



System of
Environmental
Economic
Accounting



LINKING THE TSA AND THE SEEA: A TECHNICAL NOTE

World Tourism Organization (UNWTO) - A Specialized Agency of the United Nations

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Background

This TSA-SEEA Technical Note describes approaches to linking information from the System of Environmental-Economic Accounting (SEEA) and Tourism Satellite Accounts (TSA) frameworks. This work forms a core part of the current Measuring the Sustainability of Tourism (MST) initiative of the UN World Tourism Organization (UNWTO) and the UN Statistics Division. The interrelationships between economic and environmental aspects are in fact one main focus of MST whose broader objective is to improve the organization and dissemination of information regarding tourism and sustainable development. Overall, the MST initiative will provide a strong statistical base to support monitoring progress towards the UN Sustainable Development Goals (SDGs) as part of the 2030 Development Agenda.

The development of a Technical Note was endorsed by the UN Committee of Experts on Environmental-Economic Accounting (UNCEEA) at its June 2016 meeting and by the UNWTO Committee on Tourism Statistics and TSA at its meeting in January 2017. A draft Technical Note was presented at the UNWTO International Conference on Tourism Statistics in Manila in June 2017. A draft was also discussed at a meeting of the SEEA Central Framework Technical Committee in June 2018. Based on the recommendations of that Technical Committee, the Technical Note was endorsed from an environmental-economic accounting perspective by the UNCEEA at its meeting in June 2018.

The UNCEEA has overseen the development of a number of Technical Notes relating to various components of the SEEA Central Framework. The Technical Notes that have been developed to date cover accounting for water, energy, air emissions, material flows, environmental protection expenditure and the environmental goods and services sector. This SEEA-TSA Technical Note follows the same general structure including the description of core accounts, discussion of indicators and provision of general compilation guidance.

However, the status of this note is somewhat different from other Technical Notes in that the underlying statistical framework describing all relevant treatments in the linking of SEEA and TSA remains under development. Thus, this document provides an initial set of relevant accounts and tables with a focus on broad structures and related indicators. This Technical Note also differs in covering materials from a number of SEEA components including water, energy and air emissions. The technical detail and other materials already available on these components is not summarized or repeated here but rather references are supplied and any extensions or adaptations relevant for integration with tourism are described.

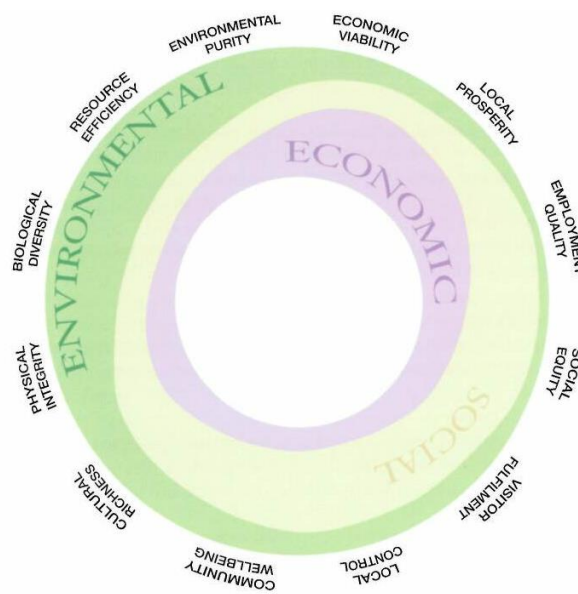
It is hoped that this draft can provide the basis for ongoing technical discussion and also provide a starting point for measurement testing in this area. All comments and suggestions would be welcome.

1. The need for statistical frameworks to inform discussion of sustainable tourism

Sustainable tourism has been a topic of discussion in tourism circles since the early 1990s. The interest in sustainable tourism has culminated in 2017 being declared the United Nations International Year of Sustainable Tourism for Development. This is especially timely given the increasing momentum on sustainable development following the adoption of the United Nations 2030 Development Agenda and the associated Sustainable Development Goals (SDGs).

The long-standing work of UNWTO in sustainable tourism is reflected in a range of contributions to policy and measurement. Using a focus on tourism destinations, the UNWTO has articulated that sustainable tourism should: (i) make optimal use of environmental resources; (ii) respect the socio-cultural authenticity of host communities; and (iii) ensure viable, long-term economic operations¹. It also identified 12 key policy themes as shown in Figure 1.

Figure 1. Relationship between policy areas and the key dimensions of sustainability



Source: UNEP/UNWTO (2005)

Significant progress in the definition and collection of internationally comparable tourism statistics has been achieved over the past 20 years. This progress is reflected in the *International Recommendations for Tourism Statistics* (IRTS) (UNWTO, et al, 2008) and the *Tourism Satellite Account: Recommended Methodological Framework* (TSA:RMF) (UNWTO & UN, 2008).

Unfortunately, there is a significant gap from a statistical perspective in defining standards for the integration of economic, environmental, social and destination level statistics that are required for assessment of the sustainability of tourism. With the aim of closing this statistical gap, in 2015 the UNWTO launched the *Measuring the Sustainability of Tourism* (MST) initiative². Broadly, the MST initiative is aimed at developing a common language to expand the measurement of tourism, which is currently largely focused on tourism as an economic phenomenon, to incorporate the social and environmental aspects of tourism for a more adequate consideration of sustainability in tourism.

¹ UNEP/UNWTO (2005) Making Tourism More Sustainable: A Guide for Policy Makers, Box 1.1

² <http://cf.cdn.unwto.org/sites/all/files/docpdf/brochurees.pdf>

This SEEA-TSA Technical Note describes both a first step and core part of the overall Statistical Framework for MST by providing a standardized approach to link the economic and environmental dimensions of tourism. The Technical Note is structured to provide a starting point for compilers of both tourism satellite accounts and environmental-economic accounts to consider ways in which their accounts can be adapted and extended to organize information for assessing the environmental sustainability of tourism. It would be expected that application and implementation of the proposals in this Technical Note would be flexible and modular, allowing countries to work on those aspects of most relevance within their country and taking into consideration the level of available resources.

There are a large number of different statistics that are brought into consideration in linking the TSA and the SEEA frameworks. This Technical Note does not provide details on the measurement of all of these statistics but rather has a focus on issues of integration and new challenges that arise. Links to relevant materials are provided through the document.

Section 2 gives an overview of the TSA and SEEA frameworks and outlines the possible ways in which the frameworks may be integrated. Section 3 describes an initial set of core accounts highlighting both the structure of these accounts and the key conceptual issues to be dealt with. Section 4 presents combined presentations in which data from different accounts are brought together to provide a summary of the economic and environmental dimensions of tourism and a base for the derivation of indicators. Section 5 discusses the compilation and measurement of data and Section 6 notes areas for extension and future development. References and relevant links to source material are provided in Section 7.

2. Integrating the SEEA and TSA frameworks

2.1. Introduction

The development of the Statistical Framework for MST (SF-MST) is based in large part on the integration of two, existing accounting frameworks – the Tourism Satellite Accounts (TSA) and the System of Environmental-Economic Accounting (SEEA). Both of these frameworks are based on the accounting framework for measuring the economy – the System of National Accounts (SNA). This section provides a brief introduction to each of these frameworks and an overview of the ways in which they can be used to organize information for assessing the sustainability of tourism.

2.2. Key aspects of the TSA framework

The TSA framework is described in the TSA:RMF. It is designed primarily for the measurement of tourism activity and its economic contribution in a manner consistent with the measurement of value added and gross domestic product (GDP) from the SNA.

Tourism activity is defined from a demand perspective. Its value added is the share of total value added arising due to the demand for products by visitors (i.e. people outside of their usual environment). Tourism cannot be observed through a focus only on the standard industry-based views of economic activity. For example, a measure of the value-added of restaurants cannot be solely attributed to tourism. The TSA provides the concepts and definitions to identify and record the tourism component of economic activity in a standardized way.

Key aspects of the TSA are:

- The definition and scope of tourism expenditure and consumption
- The definition and classification of tourism products, tourism characteristic activities and tourism industries
- The definition of tourism direct gross value added, tourism direct gross domestic product, tourism employment and gross fixed capital formation of tourism industries

The TSA:RMF describes all of the relevant accounting aspects and presents standard tables and aggregates. The TSA:RMF is aligned with the IRTS and uses the definitions and classifications of visitors to ensure that the collection of tourism statistics, such as those on visitor movements and tourism expenditure, can be utilized directly in the compilation of TSA.

The TSA uses as its starting point the activity of those people defined as visitors. The accounts of the TSA framework record the tourism expenditure, i.e. the amount paid for the acquisition of consumption goods and services, as well as valuables, for and during tourism trips. This expenditure is matched with the supply of the associated goods and services, ensuring a balance is recorded between supply and use.

The majority of visitor expenditure is on goods and services produced by tourism characteristic activities (see Box 1) and hence there is a particular focus in the TSA accounts on understanding the production, income, employment, investment and value added of these activities.

Box 1. Categories of tourism characteristic consumption products and activities (tourism industries)

Consumption products	Activities
1. Accommodation services for visitors	1. Accommodation for visitors
2. Food and beverage serving services	2. Food and beverage serving activities
3. Railway passenger transport services	3. Railway passenger transport
4. Road passenger transport services	4. Road passenger transport
5. Water passenger transport services	5. Water passenger transport
6. Air passenger transport services	6. Air passenger transport
7. Transport equipment rental services	7. Transport equipment rental
8. Travel agencies and other reservation services	8. Travel agencies and other reservation services activities
9. Cultural services	9. Cultural activities
10. Sports and recreational services	10. Sports and recreational activities
11. Country-specific tourism characteristic goods	11. Retail trade of country-specific tourism characteristic goods
12. Country-specific tourism characteristic services	12. Other country-specific tourism characteristic activities

A significant challenge in compiling TSA is distinguishing the production of goods and services for visitors within overall industry output. For example, distinguishing air transport services to visitors distinct from freight services. The integration of TSA and SEEA based accounts extends this challenge to distinguishing environmental stocks and flows relevant to visitors from total stocks and flows at the industry level. Approaches to meeting this challenge are discussed in Section 4.

2.3. Key aspects of the SEEA framework

The SEEA framework has been developed since the early 1990s to provide a means by which environmental information can be integrated with the standard economic data provided in the national accounts. It is the desire to convey a more complete picture of economic activity through the integration of environmental data that is at the heart of the SEEA approach.

The SEEA can be separated into four broad types of accounting:

- *Accounting for environmental flows* in physical terms; into, within and from the economy. This includes accounting for flows of water, energy, air emissions, solid waste and emissions to water; and can be extended to account for individual elements and substances such as carbon and nitrogen.
- *Accounting for natural resources* in terms of stocks and changes in stocks (e.g. discoveries of resources, depletion). This includes accounting for stocks of mineral and energy resources, timber, fish, water and soil.
- *Accounting for environmental transactions* that are included in the SNA but not specifically identified as “environmental”. This includes accounting for environmental protection and resource management expenditure, environmental taxes and subsidies and the supply and use of products used for environmental purposes known as environmental goods and services.
- *Accounting for land and ecosystems*. In this type of accounting the focus is on understanding the changing composition of the area of a country in terms of land use and land cover and the quality of the land in terms of the condition of its ecosystems. Accounting for ecosystems also involves considering the benefits derived from them and, correspondingly, the measurement of the flows of ecosystem services they generate. This allows for evaluation of the capacity of ecosystems to continue to generate market and non-market ecosystem services.

Accounting within the SEEA framework can be undertaken in physical and monetary terms and the focus is on the alignment of measurement boundaries such that environmental data can be directly and meaningfully related to associated economic data, for example through the use of consistent definitions and classifications of economic units.

2.4. Integrating the SEEA and the TSA

Work on combining the TSA and SEEA frameworks has been considered previously, for example in work by Canada³ and Italy⁴. An example of connecting TSA and SEEA has also been included in the SEEA Applications and Extensions, Chapter 4⁵. Using these earlier studies and pilot studies that are underway as part of the MST project, it is envisaged that a full articulation and resolution of various technical issues can be achieved. This Technical Note is designed to support this piloting activity.

A general issue that must be considered is that accounting as applied in the SEEA framework is primarily from a supply or **production** perspective – i.e. the common focus is on the use of natural inputs (e.g. water, minerals, energy) by economic units and residual flows (e.g. air emissions, wastewater, pollutants) generated by economic units, including households.

On the other hand, as noted above, tourism statistics and the associated TSA framework reflect a demand or **consumption** perspective whereby the measurement scope depends primarily on the characteristics of the consumer, i.e. whether or not the consumer is a visitor. Further, the status of an individual consumer as a visitor will change over time as people move in and out of their usual environment. Reconciling the production and consumption perspectives is an important part of integrating the TSA and SEEA frameworks.⁶

In support of the measurement of the environmental dimension of tourism, five extensions or adaptations of the frameworks can be envisaged:

- extensions within the TSA framework for describing tourism industries
- connections between SEEA accounts for individual environmental flows (e.g. water, energy, waste) and tourism activity
- accounting for produced and environmental assets relevant to tourism
- accounting for environmental protection and resource management activities and environmental transactions undertaken by tourism industries
- spatial accounting for tourism activity applying the logic of SEEA land and ecosystem accounting.

The focus of this Technical Note is on the second extension, i.e. accounting for environmental flows for tourism activity. The first extension does not require integration between the SEEA and the TSA and will be described in the broader SF-MST. The final two extensions will also be developed further in the SF-MST. An initial discussion on the potential to advance accounting for tourism related produced and environmental assets and accounting for environmental activities and transactions; and to undertake land and ecosystem accounting for tourism is presented in Section 6.

³ Jackson, C. et al. (2008), "Linking the Canadian Tourism Satellite Account and the Canadian System of Environmental and Resources Accounts to measure the environmental impact of tourism in Canada: An exploratory study for two pilot countries", presented to the 9th International Forum on Tourism Statistics, Paris, November 19-21, 2008.

⁴ Costantino, C. and Tudini A. (2005) "How to develop an accounting framework for ecologically sustainable tourism" in Lanza A., Markandya A., Pigliaru F. (eds) *The Economics of Tourism and Sustainable Development*, Edward Elgar, UK.

⁵ https://unstats.un.org/unsd/envaccounting/seeaRev/ae_final_en.pdf

⁶ The distinction between the production and consumption perspectives drawn here describes the most common areas of focus for the SEEA and the TSA. In fact, both frameworks incorporate production and consumption perspectives.

It is important to recognize that the focus on environmental flows will not provide a complete assessment of environmental sustainability. This is because to understand the sustainability of, for example water use or energy use, it is also necessary to understand the associated changes in the stocks of resources that underpin this use. By way of example, in a country with ample supplies of water or renewable energy, high levels of water and energy use are likely to be environmentally sustainable. On the other hand, in water resource constrained locations or fossil fuel dependent energy systems, even low levels of water and energy use may be relatively unsustainable.

A different but related issue of interpretation arises with respect to GHG emissions since the attribution of emissions to specific businesses or visitors is unlikely to align closely with the potential impacts arising from climate change that can be associated with those emissions.

Overall, the focus on environmental flows should be interpreted as providing information on the extent to which tourism activity is placing pressure on the environment. Assessments of environmental sustainability must go further and include an assessment of environmental assets including ecosystems and biodiversity.

3. Initial core accounts for tourism industries

3.1. Introduction

Core accounts represent a minimum set of information that countries can aim to compile and report. While core accounts present a minimum set, countries may wish to extend the level of detail in areas deemed particularly policy relevant. The development of a core set of SEEA based accounts and tables was requested by the UN Statistical Commission at its 44th session in February 2013. The core accounts based on SEEA and TSA that are presented here constitute a starting point in the development of common reporting tables but are not mandatory tabulations.

At this stage in the development of the broader SF- MST, an initial set of four core accounts are described focused on linking measurement of environmental flows recorded following the SEEA with tourism industries as accounted for in the TSA. The four accounts cover flows of:

- water, including wastewater
- energy
- greenhouse gas (GHG) emissions
- solid waste.

The level of detail and industry disaggregation of these four core accounts is relatively uniform with a clear focus on tourism industries. For presentational purposes, the number of tourism industries has been limited to five industry classes including a summary class for all transport activity and a class for all other tourism industries. In practice all tourism industries as identified in the standard TSA presentation should be reported separately. The set of tourism industries is shown in the following table.

Table 1. Categories of tourism characteristic activities (tourism industries)

Activities
1. Accommodation for visitors
2. Food and beverage serving activities
3. Railway passenger transport
4. Road passenger transport
5. Water passenger transport
6. Air passenger transport
7. Transport equipment rental
8. Travel agencies and other reservation services activities
9. Cultural activities
10. Sports and recreational activities

In addition to tourism industries, specific industries relevant to each account are included, such as the water collection, treatments and supply industry and the sewerage industry in the case of the water account.

The accounts described here are presented in terms of compilation for annual frequencies and at national level. While this is a suitable basis for description of the core accounts, for assessing tourism sustainability compilation of accounts in both sub-national and sub-annual terms is likely to be relevant. In general, the same conceptual approach will apply, but there will be additional data and compilation issues to consider.

It is noted that a focus on annual and national level compilation will likely suit the needs for national and international reporting (for example, for the SDG indicators) but, for sustainable tourism policy and analysis, this level of detail will usually not be sufficient. Nonetheless, the approach described here will provide a firm basis for the co-ordination of information at finer levels of detail and this will, in turn, support a more integrated understanding of tourism activity. In

this sense, the accounting approach provides the basis for the comparison and aggregation of information at different spatial levels and at different frequencies, recognizing that not all possible combinations of spatial detail and frequency will be needed or relevant.

All of the core accounts described here are compiled from a production perspective, i.e. by considering for each tourism industry the relevant flows of water, energy, GHG emissions and solid waste. This is distinct from commencing the analysis from the set of products purchased by visitors which will embody these environmental flows. The relationship between the production and the consumption perspectives is considered further later in this section.

While having a specific focus on tourism industries, the core accounts encompass an economy wide view such that the various environmental flows for tourism can be compared to economy wide aggregates. However, since not all of the output for each industry is consumed by visitors, not all environmental flows for each tourism industries should be attributed to tourism. For example, only a part of the water use by the restaurant industry should be attributed to tourism - its tourism share. This same principle also applies in the case of non-tourism industries since some of their output and associated environmental flows will be attributable to tourism. The estimation of tourism shares is considered further later in this section.

3.2. Accounts for water flows for tourism industries

The first core account is a physical supply and use table for flows of water. It contains information on the supply and use of water and provides an overview of water flows from the environment into tourism and other industries, the distribution and use of this water and the generation and treatment of wastewater. It is likely that, in practice, only relatively few cells in the table will be of significance and these should form the focus of initial development. These cells are highlighted as striped cells.

Physical supply and use tables for water can be compiled at various levels of detail, depending on the required policy and analytical focus and data availability. Of particular interest for sustainable tourism are the seasonal patterns in water use since in specific locations there will be peaks in the demand for water. Also, consistent with the advice in the SEEA Central Framework, it would be preferable for the tables to be compiled for individual catchments that are associated with tourism activity since the pressures on water supply will vary by location.

The breakdown of economic activities identified in the tourism industries water flow account distinguishes the main tourism industries and the main industries associated with water supply and use. Recognizing that in any given industry not all water flows will be attributable to tourism, the distinction between tourism and non-tourism flows should be made following the methodological advice discussed in Section 3.6.

In both the supply table and the use table, the rows are grouped into five sections. Each section captures different aspects of water flows. These sections follow the structure of the physical supply and use table for water presented as core account #1 in the SEEA Technical Note on water accounting, i.e. Account 1: Physical supply and use table for water.

For the purposes of describing the application to tourism, the full set of entries has been reduced to provide a focus on those entries expected to be of most relevance to the analysis of water flows for tourism industries. Ideally, the accounting for these flows would be undertaken as part of an economy wide accounting for water and the structure described supports this approach.

For a full discussion of each of these sections and the associated terms and definitions, compilers are encouraged to read the relevant materials for water accounting listed in Section 7.

At an introductory level, the SEEA Technical Note for water accounting is a good starting point. It provides a detailed description of the physical SUT for water and of the relevant SEEA Central Framework accounts and an overview of the key aggregates and indicators which can be derived from the SUT. It also deals with the data sets required to produce the tables, including the main concepts, data sources and compilation methods.

Table 2: Tourism industries water flow account (cubic metres)

Physical supply table for water										Flows from the Rest of the world	Flows from the Environment	Total supply	
Abstraction of water; Production of water; Generation of return flows													
Tourism industries										Water collection, treatment and supply	Sewerage	Other Industries	Households
Accommodation for visitors	Food & beverage serving	Passenger transport	Travel agencies & reservation services	Other tourism industries	Total tourism industries								
Tourism Total	Tourism Total	Tourism Total	Tourism Total	Tourism Total	Tourism Total	Tourism Total							
1. Sources of abstracted water													
Total supply abstracted water													
2. Water													
Distribution of abstracted water													
Own-use of abstracted water													
3. Wastewater and re-used water													
Wastewater to treatment													
Own treatment of wastewater													
Re-used water produced (for distribution)													
Total Wastewater and Re-used water													
4. Return flows of water													
Total Return flows													
5. Evaporation of abstracted water, transpiration and water incorporated into products													
Total													
TOTAL SUPPLY													

NB: Dark cells are null by definition; striped cells reflect those of most likely importance

3.3. Accounts for energy flows for tourism industries

The second core account is a physical supply and use table for flows of energy. It contains information on the supply and use of energy by type of energy product including energy from renewable and non-renewable sources. It is likely that, in practice, only relatively few cells in the table will be of significance and these should form the focus of initial development. These cells are highlighted as striped cells.

Physical supply and use tables for energy can be compiled at various levels of detail, depending on the required policy and analytical focus and data availability. For example, where there may be limitations in the availability of energy from specific sources, understanding the seasonal patterns in energy use may be of interest. It is likely to be important to include estimates for the generation of energy on own-account for example through the installation of solar panels. The changing demand for energy will be missed if such own-account production is excluded.

The breakdown of economic activities identified in the tourism industries energy flow account distinguishes the main tourism industries. All other industries are grouped in a single column and hence for additional breakdowns and comparisons, an economy wide energy flow account will need to be compiled. Recognizing that in any given industry not all energy flows will be attributable to tourism, the distinction between tourism and non-tourism flows should be made following the methodological advice discussed in Section 3.6.

In both the supply table and the use table, the rows are grouped into four sections. Each section captures different aspects of energy flows. These sections follow the structure of the physical supply and use table for energy presented as core account #1 in the SEEA Technical Note on energy accounting, i.e. Account 1: Physical supply and use table for energy.

For the purposes of describing the application to tourism, the full set of entries has been reduced to provide a focus on those entries expected to be of most relevance to the analysis of energy flows for tourism industries. Ideally, the accounting for these flows would be undertaken as part of an economy wide accounting for energy and the structure described supports this approach. A useful extension is to distinguish the use of energy products between energy from renewable and non-renewable sources.

For a full discussion of each of these sections and the associated terms and definitions, compilers are encouraged to read the relevant materials for energy accounting listed in Section 7. At an introductory level, the SEEA Technical Note on energy accounts is a good starting point. It provides a detailed description of the physical SUT for energy, discusses classifications for energy and the primary accounts from the SEEA Central Framework which inform the physical SUT for energy, highlighting key aggregates and indicators which can be derived from the SUT. It also deals with the data sets required to produce the tables, including the main concepts, data sources and compilation methods.

Table 3: Tourism industries energy flow account (joules⁷)

Physical supply table for energy															
Production energy products & Generation of residuals											Accumulation	Flows from the rest of the world Imports	Flows from the environment	TOTAL	
Tourism industries										Electricity and gas supply	Other industries	Households			
Accommodation for visitors	Food & beverage serving	Passenger transport	Travel agencies & reservation services	Other tourism industries	Total tourism industries										
Tourism Total	Tourism Total	Tourism Total	Tourism Total	Tourism Total	Tourism Total	Total	Tourism Total								
1. Energy from natural inputs															
Natural resource inputs															
Inputs of energy from renewable sources															
Other natural inputs															
2. Energy products															
Total production of energy products															
3. Energy residuals															
Total energy residuals															
4. Other residual flows															
Residuals from end-use for non-energy purposes															
Energy from solid waste															
TOTAL SUPPLY															

NB: Dark cells are null by definition; striped cells reflect those of most likely importance

⁷ According to the International Recommendations for Energy Statistics (IRES), energy statistics are supposed to be compiled by converting physical measures of mass and volume such as tonnes, litres and cubic metres into a common unit representing energy content in net calorific terms. Joule is the common unit generally used for expressing energy flows.

Physical use table for energy										Final consumption	Accumulation	Flows to the Rest of the world	Flows to the environment	TOTAL
Intermediate consumption; Use of energy resources; Receipt of energy losses												Exports		
Tourism industries							Electricity and gas supply	Other industries						
Accommodation for visitors	Food & beverage serving	Passenger transport	Travel agencies & reservation services	Other tourism industries	Total tourism industries									
Tourism Total	Tourism Total	Tourism Total	Tourism Total	Tourism Total	Tourism Total			Tourism Total						
1. Energy resources														
Natural resource inputs														
Inputs of energy from renewable sources														
Other natural inputs														
2. Energy products														
Transformation of energy products - Total														
End-use of energy products by SIEC class														
Coal														
Peat and peat products														
Oil shale / oil sands														
Natural gas														
Oil														
Biofuels														
Waste														
Electricity														
Heat														
Nuclear fuels and other fuels														
Total end-use for energy purposes														
End-use for non-energy purposes														
3. Energy residuals														
Total energy residuals														
4. Other residual flows														
Residuals from end-use for non-energy purposes														
Energy from solid waste														
TOTAL USE														

NB: Dark cells are null by definition; striped cells reflect those of most likely importance

3.4. Accounts for GHG emissions for tourism industries

The third core account is a physical supply and use table for flows of GHG emissions. It contains information on the generation of GHG emissions by tourism industries by type of GHG emissions and is adapted from the air emissions account in the SEEA Central Framework (Table 3.7). Key cells for the compilation of this account are highlighted as striped cells and focus on release of carbon dioxide emissions by tourism industries.

In general, the generation of GHG emissions will be “used”/received by the atmosphere directly. Generally, compilation of GHG emissions on an annual basis and at national level will be sufficient for policy and analytical purposes. Of particular interest will be the GHG emissions associated with transport. In this regard the method for attributing emissions to individual countries, particularly in the case of air and water transport, is of direct interest. This is discussed in more detail below.

The breakdown of economic activities identified in the tourism industries GHG emissions account distinguishes the main tourism industries. Recognizing that in any given industry not all GHG emissions will be attributable to tourism, the distinction between tourism and non-tourism flows should be made following the methodological advice discussed in Section 3.6. For a full discussion of the associated terms and definitions, compilers are encouraged to read the relevant materials for GHG and air emissions accounting listed in Section 7. Once finalized, the SEEA Technical Note for air emissions accounting (currently under development) will be a good starting point.

Depending on the availability of data, an alternative breakdown of GHG emissions would involve identifying the source of emissions, for example road vehicles, airplanes or accommodation facilities – as distinct from the industries which are responsible for these emissions.

Table 4: Tourism industries GHG emissions account (tonnes)

Tourism industries GHG emissions (Mass units - '000 tonnes)																
Supply table for GHG emissions																
Type of substance	Generation of emissions										Accumulation Emissions from landfill	Flows from the Environment	Total supply of emissions			
	Tourism industries													Other industries	Households	
	Accommodation for visitors	Food & beverage serving	Passenger transport	Travel agencies & reservation services	Other tourism industries	Total tourism industries	Tourism Total		Tourism Total							Tourism Total
Carbon dioxide																
Methane																
Dinitrogen oxide																
Nitrous oxides																
Total CO2 equivalent																
Use table for GHG emissions																
GHG Emissions released to the environment (CO2 equivalent)													Flows to the Environment	Total use of emissions		
[Dark cells representing null values]																

NB: Dark cells are null by definition; striped cells reflect those of most likely importance

3.5. Accounts for solid waste for tourism industries

The fourth core account is a physical supply and use table for flows of solid waste. It contains information on the generation, collection and disposal of solid waste by type of waste. It is likely that, in practice, only a few cells in the table will be of significance and these should form the focus of initial development. These cells are highlighted as striped cells.

In both the supply table and the use table, the rows are grouped into two sections, corresponding to the fact that while the materials at issue appear in the economy as “residuals”, they may also be purchased. These sections follow the structure of the physical supply and use table for solid waste presented in Table 3.9 Solid waste account in the SEEA Central Framework. The items selected

for the categories of solid waste are those deemed relevant for tourism industries and for the activities of other industries that meet visitors' demand.

Physical supply and use tables for solid waste would generally be compiled at a national level and at annual frequency but it may be relevant to compile accounts for specific municipal areas in which tourism is a significant activity and, depending on the capacity for the treatment and disposal of waste, measurement at sub-annual frequencies to monitor peaks in waste generated by tourism activity may be relevant.

The breakdown of economic activities identified in the tourism industries solid waste flow account distinguishes the main tourism characteristic activities and the main industries associated with waste collection and disposal. The categories of solid waste are described in Annex 1 of the SEEA Central Framework. As yet there is no standardized classification of solid waste but these categories can provide a basis for collection of data and compilation of accounts. It may be of interest to compile estimates of the total quantity of solid waste, irrespective of type. For a full discussion of each of the various entries in the account and the relevant definitions and treatments, compilers are encouraged to read the relevant materials for solid waste accounting listed in Section 7. SEEA Central Framework Section 3.6.5 summarizes the approach to accounting for solid waste.

Table 5: Tourism industries solid waste account (tonnes)

Physical supply table for solid waste											Flows from the rest of the world	Flows from the environment	Total supply	
Generation of solid waste											Imports of solid waste	Recovered residuals		
Tourism industries											Other industries	Households		
Accommodation for visitors		Food & beverage serving		Passenger transport		Travel agencies & reservation services		Other tourism industries		Total tourism industries				
Tourism	Total	Tourism	Total	Tourism	Total	Tourism	Total	Tourism	Total	Tourism	Total			
A. Generation of solid waste residuals														
Metallic waste and other recyclables														
Discarded equipment and vehicles														
Mixed residential and commercial wastes														
Other wastes														
Total solid waste														
B. Generation of solid waste products														
Total solid waste														
Physical use table for solid waste											Final consumption	Flows to the rest of the world	Flows to the Environment	Total use
Intermediate consumption; Collection of residuals											Households	Exports of solid waste		
Tourism		Other industries		Households		Tourism industries		Other industries						
Tourism	Total	Tourism	Total	Tourism	Total	Tourism	Total	Tourism	Total					
Landfill	Incineration	Recycling and reuse	Other treatment	Total										
C. Collection and disposal of solid waste residuals														
Total solid waste														
D. Use of solid waste products														
Total solid waste														

NB: Dark cells are null by definition; striped cells reflect those of most likely importance

3.6. Estimating the tourism share of environmental flows

As noted in the introduction to Section 3, the available statistical information on environmental flows does not make reference to tourism specifically, though environmental flows related to tourism activity are embedded in the estimates. For example, data on GHG emissions generated by production processes that produce output purchased by visitors (e.g. accommodation or transport services) is not available with specific reference to the tourism share. What is required therefore, are techniques to estimate the proportion of a given environmental flow that is attributable to visitor activity. A number of different techniques were examined in Costantino (2017) and the findings are summarized here. Compilers are encouraged to read the additional detail and examples presented in that paper for further information.

The paper recognizes that, at least in theory, data on environmental flows related to visitors may be collected directly in cases where tourism and non-tourism businesses are capable of providing information on the different environmental flows as they relate to visitors and non-visitors. While

some detailed information may be available in some cases (and should be used if at all possible), the paper concludes that it is unlikely to envisage these data being available on a regular basis for official statistics.

In the absence of directly collected data, three different tourism ratios are described:

- output ratios - calculated by dividing an industry's output sold to visitors by its total output
- value added ratios - calculated by dividing an industry's value added attributable to sales of output to visitors by its total value added
- intermediate consumption ratios – calculated by dividing an industry's intermediate consumption for the production of output sold to visitors by its total intermediate consumption

Each of these could be used to estimate, for each industry, the proportion of an environmental flow (water, energy, GHG emissions, solid waste, etc.) attributable to visitor activity and hence to tourism. In concept, all of these ratios can be derived from a TSA (TSA:RMF Table 6).

By way of example, the tourism share of water use in the restaurant industry may be estimated by multiplying the total water use of that industry by the output ratios of the restaurant industry as defined above.

Some care should be taken in the use of the different tourism ratios for different environmental flows. Output ratios should be used where the magnitude of the environmental flow of interest is directly related to the level of production (e.g. GHG emissions and solid waste) while intermediate consumption ratios are best applied for those environmental flows that are inputs to production (e.g. energy).

Value added ratios can be used when output or intermediate consumption ratios are not available and estimating value added ratios can turn out to be relatively more affordable, but they are not preferred. Their use depends on the extent to which it can be assumed that there is a close relationship between the value added ratio and the ratio concerning output or intermediate consumption. At the same time, where output and intermediate consumption ratios are quite high then it is likely that the value added ratio is also high and then value added ratios may be good proxies for output ratios or intermediate consumption ratios.

The more general assumption in estimating tourism shares is that the production function (mix of outputs and inputs) for an industry is the same for visitors and non-visitors. For example, the amount of water used to make a restaurant meal is invariant between consumers. In concept, this assumption is likely reasonable provided that information is available at a relatively fine level of industry detail. However, in practice it may be difficult to source suitably fine levels of industry detail in which case the appropriateness of the assumption will depend on the extent of differences in the consumption patterns of visitors compared to residents and the mix of products within the industry.

There are a number of examples of the calculation and use of tourism ratios for attributing environmental flows to tourism that are referenced in Section 7. Further, it is anticipated that this area of work will lead to ongoing discussion and testing of options such that the advice provided here can be improved over time.

3.7. Distinguishing the consumption and the production perspectives

The discussion in this section has focused on the measurement of environmental flows from the perspective of tourism businesses, i.e. a production perspective. The next step is to consider, for the same environmental flows (water, energy, GHG emissions and solid waste), the methods that would be appropriate in estimating the attribution of flows based on visitor activity.

First, measurement should consider the environmental flows associated with tourism activity where households and individuals undertake activity on their own-account. For example, the energy and GHG emissions associated with driving one's own car on holiday or staying in their own holiday homes. Also for consideration are the environmental flows associated with visitors staying with friends and relatives. In allocating SEEA estimates to tourism, these environmental flows should be recorded in addition to those caused by production processes discussed earlier in section 3.

Further, in line with SEEA advice concerning possible applications and extensions of economic-environmental accounts, one way to consider the measurement challenge from a consumption perspective is to recognize that all products are outputs from production processes which are, at an aggregate level, reflected in standard supply and use tables. By using the information on the relationships between inputs and outputs of goods and services reflected in these tables, in principle it is possible to determine a link between the environmental flows of specific production processes along the whole supply chain linked to tourism demand and the outputs that are ultimately consumed by visitors. For example, it is possible to estimate the quantity of energy embodied in the provision of accommodation services for visitors. The same logic could be applied for other environmental flows such as water and GHG emissions.

The techniques of attributing environmental flows to categories of final demand are well established and widely applied. The SEEA Applications and Extensions provides an introduction to the relevant approaches and associated literature in Chapter III and, in Chapter IV, it provides an example of applying this approach in relation to household consumption. It is possible to use the principles outlined in SEEA Applications and Extensions to attribute environmental flows to tourism characteristic products, potentially using information on tourism expenditure also to differentiate this attribution by different types of visitor.

Beyond the considerations noted above, more investigation of this topic is required to resolve specific issues. For example, since visitors are by definition outside of their usual environment, there is the dual challenge of both attributing a flow to visitors and also assigning that flow to the residence of the visitors. There is no doubt overlap here with the production perspective but differences in scope do exist.

A conceptual issue lies in appropriately defining the spatial boundaries for consumption. This is especially so since environmental flows are not constrained by national boundaries, and visitors travel between countries. The aim here is thus to describe possible methods of presenting a consumption perspective in relation to the environmental flows under investigation. It is quite likely that different approaches are relevant for different flows. Ultimately there should be an alignment of methods here with the delineation of spatial boundaries for destinations but at this stage it should be possible to develop relevant criteria for presenting the consumption perspective without knowing precisely how destinations might be defined.

The outcomes of further discussion on this topic will be presented in the SF-MST.

3.8. Allocating environmental flows associated with transport activity

Within the general discussion of the estimation and allocation of environmental flows to tourism activity, a particular consideration concerns flows related to transport activity. Because transport businesses operate by moving people and products between locations within and between countries, the allocation of relevant environmental flows to specific countries and destinations is not as straightforward as for other businesses. There are national accounting conventions that apply in relation to the treatment of expenditures and revenue by these businesses and the starting point for measurement from a production perspective in a joint SEEA / TSA approach is to consider that these conventions apply in the case of environmental flows.

However, a question requiring further consideration is whether there are any additional considerations in relation to transport that emerge when considering a consumption perspective on these flows. For example, what is the best way to consider allocation of the GHG emissions from a British Airways plane travelling between Singapore and London and carrying passengers from the United States and Australia. At this stage, no specific solutions have been developed. The outcomes of further discussion on this topic will be presented in the SF-MST.

4. Combined presentations and indicators

In addition to the core accounts, an important part of the SEEA suite of outputs is combined presentations. Combined presentations provide a means to bring together a range of information from different sources and hence present a summary of key measures and provide a basis for the derivation of indicators. In this context, the core accounts described above provide the means to ensure that summary data and indicators are based on coherently and consistently compiled data for any given topic.

Many forms of combined presentation are possible depending on the focus of communication and the range of data available. The proposal shown in Table 6 brings together some commonly available information on tourism industries compiled within the TSA framework, with information on environmental flows compiled following the core accounts described in the previous section.

The data items included in the combined presentations should be of relevance to policy makers and, often in combination, they can be used to calculate indicators, for example for reporting on progress on the SDGs. The same level of industry disaggregation used above is maintained, allowing countries to present key information at a sector specific level.

Table 6: Potential combined presentation for tourism industries

	UNIT	Tourism industries					Total tourism ind.	Other industries	Total all industries
		Accommodati on for visitors	Food & beverage serving	Passenger transport	Culture, sports & recreation	Other tourism ind.			
		Tsm Total	Tsm Total	Tsm Total	Tsm Total	Tsm Total	Tsm Total	Tsm Total	
1. Monetary flows									
Output	\$								
Gross value added	\$								
Expenditure on tourism characteristic products	\$								
Intermediate consumption									
Water	\$								
Energy	\$								
Waste treatment	\$								
2. Employment									
Tourism employment	'000								
3. Environmental flows									
Net water use	m ³								
Own-account water abstraction	m ³								
Wastewater generated	m ³								
Net energy use	j								
Use of energy from renewable sources	j								
GHG emissions	tonnes								
Solid waste generation	tonnes								
4. Potential indicators									
Water use in tourism / Tourism VA									
Share of renewable energy use in final energy use									
GHG emissions / Tourism output									

With respect to reporting on the SDGs, indicators related to sustainable tourism have been determined for Targets 8.9, 12.b and 14.7. The current indicators relate to tourism GDP and tourism employment/jobs and both of these topics are covered in the standard TSA framework and included in the combined presentation above. At present, no indicator reflecting the environmental dimension of sustainable tourism has been adopted although proposals exist for indicators related to energy use and GHG emissions. In addition, it should be possible using the measurement approaches described in this Technical Note to test and develop indicators for tourism that follow the structure of SDG indicators adopted for other SDG targets, for example in relation to targets 6.3 and 6.4 on water, targets 7.2 and 7.3 on energy and 9.4 on climate change.

It should be apparent that there are many potential indicators that might be formed from the data contained in the core accounts through combination with existing information on tourism industries. For example, analysis might be undertaken to consider environmental flows by size of tourism business. The intention in this Technical Note is to provide a starting point for discussion between compilers of accounts and decision makers such that the selection, measurement and derivation of indicators is both feasible and relevant.

5. Compilation and measurement

5.1. The Generic Statistics Business Process Model (GSBPM)

The statistical production processes to be followed for the compilation of SEEA accounts are outlined in the SEEA Technical Note: Statistical Production Processes for Implementation of the SEEA Central Framework (ref needed). More generally, an important support to the compilation of accounts is provided by the Generic Statistics Business Process Model (GSBPM). Figure 2 briefly outlines the steps of the GSBPM.

Figure 2: Steps in the Generic Statistics Business Process Model (GSBPM)

OVERARCHING MANAGEMENT FUNCTIONS	1. Specify Needs: Engage users to identify their detailed statistical needs, propose high level solution options and prepare the business case
	2. Design: Design and develop activities and any associated practical research work needed to define the statistical outputs, concepts, methodologies, collection instruments and operational processes. Specify all relevant metadata as well as quality assurance procedures
	3. Build: Build and test the production solution
	4. Collect: Collect and gather all necessary information (data and metadata), using different collection modes and load them for further processing
	5. Process: Clean data and prepare them for analysis
	6. Analyze: Produce statistical outputs, examine them in detail and prepare them for dissemination. Prepare statistical content and ensure outputs are 'fit for purpose' prior to dissemination. Ensure statistical analysts understand the statistics produced
	7. Disseminate: Release the statistical product and support users to access and use the output
	8. Evaluate: Conduct an evaluation of the process and agree an action plan

When building accounts (SEEA or TSA for example), it is often the case that existing data sources need to be used as much as possible. Consequently, the Specify Needs, Design and Build steps will often be undertaken simultaneously and iteratively, as one evaluates the capacity of existing data sets to meet needs relative to the potential costs of initiating new data development.

Steps 4, 5 and 6 will usually be the focal point for accounting efforts. They should be seen as relatively iterative processes particularly as different data sources are confronted and balanced as they are entered into the accounting framework. This task of balancing supply and use and ensuring coherence among variables and over time is the core work of accounts.

5.2. General approach to integrating SEEA and TSA information

Ultimately, the integration of SEEA and TSA based information will require that the types of accounts presented in section 3 above are based on pre-existing individual SEEA and TSA accounts. From this starting point, the integration task can be seen as either (i) requiring additional detail to be incorporated into the standard SEEA tables to reflect tourism related flows or (ii) requiring TSA based accounts on tourism industries to be extended to incorporate environmental information. As presented above, the approach suggested here is the former as this supports coherence concerning the data on environmental flows related to tourism and the overall economy. At the same time, it is also possible to compile estimates of environmental flows for tourism industries only following the definitions of the SEEA and via this means compile environmentally extended TSA.

Given these general statements there will be two main approaches to the collection of the data required to compile tourism industry environmental flow accounts. The first is to examine the sources of information used to compile standard SEEA accounts and to investigate the potential to collect additional detail on tourism industries. The second is to examine the common sources of information used to compile TSA accounts, i.e. the collection of data from tourism industries, and investigate the potential to extend collection to incorporate information on environmental flows. In

practice, an reflecting the inherent aim of national accounting to integrate data, all available data sources will need to be considered.

At the same time, the first approach may be the most straightforward and cost effective to examine in the short term in those countries with existing SEEA accounts. Its viability is supported by the fact that both the SEEA and the TSA use standard industry classifications and hence, at least in principle, gathering data at the level of detail needed for the core SEEA accounts, could be extended in relatively straightforward fashion to tourism industries. In part, the effectiveness of this approach will depend on the extent to which the collection of data is based on use of a common business register, listing all business and their key characteristics. An important reference to understand the industry linkages between the SEEA and the TSA is in Annex 3 of IRTS. It lists the correspondences between tourism industries and the ISIC. At the same time, there may remain challenges in aligning the level of industry detail as discussed in section 5.3.

As noted in a number of places through this Technical Note, a key issue for all tourism industry environmental flow accounts is to distinguish between tourism and non-tourism flows for any given industry. This will not be possible directly from SEEA based accounts. Thus, for example, while a SEEA based approach just outlined will provide information on the environmental flows associated with restaurants, it will not provide information on the share that is related to tourism activity. The estimation of tourism shares will need to be undertaken as a distinct task taking into account the proposed approaches described in Section 3.6. When trying to understand the extent of the work required, it will be instructive for those compilers from a SEEA background to get an appreciation of tourism ratios in different industries through examination of an existing TSA and in discussion with tourism statisticians.

More broadly, the largest challenge that will be faced in compiling integrated TSA and SEEA accounts will be bringing together the wide range of stakeholders both in terms of the sources of data and measurement expertise and in terms of the decision-makers. Since environmental, macro-economic and tourism data will largely be distinct areas of measurement and policy, harnessing the combined knowledge and experience will be essential but difficult, and appropriate effort and resourcing should be dedicated to the co-ordination task. There is no single solution and each country and jurisdiction will need to develop appropriate institutional arrangements, where possible building on existing cross-agency and cross-sector arrangements.

5.3. Aligning the level of industry and product detail

In practice there might be differences in the level of industry and product detail between TSA: RMF 2008 and SEEA-CF accounts actually in place. Due to this, some work would likely be required to align the break-down of data in these accounts to allow the derivation of proper tourism ratios for environmental flows starting from estimates obtained from SEEA-CF accounts.

As far as the implementation of the TSA: RMF 2008 is concerned, it is noted that when statistical offices start developing TSAs as part of their national accounting work, often no new collection of basic data is launched for that specific purpose. Therefore, certain components of the TSA: RMF 2008 will be estimated mainly by using data available from national accounting databases, and incorporating information derived from existing business surveys, travel surveys, and administrative data sources.

However, the break-down by industry of output data in the core national SUTs may not be sufficient for the purposes of compiling production accounts for tourism industries according to TSA: RMF 2008. In this situation, one option is to use data on full-time equivalent jobs which might be available with greater detail by economic activity⁸. Since this variable is a measure of labour input, then one

⁸ This national accounting aggregate is defined in terms of total hours actually worked by all employed persons divided by the average number of hours actually worked in full-time jobs (SNA 19.43).

possible method for filling gaps concerning output values is to use ratios of full-time equivalent jobs as substitutes for output shares as described in Section 3. Such an approach was experimented, for example, in pioneering work in Italy in 2012⁹. This procedure, and related approaches using labour input measures, imply the assumption that labour productivity does not vary from one activity to another within a given industry¹⁰. Where labour productivity does vary significantly these procedures will be less appropriate.

Also, TSAs may be incomplete to the extent that while estimates of tourism demand for the various products are available at a detailed level, tourism shares of the various industries' supply of each product have not been calculated. In these cases, in order to allocate tourism expenditure on a given product to the different industries, one option could be to distribute it to industries in proportion to each industry's supply of the same product. In other words, for each particular product, the ratio of tourism expenditure to its total supply (the tourism commodity ratio) would be applied to the same-product component of industries' output. Such, commodity ratios have been applied e.g. by Statistics Canada¹¹. The implicit assumption is that for a given product purchased for tourism purposes but supplied by different industries, the distribution of expenditures among those made for tourism purposes and non-tourism purposes does not vary by industry.

Also the way SEEA-CF accounts are implemented and the stage of actual development of the same accounts at a given point in time have an impact on their industry and product level of detail and on the alignment of the latter with TSA: RMF 2008 accounts' own level of detail. Overall, the general advice and direction for work should be the alignment of industry and product detail across the core national accounts and the related environmental and tourism accounts.

5.4. Compilation for water flows

In the first instance, compilers should refer to the SEEA Technical Note on water accounting for a complete introduction to the compilation of physical flow accounts for water. The Draft Guidelines for the Compilation of Water Accounts and Statistics, as well as the International Recommendations for Water Statistics (IRWS) and the SEEA Water provide more complete guidance on the organization of basic data and the preparation of accounts. References to these and other materials are provided in section 7.

A likely initial focus should be on engagement with the local water utilities to understand the availability of data on water flows by type of business. Ideally, information would be available according to a common business register and this would provide the strongest basis for aggregation and integration.

Special note should be taken of the coverage of water utilities with respect to tourism businesses. It may commonly be the case that tourism businesses access water via a distribution network however, there may be instances, for example in remote resorts, where water is abstracted by the business directly either through the collection of rainwater or from groundwater sources. The own-account production of desalinated sea-water may also need to be taken into account.

5.5. Compilation for energy flows

⁹ Massimo Anzalone: "La valutazione della sostenibilità del turismo: proposta di realizzazione di una contabilità integrata di tipo ibrido turismo-ambiente", PHD dissertation, 2012, Studiorum Universitas Messinae, Italy.

¹⁰ It is also worth noting that the number of full-time equivalent jobs - which is an accurate way of quantifying labour force - may be the best option available among potential proxies of production. Furthermore, calculations assuming constant labour productivity within broad industry groups would probably be made only for a limited number of tourism industries and might be inappropriate for industries such as transport.

¹¹ See Demi Kotsovos: "Towards sustainable tourism indicators: Linking the Canadian Tourism Satellite Account 2012 with the Canadian System of Environmental-Economic Accounts", paper presented at the 14th Global Forum on Tourism Statistics, Venice, Italy, 2016.

In the first instance, compilers should refer to the SEEA Technical Note on energy accounting for a complete introduction to the compilation of physical flow accounts for energy. The International Recommendations for Energy Statistics (IRES) and the SEEA Energy provide more complete guidance on the organization of basic data and the preparation of accounts. References to these and other materials are provided in Section 7.

In terms of data sources, the existence of established energy data programs at the international level¹², generally means that basic data on energy supply and use is available for most countries. Since these sources will likely cover the major energy flows (with possible exception of within enterprise flows and goods for processing) these data in most cases will be sufficient to form the basis for estimating an initial physical flow accounts for energy. For example, if a country has already estimated energy balances, these estimates will generally provide much of the data needed to estimate SEEA energy accounts. It is noted however that data from energy balances will require adjustments to conform to SEEA accounting rules; the most important adjustments usually concern the residency principle applied in the SEEA (and SNA), an adjustment that will likely be most significant in the case of transportation. A description of the required adjustments is presented in SEEA-Energy.

While energy balances will provide the broad framing for the estimation of the physical flows it is likely that this will not contain sufficient detail to identify flows related purely to tourism activity. In which case two energy products, electricity and oil (fuel), should be the key focus of initial measurement activity.

For electricity, a likely initial focus should be on engagement with the local electricity providers, to understand the availability of data on flows of electricity by type of business. Ideally, information would be available according to a common business register and this would provide the strongest basis for aggregation and integration.

For estimates of fuel use it is likely that direct collection of data from tourism businesses will be required, perhaps through the use of additional data items within standard business surveys. Other estimation approaches may be possible for some activities, for example using information on the number of transport vehicles and other factors to estimate their fuel usage.¹³

Special note should be taken of the coverage of electricity utilities with respect to tourism businesses. It may commonly be the case that tourism businesses access electricity via a distribution network however, there may be an increasing number of instances, for example in remote resorts, where electricity is generated on own-account through the use of solar panels or wind turbines. Information on these practices should be gathered through direct contact with tourism businesses.

¹² UNSD Annual Questionnaire on Energy Statistics, the International Energy Agency (IEA), the Statistical Office of the European Communities (Eurostat), the International Atomic Energy Agency (IAEA), the Organization of the Petroleum Exporting Countries (OPEC), and the Organización Latinoamericana de Energía (OLADE).

¹³ See for example the approach used by Saudi Arabia as part of their MST pilot study http://cf.cdn.unwto.org/sites/all/files/pdf/18thmeeting_item_4.3.4.pdf

5.6. Compilation for GHG emissions

In the first instance, compilers should refer to the SEEA Technical note on accounting for air emissions which provides a thorough overview of accounting for GHG emissions. There are a range of additional supporting materials, in particular advice from Eurostat, and these materials are listed in Section 7.

Accounting for GHG emissions is related to but different from measurement of GHG inventories as reported following the UNFCCC¹⁴. Many countries compile relevant statistics on greenhouse gas emission inventories on a regular basis and there are close parallels in the accounting for air emissions as described in the SEEA. The main adjustments required to create a bridge between SEEA based GHG accounts and data required for the UNFCCC greenhouse gas emission inventories involve removing from the UNFCCC estimates those emissions that arise in the national territory from non-resident agents such as non-resident tourists and non-resident transportation equipment operating in the national economy. Likewise, the emissions from resident tourists or transportation operations that occur outside of the national economy must be added to the UNFCCC estimates. Bridging between UNFCCC and SEEA based estimates is described in more detail in the SEEA Technical Note on air emissions accounting.

Accounting for GHG emissions will also be closely related to accounting for flows of energy, as discussed above. Because a significant source of greenhouse gas emissions is the burning of fossil fuels, there are important connections between the measurement of air emissions and the measurement of energy accounts. Indeed, data contained in energy accounts may provide a good basis for the compilation of relevant sections of air emissions accounts. Wherever relevant, a coherence should be developed between these two areas of accounting.

In developing GHG accounts there are two main starting points as regards to the main data sources: national emission inventories or energy statistics/balances/accounts. Accordingly two generic compilation approaches are distinguishable: “inventory-first-approach” and “energy-first-approach”. Deciding whether to start with energy or emissions data is typically determined by what data can be obtained and what type of cooperation with national experts can be established.

However, given the high correlation between air emissions and the use of energy products, the second approach may already exist in the form of SEEA energy accounts, or datasets that can be the foundation of energy accounts, such as basic energy statistics or energy balances. Economic data programs may also be a source of data on energy use or other physical flows that can form the basis for estimating missing components of supply in physical terms.

It is noted that a range of adjustments are required where an inventory first approach is used. For example, the emissions from international sea and air transport from bunker fuels may not be in the national inventory. The Manual for Air Emissions Accounts (Eurostat, 2015) has a detailed explanation and examples of how these adjustments can be made.

5.7. Compilation for solid waste flows

The development of international guidance for the compilation of solid waste accounts is not well advanced. A good introduction to the nature of accounting for solid waste is provided in the SEEA Central Framework, section 3.6.5. Good examples of accounting for solid waste have emerged in the Netherlands, Norway and Australia and links to the relevant publications can be found in Section 7. These publications give a good indication of the different types of data sources that are relevant and the measurement and definitional challenges that emerge in the compilation of accounts.

¹⁴ United Nation Framework Convention on Climate Change

Guidance on the definition of solid waste is provided in the Eurostat Guidance on the classification of waste (2010) although it is likely that each country will have established its own classes of waste and in the initial stages of developing accounts it is recommended to work with these national classifications in the first instance.

The collection of information for tourism will likely require direct collection of information from tourism industries, for example estimating the volume of solid waste generated per visitor. Another approach may be to engage directly with waste collectors to understand whether, for some large tourism establishments, specific information can be collated. As for the estimation of water and energy flows, it will be necessary to consider the generation and treatment of waste by more remote tourism establishments who may manage their own land-fill or incineration facilities.

5.8. Extending tourism statistics data sources

As noted above, one avenue to the collection of data on tourism industry environmental flows is to examine the potential to extend the standard tourism statistics data sources used to compile TSA accounts. To provide a suitable framing for this investigation, compilers could utilize the commentary and tables in the IRTS Compilation Guide (especially Chapter VI) and from the UNWTO Tourism Statistics Metadata Project¹⁵. Both of these provide a good and rich description of the standard approaches to the collection of tourism statistics and hence provide the basis for considering how additional information pertaining to environmental flows might be collected or gathered.

Relevant information on compilation will also be found in compilation guidance for TSA. Guidance for EU countries has been developed (Eurostat, 2010) and work is underway to develop a UN document of a similar nature. Links to these materials are provided in Section 7.

¹⁵ <http://cf.cdn.unwto.org/sites/all/files/docpdf/metadata.pdf>

6. Extensions and further development

6.1. Introduction

There are many potential areas for extension and further development in this area of statistics. These are being actively investigated and advanced in the context of the MST project. This section provides a short description of the most likely areas of extension and links to relevant material explaining the issues in more depth.

6.2. Assessing seasonality and environmental flows at destination level

In many locations, a key aspect in understanding the sustainability of tourism activity is the pattern of activity through the year. Since the TSA accounts are framed for the production of annual data they will not necessarily provide the information to support the assessment of sub-annual trends. Nonetheless, it will often be the case that for key variables such as visitor arrivals and hotel occupancy, the information underpinning the TSA estimates will be sub-annual (monthly or quarterly). A relevant extension to the TSA framework would therefore be to present certain sub-annual series ensuring that these data have been appropriately integrated with other information within the TSA framework. Information on visitor arrivals in particular may point to issues associated with the use and availability of resources (such as water) in peak times and questions of access and mobility.

6.3. Further tourism connections to the SEEA Central Framework

Beyond the integration of tourism industries and environmental flows, there are two main areas of the SEEA Central Framework that might be considered within a TSA setting. The first concerns environmental transactions as described in the SEEA Central Framework Chapter 4. Here it would be possible to extend or adapt the TSA accounts for expenditures to include environmental transactions. Environmental transactions encompass payments of environmental taxes and resource rents, receipts of environmental subsidies, and expenditure on environmental goods and services, environmental protection and resource management, including for example capital formation on waste treatment. Following the economy wide definitions provided in the SEEA Central Framework, recording these transactions in relation to tourism activity could be developed.

The second area concerns integration of information on environmental assets. The SEEA Central Framework describes the measurement of individual assets such as minerals, energy resources, timber, fish, soil and water. Many of these assets are the focus of extraction or use by primary industries and are not direct inputs to tourism activity. Consequently, not all environmental assets need to be assessed in the context of measuring tourism sustainability.

However, there are several important environmental assets that should be measured. A significant one in many locations concerns the measurement of water resources. In locations and countries where there are concerns about the availability of water to support tourism activity, it will not be sufficient to record only the levels of water use by tourism activities as described in the previous section. In addition, it will be necessary to record information on the stock of water and changes in this stock. The appropriate account is the water resources asset account. This account records the stock of water at the beginning and end of the accounting period and the changes in the stock of water due to both human activities and natural phenomena such as precipitation and evaporation.

The information can provide a basis for the assessment of the pressure being exerted on water resources through abstraction for economic activity including for tourism.

Ideally, as explained in the SEEA Central Framework, water resources asset accounts would be compiled for each water catchment across a country. In the context of assessing sustainable tourism it would be appropriate to focus only on those catchments where tourism activity is significant.

Another individual asset for which asset accounts might be developed are accounts for selected species of wild animals, for example, animals that provide the focus for safari and related activities in national parks. Recording changes in the stock of key species over time, perhaps utilizing park management information, would support an understanding of the environmental assets supporting tourism activities.

Finally, land is also an individual asset described in the SEEA Central Framework which is to be considered. Accounting for changes in the composition of land is a fundamental feature of the SEEA since land provides the space in which economic and social activities are undertaken and also because meaningful groupings of land areas can be used to provide a measurement basis for ecosystem accounting. The development of land accounts for both land use and land cover as articulated in the SEEA Central Framework would help to provide the basis for understanding the spatial context within which tourism activity takes place. An additional extension would be to examine the ownership of land and associated land rents especially with respect to the ownership of land by non-resident economic units.

In addition to connections between tourism and environmental assets, a connection may also be established between tourism and the SEEA Central Framework's definition of environmental activities and transactions. This part of the SEEA Central Framework provides measurement guidance on recording environmental protection and resource management expenditure, approaches for measuring the environmental goods and services sector (EGSS) and definitions for environmental taxes, subsidies and similar flows. In the context of measuring the sustainability of tourism these sections of the SEEA Central Framework can be adapted to focus on the activities of tourism industries and can be used to support measurement of, for example, green jobs in tourism and tourism industry responses to environmental challenges in terms of their environmental expenditures.

6.4. Tourism connections to the SEEA Experimental Ecosystem Accounting

Building on the discussion of land accounting, there is a further extension that can be made between TSA and the SEEA in the area of ecosystem accounting. Sustainable tourism has commonly been conceptualized and applied at a destination level. One area of focus in the development of the MST statistical framework will therefore be on developing a set of information that supports analysis at a sub-national spatial level. This focus on specific areas within a country has a natural connection to the spatial accounting approach used in ecosystem accounting described in the SEEA Experimental Ecosystem Accounting (SEEA EEA).

The SEEA EEA describes a number of ecosystem accounts. The standard basis for these accounts is the delineation of spatial areas across a landscape into different ecosystem types – e.g. forests, coastal zones/beaches, wetlands, agricultural areas. Each distinct spatial area reflecting a single ecosystem type is considered to provide the boundary of an ecosystem asset. Ecosystem assets may change in area over time, e.g. through deforestation, and may change in condition over time – i.e. there may be rises or falls in ecosystem functioning, integrity or health. These changes in ecosystem assets can be recorded in accounts.

Each ecosystem asset supplies a stream of ecosystem services, which can be seen as outputs of the ecosystem, that are very often used by economic units as inputs to production processes or consumed by individuals and society at large. Ecosystem services are commonly categorized into provisioning, regulating and cultural services.¹⁶ For tourism activity, flows of cultural services in which individuals engage with nature for recreation and enjoyment is perhaps of foremost interest. The supply and use of ecosystem services can be recorded in accounts and linked to the production of other specific outputs by economic units.

Although much further discussion on the application of ecosystem accounting to tourism is required, there appears a direct link that can be made between the spatial detail required for ecosystem accounting and the most common focus of sustainable tourism on destination level indicators. Put differently, application of ecosystem accounting principles and the development of ecosystem accounts may provide an information set that can be directly used at destination level to progressively build a picture of tourism's use of and impact on local ecosystems. The main steps to that are as follows:

- Understand the size and location of ecosystem assets that are of primary interest in the local area
- Record how these ecosystem assets are changing in condition and at the same time link the change to tourism activity as appropriate; the tourism impact being
 - possibly negative e.g. where tourism activity leads to poor quality water due to lack of sewage treatment, or degradation of forest condition due to excessive numbers of tourists
 - or possibly positive where activity by tourism business includes ecosystem restoration or protection.
- Understand the flows of ecosystem services that are used by tourism businesses, for example in the production of ecotourism outputs.

The ecosystem accounts that might be developed in this section would provide a framework for incorporating information on

- protected areas
- biodiversity and iconic species
- water quality
- beach, seas water and reef quality/condition
- air quality

In concept, adapting ecosystem accounting to tourism would require the delineation of spatial areas for analysis including the tourism destination itself and related ecosystems, for example beaches, coastal zones, national parks, marine areas, etc. For each spatial area, an assessment would be made of ecosystem condition, for example using indicators of the quality of beaches, which could be tracked over time to provide insight into the environmental impact that could be attributable to tourism activity. From a supply perspective, the scope of accounting might be extended to include the changing condition of water catchments and groundwater systems that underpin the provision of water to support tourism activity.

Further, assessment could be made of the supply of ecosystem services from the various ecosystems including those services that contribute to tourism activity but also other services that may be jointly supplied. For example, carbon sequestration of forests which are visited by tourists. An important distinction might be identified between visitor direct consumption of natural inputs, e.g. water; and visitor use of ecosystems for recreation, e.g. lakes, rivers and beaches. The allocation of ecosystem services to various beneficiaries, including visitors, permanent residents of the area and others, can support a broader discussion on the potential changes in the mix of ecosystem services supply, and also on (related) economic alternatives, associated with tourism activity and development.

¹⁶ See e.g. the classification of ecosystem services developed from the work on environmental accounting undertaken by the European Environment Agency, known as CICES (<https://cices.eu/>).

In the first instance, ecosystem accounting in physical terms would be the focus for measurement. However, there may be interest in the valuation of ecosystem services and related ecosystem assets that can be supported by the MST initiative. To this end, the fact that much information on tourism can be attributed to specific destinations may provide information to support valuation of ecosystem services within economic analysis work. This may in turn be used to support broader work on ecosystem accounting if consensus is reached within official statistics on enlarging the scope of the latter discipline by introducing modeling to some extent.

Finally, it is noted that the spatial accounting for ecosystem assets envisaged in the SEEA EEA, can also be extended to consider a broader range of assets that are present in the landscape. For example, to understand changes in particular spatial areas it may be relevant to consider the influence and condition of infrastructure that supports tourism such as walkways and viewing platforms and camping sites. Also, it would be appropriate to account spatially for cultural assets that may be frequently visited. In short, the spatial accounting principles of ecosystem accounting provide a basis for capturing many aspects of relevance at a destination level.

6.5. Environmentally extended Input-Output tables and related analysis

One of the distinct advantages of organizing and integrating data using an accounting framework is that the information can be directly linked to economic modeling that uses input-output tables summarizing the structure and inter-linkages of the economy. This is possible due to the use of consistent definitions of income and production and the use of common industry classifications.

There are many examples of the use of environmental flow information in connection with standard input-output tables and an introduction to the principles and summary of the relevant literature is provided in SEEA Applications and Extensions as already noted. Examples already exist in the area of tourism, for example the work for Wales on the connections of tourism and GHG emissions (ref needed). Advancing the measurement of integrated TSA and SEEA accounts will further support these efforts in understanding the broader connections between tourism activity and the environment and ensuring that environmental data can be taken into account in economic modeling of tourism.

6.6. Other aspects of the SF-MST

As a final observation on the potential for extension it is noted that there are a range of non-environmental aspects of sustainable tourism that are being considered in the context of the broader MST project. These include:

- Extensions of the TSA and tourism statistics to sub-national levels to provide data useful for analysis of tourism at destination level. This includes for example mapping the location of tourism businesses and documenting the mix of tourism businesses by size and type of ownership
- Measurement of various aspects of employment including gender, wages and decent work
- Assessment of the capacity and condition of tourism infrastructure and similar assets such as airports, ports, transport equipment, roads and hotels.
- The development of indicators of the social dimensions of sustainable tourism and investigation of the potential to integrate this dimension via accounting approaches including, for example the UNESCO work on cultural satellite accounts.

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