
Sub-total	**26893**	**28683**	**9511**	**8975**	**13064**	**11555**	**49468**	**49213**
Lodging and accommodation								
Conventional	36477	20781	13993	7971	23460	13365	73930	42118
Green/Low carbon	6393	25103	2071	8133	3681	14455	12144	47691
Sub-total	42870	45884	16064	16105	27141	27820	86075	89809
Electricity sector								
Fossil sources	1660	858	2285	1179	1521	545	5466	2583
Renewable sources	501	1305	809	1828	603	1655	1913	4788
Sub-total	**2161**	**2163**	**3094**	**3007**	**2124**	**2200**	**7379**	**7371**
Total employment	**110554**	**116792**	**38308**	**38184**	**54730**	**53979**	**203593**	**208955**
Total green jobs	**21831**	**66974**	**7278**	**20907**	**9414**	**28989**	**38523**	**116870**

the renewable energy produces more activities locally than the use of fossil fuel does. The net effect, as expected, is a decline in CO_2 eq.

Table 4.2 shows the employment effects of the GCLS. In the agriculture, direct employment rises from 25,290 to 26,996, while the indirect employment increases from 5,261 to 5,394. There is also an increase in induced employment relative to the BAU. The effects in the manufacturing textile show a rise in direct employment but a fall in indirect employment in contrast to the BAU. The impacts emanate from the rising efficiency of the two industries (yarn and thread and knitted and crocheted fabrics) which have an ambiguous effect on employment. Efficiency in the yarn and thread textile leads to lower direct jobs while in knitted and crocheted fabrics, it leads to higher employment. Production level in yarn and thread is nominal due to constrained demand; thus efficiency does not lead to significant output effect. In contrast, the efficiency in the knitted and fabrics industry leads to significant output effect, causing resulting in additional employment. In the Lodging and Accommodating sector, both the direct and indirect employment are higher.

The GLCS leads to a total of 66,974 in direct green jobs by 2030 compared to 21,831 under the BAU. Indirect green jobs are estimated at 20,907, higher than the BAU, estimated at 7,278. Importantly, total employment for the entire economy is higher in the Green as compared to the BAU scenario, adding more than 5000 jobs across the economy. The summary of percentage changes in employment and CO_2 eq. from the BAU is shown in table 4.3. It is worth highlighting that while the economy is growing at the same rate as in the BAU scenario, there is a fall in CO_2 eq. in the Green scenario which also associated with a 2.6% rise in overall employment.

▶ **Table 4.3. Percentage change in employment and CO2 eq. BAU vs. GLCS**

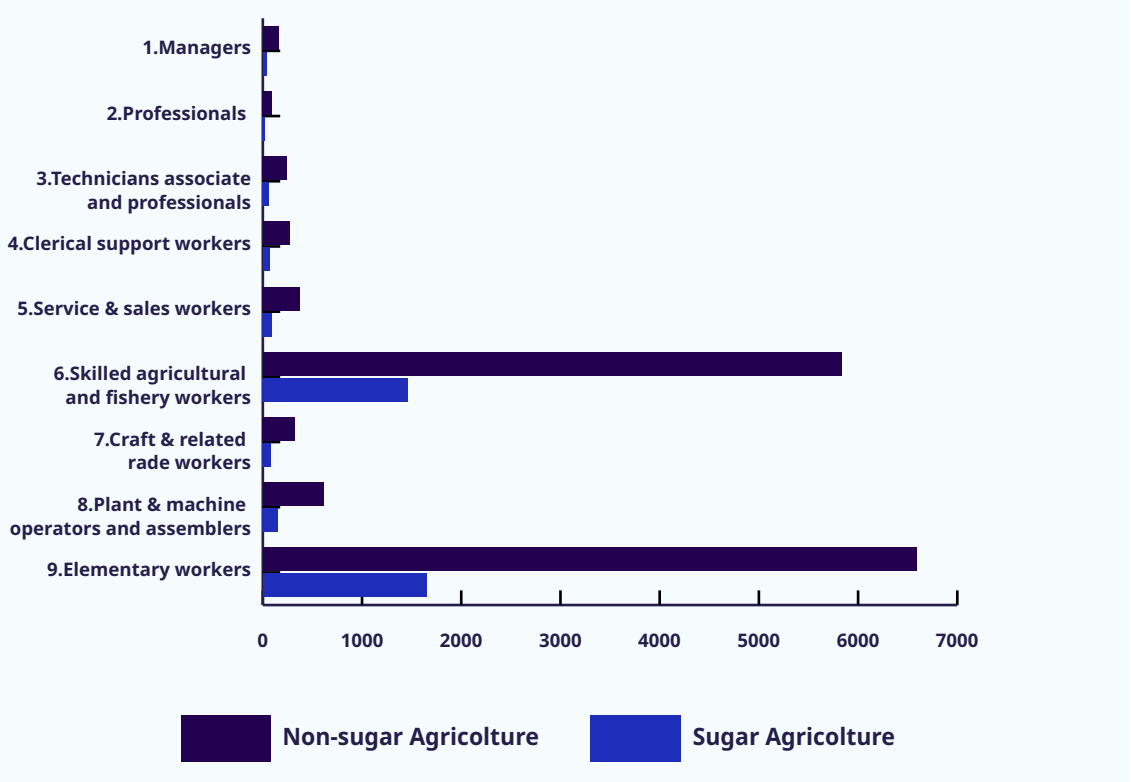
	% Change in employment				% Change in CO_2 eq.			
	Direct	Indirect	Induced	Total	Direct	Indirect	Induced	Total
Non-sugar agriculture	6.75	2.54	2.14	5.28	-34.27	2.23	0.04	-26.32
Sugar agriculture	1.22	5.62	3.43	2.49	-33.11	11.50	0.00	-27.88
Textile: yarn and thread	-5.81	9.34	-7.05	-3.39	-12.22	-6.29	0.67	-8.39
Textile: Knitted or crocheted fabrics	6.66	-5.64	-11.55	-0.52	-21.45	-5.63	-0.05	-13.26
Lodging and accommodation	7.03	0.25	2.50	4.34	-21.45	-5.63	-0.05	-13.26
Electricity sector	0.10	-2.79	3.57	-0.11	-65.74	0.94	0.87	-64.99
Aggregate from the sectors	5.6%	-0.3%	-1.4%	2.6%	-59.8%	-12.3%	0.2%	-51.8%

5. Green skills and human development

The transition to a green and low carbon economy will trigger a transformation across a wide range of sectors. As shown in the preceding section, there is a likely positive effect on employment with a rise in green jobs in the agricultural, manufacturing, tourism and electricity sector. New jobs will be created while some existing jobs will be replaced. Mostly, jobs will be redefined. The effects of the green transition on employment a will require the current/existing workforce to re-skill as well as upskill. There is thus the need to address the skilling and reskilling of workers and anticipate changes in workplaces so as to enable workers to adjust rapidly in a changing world of work[26]. The total green jobs which are in need for green skills at 67,000. The right skills pave the way for productive transformation, as well as avoiding transitional disruptions and institutional failures. This section draws attention to the essential development needed for different occupational groups. Data from Census regarding the different occupational groups at sectoral level is used and applied to the employment data.

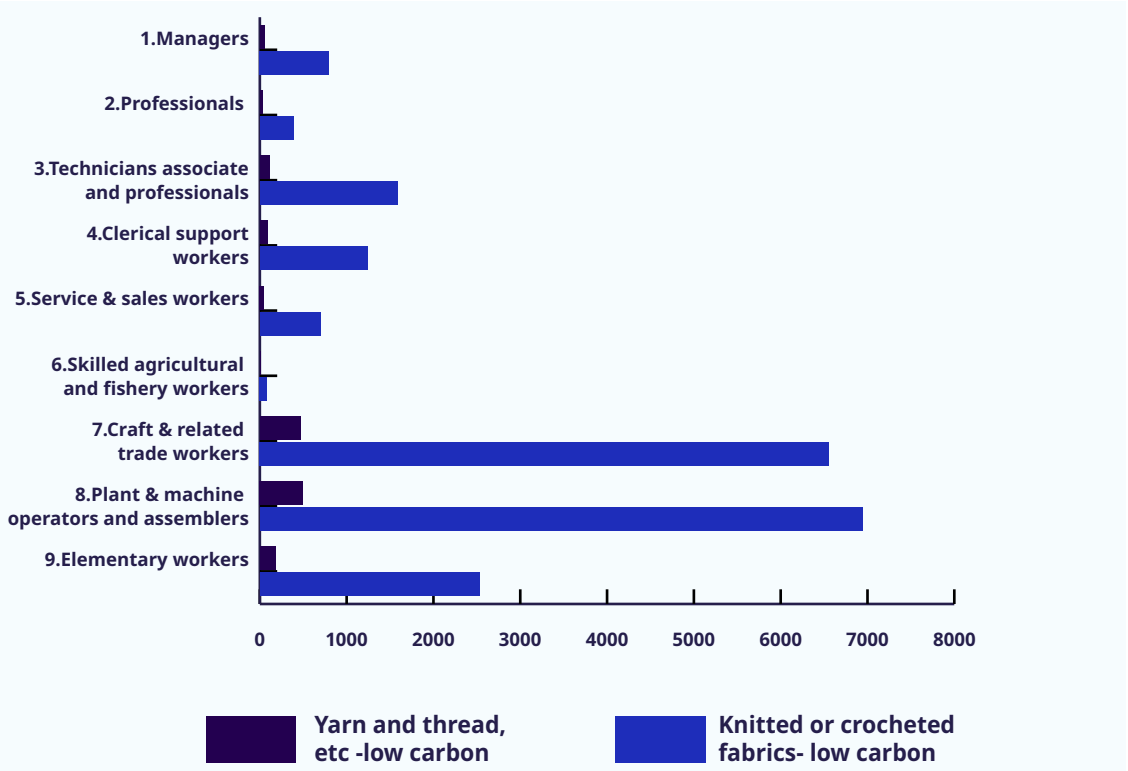
Assuming the baseline scenario of 4% growth in GDP, 2.5% in non-sugar agriculture, no growth

Figure 5.1. Green Skills in the Agricultural Sector

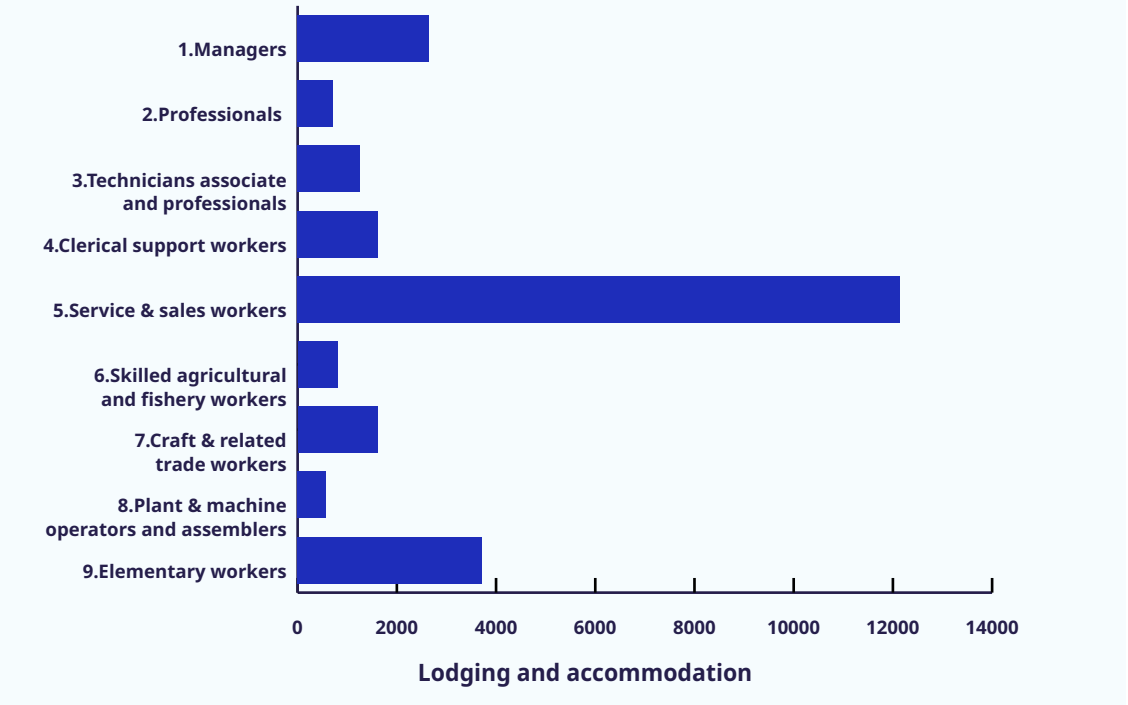


26 This is particularly the main objectives of the European Climate Pacthttps://europa.eu/climate-pact/about/priority-topics/green-skills_en (accessed on 07/08/2022).

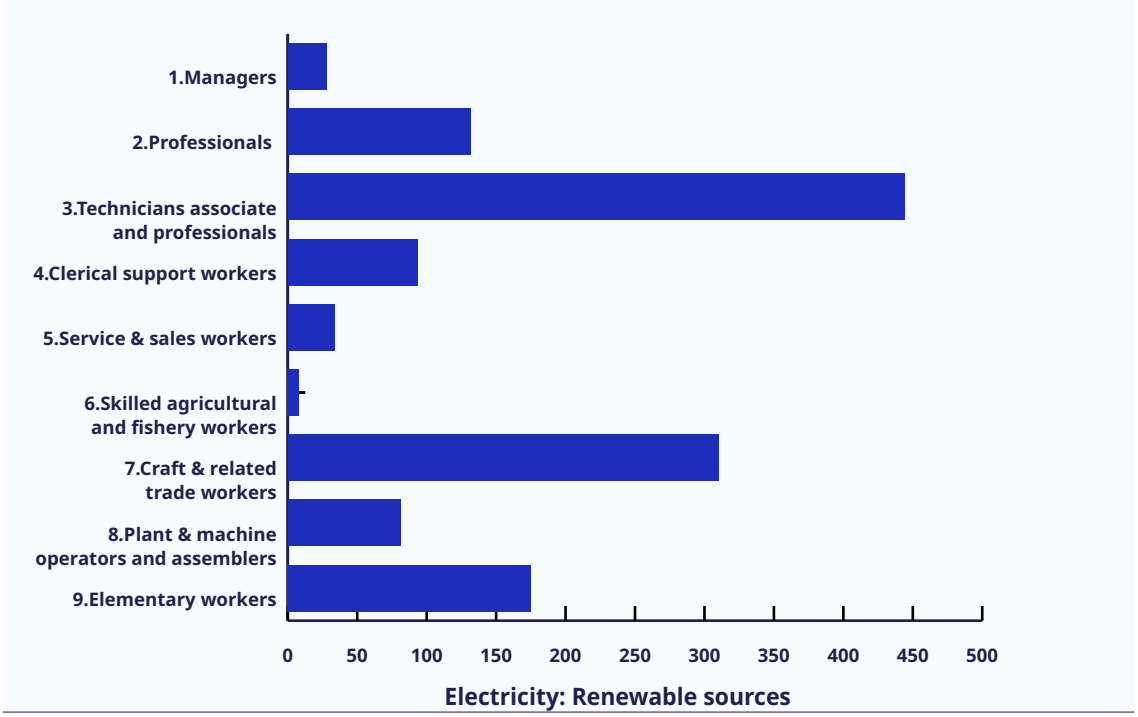
▶ **Figure 5.2. Green Skills in the Manufacturing Textile Industry**



▶ **Figure 5.3. Green Skills in the Lodging and Accommodation Sector**



▶ **Figure 5.4. Green Skills in the Renewable Electricity Sector**



in sugar sector, and the 50% being completely green and climate resilient (for e.g., climate smart agriculture), green jobs in the agriculture sector will stands at 18,000 in 2030. Figure 5.1 shows the distribution of the green jobs according to the International Standard Classification of Occupations (ISCO)'s nine occupation groups[27]. Most of the green skills will concentrate at the level of skilled agricultural workers (app. 7,300) and elementary workers (app. 8,200). This group will require knowledge of and ability to implement sustainable farming methods (such as the adoption of organic and bio-friendly fertilisers and pest management), and sustainable management of land, as well as the ability to operate efficient energy, water and waste management systems[28]. Skill development is anticipated at the level of agricultural technicians (app. 306) who are involved with crop diversification, application of improved technologies, and the design of efficient crop systems[29].

At the higher occupational hierarchy, skills include soil and water conservationists; environmental

27 The International Standard Classification of Occupations (ISCO) is used to disaggregate jobs according to the occupational groups. The ISCO is a system for classifying and aggregating occupational information according to nine major groups, commonly referred to ISCO-08. The occupation groups are: Managers; Professionals, Technicians and Associate Professionals; Clerical Support Workers; Services Workers; Skilled Agricultural, Forestry and Fishery Workers; Craft and Related Trades Workers; and Plant and Machine Operators, and Assemblers.

28 CSA includes agricultural practices and interventions that simultaneously adapt to climate change and contribute to mitigate climate change, while also promoting sustainable food systems that are efficient, using less land, water, and inputs (FAO, 2010)

29 ILO Skills for Employment Policy Brief. https://www.ilo.org/wcmsp5/groups/public/---ed_emp/documents/publication/wcms_731957.pdf

restoration planners (certification specialists); water resource specialists and water/ wastewater engineers' agricultural meteorologists (app.114). Given the key role of Managers in business operations, they will need to understand the climate-related impacts, and possible adaptation and mitigation strategies. As technology is likely to play an important role, there will be a need to anticipate changes in new technologies, particularly the use of Artificial Intelligence to make smarter planning decisions. Investment projects will be mostly funded through 'green design' and therefore, will require impact analysis on the avoided GHGs, carbon footprint, and economic benefits from green investments, among others. Managers will accordingly be expected to be acquainted with many concepts from an environmental, engineering as well as economic point of view.

In the manufacturing textile, assuming the no-growth, with 30% and 70% of Yarn and Thread, and Knitted and Crocheted being respectively transformed to green production processes, green jobs will stand at approximately 22,400. Most of them, as shown in figure 5.2, will be concentrated towards plant and machine operators (7,400) and craft and related workers (7,000). Core skills will include adaptability and transferability skills to enable workers to learn and apply the new technologies and processes required to improve energy efficiency and waste management.

Professional and technicians with green skills will stand at 2100. These skills will entail analytical thinking (including risk and systems analysis) to interpret and understand the need for change and the measures required, as well as the design of practices to reduce environmental impacts (e.g., pollution control officers, energy auditors). Green skills also include the implementation of ISO14000, and conducting Life Cycle Assessments, carbon footprint assessment, energy auditing, eco-friendly processes with minimum environmental impacts, among others. At management level (app. 900), business operators will require skills for the design and production of new products and systems (e.g., product designers, production engineers) as well as entrepreneurial skills to seize the opportunities of low-carbon technologies and environmental mitigation and adaptation.

Figure 5.3 shows the distribution of green skills in the Lodging and Accommodation sector, assuming 50% of the sector is transformed to greener practices and a growth rate of 6% annually. Around 12,000 service and sales workers will be required, followed by an approximate of 2,800 elementary workers. Around 2,600 managers would require development of green skills in the sector in question. Green skills also include the implementation of ISO14000 as the manufacturing sector. Skilling, reskilling and upskilling covers not just technical skills but also core/soft skills such as environmental awareness, analytical skills, teamwork, innovation, communications, leadership, negotiation abilities, and management and entrepreneurship skills.

Finally, figure 5.4 shows the green skills required in the renewable electricity sector, with an estimate of 1,300 direct jobs. Most of the employment is concentrated at the level of technicians (500) and crafts and related trade workers (300). The special mechanics and assembly has the responsibility to install and mount the renewable energy system. The groups specialising in mechanics and assembly work is primarily concerned with the installation, assembly, disassembly, as well as performing quality measurements, troubleshooting and documentation in connection with the work. Plant and machinery operators and elementary workers stand at 260.

The GLCE strategy will require the around 3,700 managers possessing green skills distributed unevenly across the four sectors under consideration. A need is observed for Production and Specialized Services Managers across economic sectors. Over and above their conventional management practices, managers would require specific knowledge, expertise and working practices which are geared towards sustainability, efficient reporting, and novel marketing approaches (branding, packaging, etc). Managers will be expected to develop innovative projects to increase their energy and resource efficiency, manage waste and monitor progress. Demand for engineering professionals and technicians with green skills are predicted for agricultural and manufacturing textile. Two main occupations that would require green skill upgrade are General and Keyboards Clerks, and Numerical and Material Recording. Mechanics, Repairers at the level of Craft Workers, Plant and Machinery Operators, and assemblers may have to operate different technology-oriented machineries and equipment.

6. Conclusion

This report concludes that reaching the 40% emission reduction target requires significant additional investments in green technology and human resource development. The current Green scenario modelled for this report only achieves a 32% reduction by 2030, with a remaining reduction gap of 8%. Notably, in the energy and electricity sector, the current sector targets are not sufficient to reach an overall target of 40% for the entire economy. This is due to the indirect and induced emissions which result even in the Green scenario from a growing economy. Additional private sector incentives, such as carbon pricing, green tax rebates or concessional loans are required to further increase green investment and shift away from the conventional processes and practices towards greener business practices. A positive conclusion from this analysis is, however, that increased climate ambition, higher sector targets and additional green investments will accelerate the transition towards a low carbon economy for the period 2022-2030 and thereby contribute to further GDP growth and more net job creation as compared to a Business-as-Usual scenario.

Subsequently, a significant number of green jobs in main economic sectors will be required to spearhead the transition. Thus, preparing the labour force to enable them to cope, matching the capital investments and ensuring growth in the green sector become pre-requites to achieve the low carbon emissions goal. Effectively designed NDCs need to integrate climate change literacy, promoting and providing skills training and capacity building at both national and sectoral levels. This will require bold actions to invest in people's capabilities so as to realise their full potential thus, contributing to the productivity of enterprises.

The move towards energy and resource efficient enterprises would require initial training as well as re skilling and an upskilling of the personnel at different levels regarding green practices. Green skills are likely to be essential at different occupational group, from managers to professionals and technicians to plant and machinery operators and elementary employees. There is a need for a coordinated policy approach among public and private sector. A Green Skill Development Plan is the way forward, which must be adopted holistically by different stakeholders, including training and educational institutions. In addition to skills policies, well designed macro-economic, industrial, enterprise and social protection policies are required to maximize employment gains, accelerate the transition, and make it just for all Mauritian men and women.

Appendix 1: Modelling strategy and data issues

Agricultural sector: In the agricultural sector, the key data sources on disaggregated foodcrops sector are the Supply and Use Table (SUT) 2013, the Digest of Agricultural Statistics (2019) and the National Accounts Statistics (2019). In the SUT, the agricultural sector is divided into sugarcane, foodcrops and animal production, fishing, forestry, and other agricultural services (government contribution). The second sub-sector i.e., foodcrops and animal production is further disaggregated in the National Accounts under the heading *foodcrops, fruits and flowers* and *Livestock & Poultry*. Using the data, foodcrops is separated and Gross Value Added, Compensation of Employees, and Taxes/subsidies are calculated.

Green or sustainable agriculture is defined as farming which uses significantly lower chemical inputs. In the current model, a green agriculture farm uses 80% less chemical fertilisers, and more of sustainable agriculture, in terms of composts and plants; manure from animal farming; and mineral fertilisers. This is applied to both the non-sugar (*foodcrops, fruits and flowers)* and sugar. In 2019, 29645 t of chemical fertilisers were exported. Around 13290t are classified for non-sugar agricultural products. The 5.9% green agriculture consequently uses 133t representing 80% of the conventional farming use (664.5t). The industry linkages are adjusted through a rise in intermediate inputs for agriculture compost and live animals, and an equivalent fall in imports. Greening processes require a systematic approach of monitoring and evaluating the requirements and hence, there is a need for higher professional services (10% more than conventional farming). The rise in professional services lead to an equivalent fall in value-added. The model also considers a fall in transport services, adjusted through value-added. Finally, the green sector also records a rise in yield.

A similar approach is adopted for the sugar sector. The total fertilisers correspond to the common practice of 138kg of Nitrogen, 50kg of Phosphorous, and 50kg of Potassium per hectares. Applying the inputs to area harvested of 48840 ha leads to 18000tonnes of fertilisers; the remaining domestic fertilisers of 29645 tonnes for 2019 are attributed to non-sugar agricultural sector. The green/low carbon sugar cane sector uses 80% less of chemical fertilisers. The equivalent adjustment is made through the purchase of organic fertilisers supplied by the agricultural sector, and manure from livestock sector. The green sugar farming follows the same adjustment in relation to transport and professional services and yield.

Green manufacturing sector: Data on gross output, value-added and consumption of electricity were extracted from the Census of Economic Activities for the Manufacturing textile sector. The Census provides comprehensive data collection for large establishment while, the data is based on a weighted sample in small establishments. In this respect, the enterprises with less than 10 employees have been separated from the large establishment with greater and equal 10 employees. The inter-industry linkages for the 10% most energy efficient textile component (in terms of gasoline, diesel and fuel oil) are estimated. Data on electricity input for Yarn and Thread, Woven and Tufted textile fabric shows that the low carbon component uses 63% of electricity less than the conventional one In the case of Knitted and Crocheted Fabrics, electricity input is 17.3% less in the low carbon sector as compared to the conventional one. The lower electricity expenditure leads to a rise in value-added of the green/low carbon enterprises. The IO table has been adjusted in this respect.

Sugar milling provides bagasse to the production of bagasse-based electricity, consuming 76% and exporting the remaining to the electricity distribution network. In this respect, a production line of bagasse-based electricity has been constructed. The production account is based on the revenue generated from bagasse. The electricity produced in 2019 stands at 439.6 GWh and the bagasse transfer fund was Rs 55million. Bagasse accounts for about 30% of the weight of sugar cane inputs.

Renewable energy sector: The renewable energy options include: solar energy produced by the Central Electricity Board, solar energy from household production; solar Energy from small

Independent Power Producers; onshore wind; offshore wind; biomass bagasse; biomass cane trash; landfill gas; waste to energy generation, hydro; and wave. Several options do not exist such as offshore wind and wave; however, their production linkages have been assumed, with a zero output. The non-use of fossil fuel in the renewable energy sector leads to an increase in value-added, reflecting the lower expenditures. However, the sector uses more of technical services, manufacturing parts for generators and construction which lead to a reduction in value-added.

Green tourism and other services: Modelling inter-industry linkages on the green/low carbon component of Lodging and Accommodation follows the same approach as in the manufacturing textile. The 10% most efficient in fossil fuel consumption is taken as green. The adjustment to the IO table are as follows: the green/low carbon Lodging and Accommodation sector uses 50% electricity less than the conventional. This implies an increase in value-added of that sector. On the other hand, data collected suggests that they use more of organic agriculture and professional services by 20% and 40% respectively. This is also adjusted through value-added.

Appendix 2. Output/employment and CO_2 eq. Multipliers

	OUTPUT			EMPLOYMENT				CO_2 EQ			
	Indirect	Induced	Total	Direct	Indirect	Induced	Total	Direct	Indirect	Induced	Total
Non-sugar agriculture	0.241	1.204	2.445	1.794	0.375	0.517	2.686	6.133	1.639	6.757	14.529
Green non-sugar agri	0.258	1.260	2.518	2.062	0.396	0.541	2.999	1.654	1.719	7.071	10.444
Forestry	0.013	0.986	1.999	1.695	0.025	0.424	2.144	0	0.051	5.533	5.583
Sugar cane agriculture	0.402	1.789	3.191	2.719	0.868	0.769	4.356	13.499	1.614	10.037	25.151
Green sugar cane agri.	0.503	1.943	3.445	2.802	0.991	0.835	4.628	3.186	2.090	10.901	16.177
Live animals and animal products	0.481	1.425	2.907	1.233	0.747	0.612	2.592	5.546	3.269	7.999	16.814
Unsustainable (coastal fishing)	0.156	0.700	1.856	7.739	0.182	0.301	8.222	0	0.988	3.929	4.916
Sustainable fishing (high seas and FADs)	0.154	0.702	1.855	1.064	0.205	0.302	1.570	0	0.946	3.938	4.885
Aquaculture	0.154	0.702	1.856	1.510	0.206	0.302	2.017	0	0.948	3.940	4.888
Ores and Minerals	0.677	1.071	2.748	0.688	0.385	0.460	1.534	0	7.374	6.011	13.385
Fruit, vegetables, oils and fats, grain mill products, starches and starch products	0.835	1.056	2.891	0.318	0.874	0.454	1.646	1.709	5.051	5.926	12.686
Meat and Poultry processing	0.705	0.488	2.193	0.312	0.705	0.210	1.227	0.977	4.614	2.736	8.328
Beverages and Bottling related products	0.431	0.259	1.690	0.312	0.272	0.111	0.696	2.317	3.848	1.454	7.619
Fish processed	0.400	0.554	1.953	0.239	0.390	0.238	0.867	0.435	2.233	3.107	5.774
Sugar milling	1.198	1.760	3.958	0.361	2.993	0.756	4.110	0	11.419	9.875	21.294
Yarn and thread, etc	0.476	1.365	2.842	1.156	0.334	0.587	2.077	7.961	13.762	7.661	29.384
Yarn and thread, etc -low carbon	0.595	0.807	2.403	0.755	0.514	0.347	1.616	2.766	8.654	4.528	15.948

	OUTPUT			EMPLOYMENT				CO_2 EQ			
	Indirect	Induced	Total	Direct	Indirect	Induced	Total	Direct	Indirect	Induced	Total
Knitted or crocheted fabrics - SMES	0.526	0.839	2.365	1.406	0.465	0.361	2.232	9.602	6.480	4.709	20.791
Knitted or crocheted fabrics- conventional	0.584	1.836	3.421	1.214	0.517	0.789	2.520	7.860	7.203	10.303	25.367
Knitted or crocheted fabrics- low carbon	0.482	1.237	2.718	1.523	0.426	0.531	2.481	3.339	5.936	6.939	16.214
Manufacturing of chemical and related products	0.293	0.231	1.524	0.821	0.175	0.099	1.096	6.862	3.056	1.296	11.214
Paper and Printing	0.164	0.123	1.286	0.819	0.078	0.053	0.950	2.464	2.488	0.688	5.641
Manufacturing of composting	0.662	0.573	2.235	0.778	0.393	0.246	1.418	1.963	6.650	3.216	11.829
Recycling 1: Paper	0.512	0.490	2.002	0.778	0.313	0.211	1.302	1.725	6.233	2.751	10.709
Recycling 2: PET recycling	0.611	0.405	2.016	0.735	0.359	0.174	1.268	1.795	10.877	2.270	14.942
Recycling 3: Textile	0.625	0.506	2.131	0.769	0.495	0.217	1.482	2.077	10.724	2.839	15.640
Recycling 4: Tyre repairing	0.797	0.344	2.141	0.743	0.527	0.148	1.418	2.415	10.912	1.930	15.256
Recycling 5: E-waste materials	0.819	0.670	2.490	0.910	0.538	0.288	1.736	3.021	8.553	3.762	15.337
Recycling 6: Oil waste	0.564	0.428	1.992	0.727	0.313	0.184	1.224	1.672	6.377	2.404	10.453
Recycle 7 Glass recycling	0.807	0.416	2.223	0.855	0.519	0.179	1.553	2.216	11.920	2.336	16.471
Ship buildings	0.232	0.698	1.930	1.138	0.169	0.300	1.607	2.201	2.573	3.918	8.692
Other manufactured goods	0.419	1.288	2.708	0.769	0.315	0.554	1.638	5.130	4.620	7.229	16.979
Constructions and construction services	0.286	0.997	2.283	0.781	0.231	0.429	1.440	0.333	1.252	5.597	7.182

	OUTPUT			EMPLOYMENT				CO_2 EQ			
	Indirect	Induced	Total	Direct	Indirect	Induced	Total	Direct	Indirect	Induced	Total
Wholesale and retail trade services	0.253	0.989	2.242	1.231	0.121	0.425	1.778	0.733	2.648	5.550	8.930
Food and beverage serving services excl hotel	0.421	0.958	2.379	1.328	0.240	0.412	1.979	4.164	7.393	5.375	16.932
Lodging and accommodation	0.429	0.957	2.386	0.639	0.245	0.411	1.295	3.376	7.839	5.367	16.582
Lodging and accommodation (Low Carbon)	0.394	1.021	2.415	0.762	0.247	0.439	1.447	2.244	4.488	5.727	12.459
Sea transports	0.308	1.093	2.401	0.577	0.194	0.470	1.240	10.732	2.327	6.134	19.194
Sightseeing boats	0.270	1.253	2.523	0.897	0.162	0.538	1.597	12.386	2.139	7.029	21.554
Storage and Freeport infrastructure	0.660	1.375	3.035	0.577	0.399	0.591	1.567	0.853	5.106	7.717	13.677
Cargo handling	0.615	1.339	2.954	0.577	0.370	0.575	1.522	0.171	4.772	7.515	12.457
Transport services: Land and ocean	0.606	0.907	2.513	0.293	0.361	0.390	1.044	0.554	4.726	5.090	10.370
Shipping agents	0.542	1.282	2.824	0.679	0.327	0.551	1.557	2.452	4.201	7.196	13.849
Passenger air transport services	0.197	1.012	2.209	0.577	0.119	0.435	1.131	0.332	1.524	5.681	7.536
Land transport, excl. public transport	0.475	1.265	2.740	0.577	0.381	0.544	1.501	5.994	2.901	7.101	15.996
Public transport	0.372	1.175	2.548	0.577	0.311	0.505	1.393	5.994	2.004	6.595	14.593
Electricity distribution sector	1.291	0.263	2.554	0	0.279	0.113	0.392	0	173.398	1.476	174.874
Electricity kerosene	0.286	0.323	1.609	0.112	0.154	0.139	0.404	0.227	1.938	1.811	3.976
Electricity Fuel oil	0.286	0.164	1.451	0.112	0.154	0.071	0.336	146.878	1.938	0.921	149.737

	OUTPUT			EMPLOYMENT				CO_2 EQ			
	Indirect	Induced	Total	Direct	Indirect	Induced	Total	Direct	Indirect	Induced	Total
Electricity diesel	0.286	0.164	1.451	0.112	0.154	0.071	0.336	87.975	1.938	0.921	90.834
Electricity coal	0.286	0.323	1.609	0.112	0.154	0.139	0.404	304.396	1.938	1.811	308.145
Electricity Solar energy (CEB)	0.296	0.340	1.636	0.112	0.161	0.146	0.419	0	1.982	1.907	3.889
Electricity Onshore wind	0.296	0.340	1.636	0.112	0.161	0.146	0.419	0	1.982	1.907	3.889
Electricity Solar energy (residential sector prod)	0.296	0.340	1.636	0.112	0.161	0.146	0.419	0	1.982	1.907	3.889
Electricity Solar Energy (Commercial sector prod.)	0.296	0.340	1.636	0.112	0.161	0.146	0.419	0	1.982	1.907	3.889
Electricity Biomass Bagasse	0.311	0.360	1.671	0.131	0.227	0.155	0.513	0	2.099	2.019	4.117
Electricity Biomass Cane Trash	0.296	0.340	1.636	0.211	0.161	0.146	0.519	0	1.982	1.907	3.889
Electricity Landfill Gas	0.296	0.340	1.636	0.135	0.161	0.146	0.443	0	1.982	1.907	3.889
Electricity Waste to energy generation	0.296	0.340	1.636	0.140	0.161	0.146	0.447	0	1.982	1.907	3.889
Electricity Offshore wind	0.296	0.340	1.636	0.140	0.161	0.146	0.447	0	1.982	1.907	3.889
Electricity wave	0.296	0.340	1.636	0.140	0.161	0.146	0.447	0	1.982	1.907	3.889
Electricity hydro	0.296	0.340	1.636	0.112	0.161	0.146	0.419	0	1.982	1.907	3.889
Gas and air conditioning	0.509	0.456	1.965	0.112	0.168	0.196	0.475	0	21.002	2.561	23.563
Water sector	0.501	1.812	3.314	1.099	0.213	0.779	2.091	0.969	16.405	10.170	27.544

	OUTPUT			EMPLOYMENT				CO_2 EQ			
	Indirect	Induced	Total	Direct	Indirect	Induced	Total	Direct	Indirect	Induced	Total
Financial intermediation, insurance and auxiliary services	0.275	0.942	2.217	0.142	0.104	0.405	0.651	0.033	0.920	5.287	6.240
Real estate services	0.179	0.245	1.424	0.049	0.087	0.105	0.242	0.911	0.639	1.373	2.923
Telecommunications services; information retrieval and supply services	0.404	1.439	2.842	0.616	0.172	0.618	1.406	2.340	8.601	8.072	19.013
Travel Tour and Agency	0.420	0.906	2.326	0.520	0.216	0.389	1.125	0.413	3.943	5.082	9.438
Cleaning and Landscaping	0.245	1.583	2.828	0.743	0.126	0.680	1.549	4.463	2.300	8.884	15.646
Other bus. Ser.	0.296	1.343	2.639	0.715	0.152	0.577	1.444	1.477	2.764	7.534	11.775
Public administration and other services to the community as a whole; compulsory social security services	0.079	2.877	3.956	1.272	0.003	1.236	2.512	0.014	0.974	16.145	17.133
Education services	0.096	3.166	4.262	1.359	0.109	1.360	2.828	0.135	0.441	17.765	18.341
Health and social services	0.186	2.089	3.275	0.771	0.121	0.898	1.790	0.342	2.763	11.722	14.827
Sewage and refuse disposal, sanitation and other environmental protection services	0.580	1.769	3.349	0.826	0.310	0.760	1.896	0.679	14.773	9.928	25.381
Services of membership organizations	0.087	1.673	2.760	4.400	0.043	0.719	5.162	1.426	0.672	9.389	11.486
Land-based Sports and Recreation activities	0.390	0.979	2.370	0.635	0.135	0.421	1.191	1.086	2.318	5.494	8.898

	OUTPUT			EMPLOYMENT				CO_2 EQ			
	Indirect	Induced	Total	Direct	Indirect	Induced	Total	Direct	Indirect	Induced	Total
Ocean-based sports and recreation activities	0.390	0.979	2.370	0.635	0.135	0.421	1.191	0.554	2.318	5.494	8.366
Other amusement activities	0.166	0.821	1.987	0.232	0.057	0.353	0.642	0.554	0.987	4.606	6.147
Other services	0.241	1.726	2.968	3.116	0.125	0.742	3.983	1.479	3.106	9.688	14.272
Households	0	0	4.161	0	0	0	1.788	4.648	0	23.349	23.349

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