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Project Management Model Applied to Carbon Capture and Storage in Trinidad

Ruel L.A. Ellis [a Ψ] and Lorraine Sobers [b]

[a] Department of Mechanical and Manufacturing Engineering, The University of the West Indies, St. Augustine, Trinidad and Tobago, West Indies; E-mail: Ruel.Ellis@sta.uwi.edu

[b] Department of Chemical Engineering, University of the West Indies, Trinidad and Tobago, West Indies;
E-mail: Lorraine.Sobers@sta.uwi.edu

[Ψ] *Corresponding Author*

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Abstract: *Carbon Capture and Storage (CCS) demonstration projects are needed worldwide to advance the reduction of carbon dioxide emissions to commercial operations. There are less than ten (10) large-scale projects in operations worldwide; none of these are in developing countries. The overall objective of these activities is the mitigation of increasing global average temperatures. In Trinidad and Tobago (T&T), CCS implementation is likely to be the integration of ongoing upstream and downstream energy industry operations to achieve sustainable development. In this paper, the planning stages of the Project Management Model advocated by the Global Carbon Capture and Storage Institute (GCCSI) is discussed with reference to the CCS implementation in T&T. Policies, regulations and government-led incentives for CCS are currently under development, and the opportunities for implementation are encouraging. This paper demonstrates the application of the project management model for CCS via international collaboration, and explores the opportunities and challenges of CCS implementation in T&T.*

Keywords: *Sustainable development, CO_2 emissions, storage, project lifecycle, Trinidad and Tobago*

1. Introduction

The Global Carbon Capture and Storage Institute (GCCSI) has established a project delivery handbook for carbon capture and storage (CCS) implementation worldwide. This is an online collaborative platform for sharing best practices and procedures gained from experience in the implementation of CCS projects worldwide. However, the sources, quality and distribution of carbon dioxide (CO_2) in Trinidad are not typical of most CCS projects. In this paper we have applied the project management model to publicly available information which can be used to scope a CCS implementation project in Trinidad. The paper provides the background, an overview of CCS and motivation for a CCS project in Trinidad before applying the project management model. First, the Identify and Evaluate stages are considered for the capture and transportation of CO_2, based on the information in the public domain; then for geological storage of CO_2 in oil reservoirs, the Identify, Evaluate and Define stages are considered.

The average global concentration of greenhouse gases in the atmosphere has been increasing steadily since the industrial era (the late 18th century). CO_2 emissions from anthropogenic sources such as power generation stations and petrochemical plants have been identified as the major contributor. The Inter-governmental Panel on Climate Change has reported that this would result in an increase in the average global temperatures, a phenomenon known as global warming (Houghton, 1990). Global warming is predicted to cause climatic changes which will have devastating effects on human life, the environment, availability of resources. Caribbean islands are expected to face stronger, more frequent hurricanes, flooding, rising sea levels, fresh water contamination and increased prevalence of tropical diseases. To mitigate the anticipated effects of global warming, geologic storage of CO_2 in hydrocarbon reservoirs, aquifers and coal seams has been proposed as an intermediate solution to check the rising atmospheric CO_2 concentration (Parry et al., 2007).

Geologic storage of CO_2 is one in a set of technologies, known as Carbon Capture and Storage (CCS), proposed to reduce CO_2 emissions for sustainable development in the use of fossil fuels (Metz, 2007). CCS includes:

1. CO_2 capture from industrial sources.
2. Handling and Transportation of CO_2.
3. Injection and storage of CO_2 in deep geological formations.

CCS is a critical transitional technology for reducing emissions in the short to mid-term. In the long term, energy generation and the consumption of fossil fuels will have to be reviewed and re-engineered. The technology for each component of CCS has been used in the upstream (such as hydrocarbon exploration and production) and downstream (such as hydrocarbon consumption and processing) industries for decades. However, the integration of the separate components to handle large volumes of CO_2 is in the development stage. Only eight large-scale projects (i.e., greater than 4 × 10^5 metric tons of carbon per annum) operate worldwide (GCCSI, 2011).

In this paper, we discuss the first stages of the Global CCS Institute's Project Management Model as it applies to CCS implementation in Trinidad. CCS projects using a project management model allow the project management team to plan and successfully execute a complex undertaking which integrates three major operations: capture, handling and transportation and, storage.

2. Overview of CCS Elements in Trinidad

2.1 Capture

CO_2 capture is the separation of CO_2 from the effluent gas stream. CO_2 generated at industrial sites or fossil-fuel burning power stations is separated from the effluent gas stream. The capture of CO_2 is an additional cost to downstream operations and this stage often represents the major limiting cost factor of CCS, increasing energy consumption by about 20% (Metz, 2005). In Trinidad and Tobago (T&T), one-fifth of the CO_2 is emitted from eleven ammonia plants in a relatively pure form (90-96% CO_2). A small fraction of this pure CO_2 is used as feedstock for methanol, urea and downstream petrochemical manufacture (Boodlal and Furlonge, 2008). As such the collection of CO_2 is needed rather than capture. The main stakeholders for this phase of CCS are the industrial plants and power stations.

2.2 Transportation

CO_2 can be transported in a liquid form in road tankers or in gaseous form by pipeline. There is a network of CO_2 pipelines within the Point Lisas Industrial Estate connecting several ammonia plants to methanol production plants. For CCS implementation this pipeline network can feed into a dedicated trunk pipeline to transport CO_2 to potential storage sites on land and offshore. The potential sinks for CO_2 storage in oilfields are within a radius of 30-50km of the Point Lisas Industrial Estate (see Figure 1). There are pipelines and related facilities between Point Lisas Industrial Estate and the indicated oil fields but these have been either decommissioned or fallen into disrepair.

However, a High Density Polyethylene (HDPE) pipe sleeved within the existing decommissioned carbon steel pipeline may be considered as a cost-effective option in some areas. Furthermore, the CO_2 pipeline right- of-way (ROW) still exists and may be used for the installation of a new trunk pipeline connecting CO_2 sources in Point Lisas to onshore producing fields. The main stakeholders for this phase of CCS will be either the emitters or the owners and operators of potential storage sites depending on the direction of future carbon emission reduction policy.

2.3 Storage and CO_2 Enhanced Oil Recovery

A pilot project was undertaken in the 1970s to transport CO_2 for enhanced oil recovery (EOR) (Mohammed-Singh and Singhal, 2005). Figure 1 shows a map of the southern peninsula of the island of Trinidad showing the pipeline route between Point Lisas Industrial Estate and the CO_2 injection pilot projects in Oropouche and Forest Reserve.

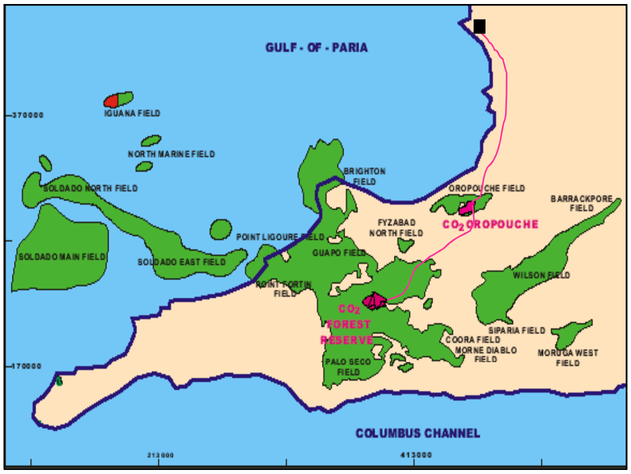

Figure 1. Map of the southern peninsula of the island of Trinidad showing the pipeline route and the CO_2 injection pilot projects in Oropouche and Forest Reserve
Source: Reproduced from Mohammed-Singh and Singhal (2005)

CO_2 injection for EOR method is known as CO_2EOR. CO_2 can exhibit complete or limited solubility in oil based on reservoir conditions and fluid composition. Dissolution of CO_2 in oil can reduce the oil viscosity and increases the reservoir pressure. The combined effect results in increased oil production. The Forest Reserve CO_2EOR pilot project realised an oil recovery increase of 2 to 8% of the original oil volume in place.

Enhanced oil recovery processes such as CO_2EOR are needed to boost oil production in Trinidad which has declined at 9% per year (Ministry of Energy and Energy Affairs, 2012). Geological CO_2 storage coupled with CO_2EOR can reduce CO_2 emissions and arrest declining oil production. The main objectives for implementing CCS are to:

1. Increase oil production
2. Reduce CO_2 emissions, and
3. Operate environmentally sustainable natural gas based industries

Natural gas is piped from onshore and offshore hydrocarbon fields to the Point Lisas Industrial Estate and the Point Fortin LNG facility. To implement CCS, it is proposed that waste CO_2 is transported from these two locations to hydrocarbon reservoirs to increase oil production and store CO_2. The integration of upstream and downstream operations can improve the economic and environmental benefits for various stakeholders. The main stakeholders at this phase are the oilfield operators.

2.4 CCS Project Lifecycle

The GCCSI Project Management model divides a CCS project into three (3) phases: capture; transportation and storage. For each phase, specific project guidelines are given for performance criteria, and project specifications (GCCSI, 2012). Traditional project management models have a lifecycle with four (4) phases while the GCCSI's Model consists of six (6) specific phases. Table 1 lists and compares the phases for each model. A comparison between the traditional model and the GCCSI's model reveals an overlap in the definition and description of project management stages. The major difference in both models is the inclusion of an Operation phase in the GCCSI's model. Operations are not usually included as part of a project lifecycle. By definition a project is 'a temporary activity designed to produce a unique product, service or result (PMI, 2012). However, CCS implementation projects are essentially demonstration projects where the objective is to execute and operate all three elements simultaneously.

In this paper, we focus on the planning stages of the GCCSI's Model for each phase of CCS implementation (i.e., capture, transportation and storage) in T&T. For the 'capture' and 'transportation' stages, we have considered the first two stages of the project life cycle where planning and evaluation are the dominant activities. In the 'storage' stage, CO_2 injection in producing oil reservoirs has been considered. The first three lifecycles are influenced by the applicability of the permissions and the availability of data from past CO_2EOR projects, exploration and production operations. The highlighted elements of each stage are discussed based on current available information and relevance to CO_2EOR in T&T.

3. Carbon Capture - Identify and Evaluate

CO_2 emitted in T&T are mainly a result of industrial plant processes and the power generation for these plants. The petrochemical sector (56%), power generation (17%) and liquefied natural gas (LNG) processing (13%) are the three largest contributors to CO_2 emissions. Ammonia manufacture accounts for about half of the petrochemical emissions. This distribution of CO_2 emission sources in T&T is not typical of most countries. Typically, CO_2 sources are mainly from power generation plants with low CO_2 concentration in the effluent stream.

CO_2 capture can be divided into two main categories, high and low CO_2 concentrations in effluent gas. High CO_2 concentrations (greater than 90% CO_2) in effluent gases are typical of the ammonia manufacture, natural gas processing and liquefied natural gas (LNG) operations. In the manufacture of ammonia, pure CO_2 is a by-product; in latter two operations, CO_2 is separated from the natural gas feed before processing. Such high purity CO_2 streams can be collected, compressed and transported to sequestration sites; there is no need for the capture processes. This accounts for 58% of Trinidad and Tobago's CO_2 emissions (Boodlal and Furlonge, 2008).

In order of magnitude, the remaining CO_2 emissions which may be considered for capture are emitted through power generation (17%); transport (8%); iron and steel (7%); flaring (3%) and; light commercial manufacture (3%). In this paper we consider only power generation for carbon capture given that the remaining stationary CO_2 emission sources account for less than 15% of CO_2 emissions combined and may be uneconomic to retrieve.

Table 1: Comparison of Traditional to CCS Project Lifecycles

Traditional Model	Description	Global CCS Institute Model	Description
Conception/Initiation	Develop a Business case, Undertake a feasibility Study, Establish the Project Charter, Appoint the Project Team, Set-up the Project Office	Identification	Consideration of high level options
		Evaluation	Critically examine the flaws of all high level options identified and select the best
Project Planning	Create the Project Plan, Resource Plan, Financial Plan, Quality Plan, Risk Plan, Acceptance Plan, Communication Plan, Procurement Plan	Definition	Provide a further definition of the selected option which will allow investment decisions to be made. (Technical and Economic Feasibilities)
Project Execution and Control	Emphasise Time, Cost, Quality, Change, Risk, Issues, Procurement, Acceptance and Communications Management	Execution	Undertake remaining (detailed) design. Build an organisation to commission and manage the asset
		Operate	Operate the asset within regulatory compliance requirements for the operating life of the asset
Closure	Perform Project Closure and Review Completion	Closure	Decommission asset to regulatory compliance requirements. Rehabilitate site for future defined use.

In the 'Identify' stage, a new-build of the plant or retrofit for capture may be considered (see Table 2, ID3). Power generation projects are particularly susceptible to the risks and additional cost associated with new-build or retrofitting for carbon capture (Metz, 2007). Based on the economic analyses, these costs and the associated risks cannot be supported by either traditional or progressive electricity markets where climate policies and carbon pricing are in place.

Table 2. Identify and Evaluate Stages for Capture of CO_2 reproduced from the Global CCS Institute

Identify		Evaluate	
ID1.	Concept Studies	EV1.	Pre-feasibility Studies
ID2.	Identify potential of the new or expanded business	EV2.	Consider different capture technologies
ID3.	Consider new-build or retrofit for capture	EV3.	Consider different EPC contractors
ID4.	Consider saline reservoir or EOR or other for storage/beneficial reuse	EV4.	Consider different process, location and project configuration options
ID5.	Document general features of the project	EV5.	Consider different capacities for the project
ID6.	Estimate order of magnitude costs of the project (both capital (+/- 30-35% accuracy) and operation	EV6.	Assess the likely technical and economic viability of the project
		EV7.	Recommend the preferred option and size for final study
		EV8.	Estimate costs of the project (both capital (+/- 20-25% accuracy) and operating (+/- 10-15% accuracy)

Carbon capture in power generation plants has not been demonstrated locally. However, the downstream energy industry in Trinidad and Tobago has over 30 years experience with chemical and process engineering. The largest power plants are located in Point Lisas (838 MW), La Brea (720 MW), Port of Spain (308 MW) and Penal (236 MW) (MEEA, 2012). The Point Lisas, La Brea and Penal power generation plants are located within 50 km of producing and abandoned oil fields which may be candidates for CO_2EOR. The Port of Spain plant is planned for decommissioning within the next decade. Atlantic also produces about 60 MW for LNG processing.

At the 'Identify' stage for carbon capture (see Table 2, ID4), the Global CCS Institute recommends considering the end use or storage for captured CO_2. The end-use will influence the capture process operation in producing to any purity specification required. The capture process will also need to be aligned to the capacity for storage and consumption of captured CO_2 (see Table 2, EV5). In Trinidad and Tobago, proposed carbon reduction projects consider mainly CO_2EOR in producing oil fields for sequestration but the feasibility of other opportunities may also be considered (see Table 2, ID4).

In the Evaluate stage, different capture technologies are considered (see Table 2, EV2). In Trinidad, power generation plants are natural gas-based. The capture stage represents a significant cost (Metz, 2007) of implementation because additional energy is needed for the capture processes which may be considered (such as pre-, post- and oxyfuel combustion).

4. CO_2 transportation - Identify and Evaluate

Within the Point Lisas Industrial Estate, large-scale collection and transportation of CO_2 may be managed by the Point Lisas Industrial Port Development Corporation (PLIPDECO). The expansion and use of the existing CO_2 trunk line within the industrial estate is a critical path of the project life cycle.

During the 1970s and 1990s, CO_2EOR operations used old oil pipelines to transport CO_2 from Point Lisas Industrial Estate to the Oropuche and Forest Reserve oil fields (see Figure 1) from a single ammonia plant (Mohammed-Singh and Singhal, 2005). The experience of these pilot projects will influence the concept studies (see Table 3, ID7), transport method (see Table 3, ID8) and routes (see Table 3, ID9) considered in the Identify stage of the project life cycle.

Table 3. Identify and Evaluate stages for the Transportation of CO_2 modified from the Global CCS Institute

Identify		Evaluate	
ID7.	Concept Studies	EV9.	Pre-feasibility Studies
ID8.	Consider pipeline or other CO2 transport options	EV10.	Consider different EPC contractors
ID9.	Consider existing or new transport route	EV11.	Consider different routes and configuration options
ID10.	Consider single or multi-user transport route	EV12.	Consider different capacities for the project
ID11.	Estimate order of magnitude costs of the project (both capital (+/- 30-35% accuracy) and operating (+/- 15-20% accuracy)	EV13.	Assess the likely technical and economic viability of the project
		EV14.	Recommend the preferred option and size for final study
		EV15.	Estimate costs of the project (both capital (+/- 20-25% accuracy) and operating (+/- 10-15% accuracy)

The CO_2-dedicated pipelines used for CO_2EOR pilot projects have been decommissioned and/or fallen into disrepair (Mohammed-Singh and Singhal, 2005) but high density polyethylene (HDPE) sleeves may be inserted within these pipelines to transport CO_2 safely along the established route. Another factor for consideration in using pipeline transportation is the potential risk to people squatting in close proximity to above ground pipelines. This safety aspect is not stated explicitly in the project model but it may be considered in the Evaluate stage (see Table 3, EV13) in the assessment of technical viability.

In considering different routes and configurations during the Evaluate stage (see Table 3, EV11) the use of ROW owned by state companies, Petroleum Oil Natural Gas Commission (NGC) can be useful in developing options for alternative routes, if CCS is government supported and facilitated. Pipeline transportation is the only option for storage in offshore fields (see Table 3, EV11). There is the possibility of reducing cost by piggy-backing on pipeline laying operations in the Gulf of Paria (Sobers and Lashley, 2012). Road transport can also be considered (see Table 3, EV11) given the short distance, less than 20km in some instances, between the sources and potential sinks. The utility cost and risks of each option are considered at this stage.

In considering the capacities for the project in the Evaluate stage, the location and synergies of CO_2 emission sources will be a major factor for consideration. Pipelines from the Point Lisas Industrial Estate will require the largest pipeline capacity to transport pure CO_2 from the ammonia plants and, in the future, be able to accommodate CO_2 captured from the flue gas of the power generation plant and additional industrial plants on the estate.

5. CO_2 Storage - Identify, Evaluate and Define

There are several CO_2 storage options outlined by the Intergovernmental Panel on Climate Change (IPCC) (Houghton, 1990). These include geological storage in saline aquifers, depleted or producing hydrocarbon reservoirs. CO_2 storage in producing oil reservoir combined with enhanced oil recovery is known as CO_2EOR. According to Boodlal and Smith (2007), CO_2EOR has been identified as the highest impact carbon reduction activity that can be economically undertaken by T&T. It has the potential to generate revenue which can offset the cost of CCS implementation. PETROTRIN, the national petroleum company, owns the producing and depleted oil fields which may be used for carbon storage. In earlier CO_2EOR pilot projects, PETROTRIN purchased small volumes CO_2 from an ammonia plant. However, much larger volumes and greater storage capacities will be needed for effective CCS implementation.

The first three stages of the Storage Project Life cycle described in Table 4 are likely to be based on data available from PETROTRIN. There are operational differences implementing CO_2 injection for EOR only and for CO_2 injection for an EOR coupled with carbon storage project. If significant carbon emissions reduction is anticipated, the screening studies (ID12), screening basis (ID13) and, planning (ID14) for potential storage sites must account for the volumes to be injected. It is also possible that new and innovative injection strategies may be considered to optimise storage (Sobers, 2011). After CO_2 injection is completed, monitoring, measurement and verification (MMV) of permanent storage must continue for several years (Kaldi and Gibson Poole, 2008).

The main advantage of geological storage of CO_2 in hydrocarbon reservoirs is the availability of data from exploration and production activities. The data required in the Identify stage are acquired mainly during exploration and development of oil and gas fields. In the Identify stage, site screening studies (ID14), identifying potential sites (ID15) and estimating capacity of level of uncertainty (ID16) can be conducted at low cost. The reservoir description and characterising that have already been largely acquired can be used for CO_2 site assessment studies (EV16 and D1). This advantage can also be realised in the Evaluate and Define stages for assessment and selection studies, ranking and planning.

Additionally obtaining exploration permits (EV 17) will not be required for storage in producing or depleted hydrocarbon reservoirs. Currently, there are no regulations governing CO_2 storage as specifically referred to in the Define stage (EV17) in T&T. However, under the Petroleum Licence granted to operators, CO_2 storage activities can fall under the definition of petroleum operations (GORTT, 2010) and separate permission may not be necessary. Policies, regulations and incentives for CCS have not yet been developed in Trinidad and Tobago. However, the potential revenue streams from increased oil production (Boodlal and Smith, 2007) and the country's commitment to the Kyoto Protocol Agreement are incentives for initiating and implementing CCS.

Table 4. Identify, Evaluate and Define for the Storage of CO_2

Identify		**Evaluate**		**Define**	
ID12.	Site Screening Studies	EV16.	Site Assessment Studies	D1.	Site Selection Studies
ID13.	Define screening basis	EV17.	Obtain exploration permit	D2.	Specify performance targets
ID14.	Develop screening plan	EV18.	Define selection basis and develop selection plan	D3.	Prepare CO2 storage development plan
ID15.	Review available data and identify potential sites	EV19.	Acquire data, test, analyse, rank risks	D4.	Evaluate compliance with regulations and qualification goal
ID16.	Estimate capacity and level of uncertainty	EV20.	Select site and engineering concept	D5.	Obtain storage permission
ID17.	Shortlist storage site				

Source: Reproduced from the GCCSI (2011)

6. Implications for Project Management Constraints

Any CCS project will be subject to the triple constraint of Time, Cost and Scope. It should be noted however, that the technologies utilised in CCS projects are in the Introduction/Growth phases of their product life cycles (Al-Juaied and Whitmore 2009). It is estimated that the cost of CCS would be dependent upon the type of technologies employed, and provided an analysis of the CCS process with the year 2008 as the datum. In their analysis, Al-Juied and Whitmore (2009) surveyed multinational organisations which were actively involved in CCS. The cost of capture based on this survey is shown in Table 5. Capture costs are significant but will decrease with time. However, this constraint does not have a significant bearing on Trinidad and Tobago CCS implementation in the short term.

Table 5: Results of Survey of Cost Estimates for Capturing Carbon

Estimate Source	**Costs now** $/t$CO_2$ avoided	**Future costs (2030)** $/t CO_2 avoided
Consulting Group (2008)	70	45
McKinsey (2008)	80-115	40-60
S&P (2007)	-	40-80
BERR (2006)	-	40
Shell (2008)	130	65 or below
Chevron (2007)	Significantly greater than 100	n/a
Vattenfall (2007)	45	25-45
Al Juaied and Whitmore (2009)	120-180 on a 2008 basis	35-70 on a 2008 basis
(excluding transport and storage)	90–135 with capex deescalation	25-50 with capex de-escalation

Source: Al-Juaied and Whitmore (2009)

The technologies considered for the CCS are 1) First-of-a-Kind (FOAK) plants, and 2) Nth-of-a-Kind (NOAK) plants where the technologies are more mature. Their findings excluding transportation and storage costs are summarised in Table 6.

Table 6: Expected Costs and Cost Range for FOAK and NOAK Technologies

.Technologies	**Expected Cost ($/t$CO_2$ avoided)**	**Cost Range($/t$CO_2$ avoided)**
FOAK	$150	$120 - $180
NOAK	--	$35 - $70

Source: Al-Juaied and Whitmore (2009)

It is necessary to then add the cost of transportation of the CO_2 and the Cost of storage of the CO_2. It is proposed to utilise existing oil-pipeline infrastructure to transport the CO_2, and abandoned oil wells to store the CO_2, thus minimising the cost of Transportation and Storage. A conservative estimate puts these costs at 25% to 40% that of the typical cost of Capture.

Time is another constraint for which only estimates are possible. The European Union plans to embark on a CCS project, where the main elements include; the passing of legislation, the creation of CO_2 producing clusters, the deployment of the carbon capture technologies, the transportation and storage of CO_2. This program is expected to have duration of 6 years, beginning in the year 2014 and ending in 2020. This estimate is based on plants producing between 60 and 90 million tonnes of CO_2 per year (ICE, 2009). In order to estimate the duration of conducting a CCS project in Trinidad and Tobago, one can use the relative proportion of CO_2 produced in Trinidad and Tobago (36.2 million tonnes) and scale to the six (6) years required for a project to mitigate 60 to 90 million tonnes of CO_2 per year; the result is 3 to 4 years.

The scope of the CCS project, has been discussed in the Background section of this paper and generally includes CO_2 capture from industrial sources, Handling and Transporting of CO_2 and Injection and storage of CO_2 in deep geological formations. It should be noted however, that the Scope may have to expand to include to passing of the appropriate legislation which would make it mandatory for industrial plants to reduce their emissions.

7. Summary and Conclusions

In each area of CCS, the special circumstances within the Trinidad and Tobago energy industry allow for relatively quick and cost effective implementation of CCS. In the Capture phase there is no need for capturing 58 % of CO_2 emissions, given the relatively high purity (i.e., greater than 90% volume fraction) of CO_2 emissions.

The largest source of CO_2 emissions that will require capture processes is located close to possible collection sites, Point Lisas and Point Fortin, and within a short distance (i.e., less than 30 km) from potential storage sites. In the Transportation phase, there are opportunities for integration with ongoing operations and existing facilities. The integration of these operations can reduce the cost of new CCS projects. There are pipelines, ROW and, experience in CO_2 transportation by pipeline between Point Lisas and oilfields south of the industrial estate. Furthermore, small volumes can also be transported by road between source and sinks where the economics and safety of short-distance road transport can be justified.

The state-owned oil company, PETROTRIN, operates mature oil fields 30-50 km from CO_2 sources which can benefit from CO_2EOR operations. There is a wealth of data and experience from exploration, development and operation in these areas which can be retrieved and applied to screening and ranking these reservoirs for CO_2 storage in the 'Identify' and 'Define' stages of CCS implementation. The close proximity of CO_2 source and sinks, purity of CO_2 emissions and experience in CO_2EOR are the main strengths of a CCS in Trinidad.

Based on the preceding discussion, it is concluded that:

1. CO_2 capture will not form an integral part of CCS implementation in Trinidad in the short to medium term.
2. A commitment to CCS in T&T will need to focus mainly on the 'Define, Execute and Operate' stages of the Transportation phase after making final decisions on route and transportation options.
3. The screening and selection studies in the 'Identify, Evaluate and Define' stages for the Storage phase will likely use data and permissions obtained during oil exploration and production operations. The 'Execute and Operate' stages will be a modified version of the oil production operations.
4. The experience of CO_2EOR operations may be leveraged upon for CCS implementation.
5. The peculiar circumstances in T&T allow the execution stages of the project lifecycle (i.e., Define, Execute, Operate) to be within relatively close grasp of stakeholders in local CCS projects, and
6. CCS implementation in Trinidad and Tobago will take approximately three (3) years.

Future work for using a project management model for CCS implementation will consists of a review of Project Integration Management and an evaluation of the Project Management Maturity of the main stakeholders. Project Integration Management will be crucial to CCS implementation in Trinidad given the involvement of the various stakeholders which include, but is not limited to, PLIPDECO, NGC and PETROTRIN. An assessment of the overall Project Management Maturity of an organisation reviews the key elements of the scope, time, human resource, risk, communication, procurement, cost and, quality needed to manage projects undertaken by the organisation.

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Authors' Biographical Notes:

Ruel L.A. Ellis *is a Lecturer in the Department of Mechanical and Manufacturing Engineering at The University of the West Indies, St. Augustine Campus. He is also a member of IEEE Computer Society and Secretary, IEEE Technology Management Council and present chair of the IEEE Education Society, Trinidad and Tobago Section. He is also a member of the American Society of Engineering Educators, and the International Institute of Industrial Engineers. His research interest area is in the areas of Industrial Engineering, Information Systems and its Application in Project Management and Education Technology.*

Lorraine Sobers *is a Lecturer in the Petroleum Studies Unit of the Department of Chemical Engineering at The University of the West Indies, St. Augustine Campus. She is a Reservoir Engineer specialising in Enhanced Oil Recovery and Carbon Storage and has recently presented her research at international and local* *conferences. Dr. Sobers has a first degree in Chemical Engineering and postgraduate degrees in Petroleum Engineering from Texas Tech University (M.S.) and Imperial College London (Ph.D.). She currently sits on the board of the Society of Petroleum Engineers Trinidad and Tobago Section as the Director of Continuing Education.*

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