Early beginnings for systemic change

In seeking a system that facilitated a transition from the current system to one where systemic change was driven by learning organizations, our Founder, Michael Doyle presented a series of research papers to the University of Stellenbosch is which he imagined a company that facilitated this change.

The imagined company was the beginnings of the Global 1000 Schools Project.

Futures related research papers that included:

Managing for Change – an imagined company driving systemic change by learning organizations and the future influence they have in a new world.

Measuring and making the future – the processes that needed to be followed in order to ensure a thorough analysis a learning organization needed to conduct in ensuring systemic change.

Understanding the World – this research imagined a whole country and it's move to the world of renewable energy. It contained an in depth look at the PESTLE (Politics, Economics, Social, Technology, Legal & Governance, and Environment.

Measuring and Making the Future

Contents **Page**

Figures:

Tables:

1. Problem: Why is there disconnect between Sustainability Education and the practical implementation thereof? What is the solution developed to solve this disconnect?

In previous research conducted prior to (Doyle. 2013) and for the PGD in Futures Studies (Doyle. 2015) the author was able to develop a business model for Carbon Trading Concepts (CTC), a renewable energy and carbon trading company, for the development of renewable energy in learning organizations. It was founded out of the understanding of, and the need to resolve the problematic disconnect between sustainability education and the 'business as usual' scenario which primarily exists in many organizations. In identifying where this disconnect exists, it was found that very few learning organizations practically apply the theoretical principles of sustainability, or that their sustainability practices amount to 'green washing'. Generally learning organizations focus is on education and the easier to implement programs such as recycling, composting and some degree of energy efficiency. Research indicates that sustainability education needs to be both theoretical and experiential in order for previous sustainability paradigms to change and become habitual. (Annexure 1: Doyle. 2013).

Due to the extent of the global warming problem the biggest practical impact these organizations can have, in mitigating for the carbon emissions problem, and the development of an enabling experiential environment, is on the reduction of carbon emissions through the move from fossil fuel based energy purchases to renewable energy. The primary reason for this required shift is that carbon emissions have a 'long tail' which causes exponential build-up of green-house gases in earth's atmosphere resulting in the green-house effect. This could result in a 'Black Swan' event; the problem of the runaway greenhouse gas effect. The move to operating the learning organization on a renewable energy basis would demonstrate to the organization's stakeholders that the requirement to move towards a sustainable future is a serious one, and one that needs immediate strategic action as opposed to theoretical knowledge due to the serious global impacts that climate change is already having on the world, and will continue to have in an ever worsening manner.

Further research showed that: “One of the primary reasons for the difficulty in this move is a financing one.” (Doyle, 2015). While, in theory, there is a paradigm shift in worldviews from a ‘business as usual’, Thomas Friedman way of thinking, towards a more sustainability focused future, there exists a financial constraint for the deployment of renewable energy technology. While renewable energy, and especially solar photo-voltaic (solar PV) energy systems, is dropping in price, it is still seen as an expensive option given the still relatively cheap price of traditional electricity supply – although each year this becomes more expensive. CTC also took note of the fact that learning organizations primary area of focus is that of education and as such, “funds are allocated firstly to the learning needs of its stakeholders.” (Doyle, 2015). Learning organizations are subject to reliance on the current utility provider and their method of generating power – in Southern Africa’s case, this being Eskom’s coal-fired power. The learning organizations are currently caught within a vicious reinforcing loop where their theoretical sustainability goals are hindered by both the financial constraints and supply constraints. The learning organizations firstly, compete internally for financial resources across their departments (between academic and operational), and secondly, have uncertainty in both energy supply and future pricing as these are external inputs. In the development of its model, CTC looked for points of leverage in order to remove both the financial and supply constraint in order to balance the reinforcing loop.

In reconciling and removing the disconnect between the theory and practice of renewable and sustainable energy, CTC seeks to facilitate the application of sustainability theory in learning organizations via a practical business model that will allow the organization to switch to a renewable energy source, as well as to contribute to a reduction of anthropogenic effects on the natural environment through the reduction of carbon emissions. CTC has sought to further include in its model the cascade effects that renewable energy offers into community stakeholders.

In order to not only reduce the learning organizations energy costs, increase its supply and price certainty, and reduce its carbon footprint, the opportunity exists for bundling learning organizations into a ‘World Leading Project’ to be registered with the Greenhouse Gas Protocol. This will assign the carbon offsets, generated by the learning organization, a monetary value to be traded on one of the GHG trading schemes. The purchaser of these credits will have the facility to not only offset their emissions, but also to report the investment as part of their corporate social responsibility (CSR) program once the funds are invested into social stakeholder programs.

Doyle (2015) went on to further discuss the reasons why CTC chose its target market of learning organizations. Firstly, sustainability education needs to start at a very young age in order for the concept of sustainability to become an embedded part of a learner’s worldviews. Secondly, learning organizations operate primarily during daylight hours, which allow the organization to take advantage of the high incidence of sunlight South Africa experiences and to primarily install the, currently, most cost effective renewable energy – solar PV. At the same time, this allows removal of the cost of the most expensive component of solar PV – large scale power storage. The learning organization will be able to build more capacity from savings generated through supplying their own power. Thirdly, learning organizations generally do not operate over weekends or during lengthy holiday periods. This provides the opportunity for CTC to develop learning organizations into Independent Power Producers (IPP’s) in order to sell surplus power back to the utility. This will also provide the necessary set off required in the event the learning organization draws power from the grid. As a system is scaled up (including development of other renewable energy resources besides solar PV), the opportunity exists to be a net provider of power to the grid.

2. Contextualizing Stakeholder Forecast Considerations

During the development of the CTC business model, it was found that various stakeholders exist and that they have different information and forecast data requirements. Through its research CTC found it essential to contextualize the current reality of the energy industry and its various components, what constraints exist, and how this would relate to the data requirements of stakeholders.

Internal Environment

In the development of a worldwide renewable energy project for learning organizations, CTC started with its vision and the internal environment that it currently operates within. CTC, which has the vision of carbon neutral learning organizations, sought a partnership with the Independent Schools Association of Southern Africa (ISASA) as they are the co-ordinating body for independent schools. They have the ability and resources to recommend initiatives to their member schools. ISASA also has sustainability education as one of its core focuses.

Transactional Environment

Due to the financial constraints outlined above, learning organizations remain in the transactional environment, where CTC has yet to influence their decision making. The CTC/ISASA partnership approach to them on a co-ordinated energy model requires both a qualitative and quantitative proposal based on sound data. Primary research has indicated that learning organizations would seek to incorporate renewable energy into their operations in order to demonstrate practical sustainability strategies.

Suppliers of the required technology (IPP's) border the internal and transactional environment as they see the opportunity to invest in renewable energy projects. Expert stakeholders include Independent Power Providers (IPP's) of renewable and alternative sources of energy.

International IPP's and investors are looking to expand their markets into Sub-Saharan Africa (SSA). Due to new regulations within the carbon trading market in European and other more developed countries (MDC's), Sub Saharan Africa (less developed countries (LDC's) or non-annexure countries) is classified as a preferred funding opportunity for Annexure 1 countries both for their expansion models and carbon emission reduction requirements under the various trading schemes and emission target commitments such as the Clean Demand Mechanism, Gold Standard, Kyoto Protocol, etc. This allows suppliers and project developers to link with funders such as the European Union, Power Africa, etc.

There are currently only two 'Green Energy Traders' in South Africa who are licensed with NERSA. CTC is in consultation with them in order to ensure that learning organizations are able to connect to the grid legally in order to maximize investor returns through the supply of energy requirements to learning organizations, and surplus energy to the grid. CTC is seeking to influence and partner with IPP's and funders and as such, will be required to provide them with the necessary qualitative data to justify their investments.

Contextual Environment

In seeking to position CTC as a leader within the renewable energy sector it is necessary to contextualize the energy mix in South Africa. One dominant utility, Eskom, supplies energy to South African municipalities, who then sell-on the power to their customers, or directly to larger customers. According to the BP Statistical Review of Energy 2013, the primary and majority of Eskom supply is fossil fuel based - coal (72%), oil (22%), natural gas (3%), nuclear (3%), - and renewables (less than 1% - primarily from hydropower). In terms of the country's future energy mix, there is a move towards renewable energy; however the current short term focus is on fossil fuel energy sources and a possibility of a move to the expensive option of nuclear power energy.

(Doyle. 2015). The reliance fossil fuel energy is what the CTC project seeks diminish in its vision of mitigating the effects caused by the associated carbon emissions and climate change.

The South African government commitment, in terms of its proposed renewable energy mix, falls well short of the potential a solar energy rich country such as South Africa has to offer. There has been a move during 2015 to some larger scale solar PV projects such as Jasper, and a further 13 licences were issued to renewable energy projects. In terms of supply capacity (according to the Department of Energy), South Africa's installed capacity is about 45, 700 MW (generated by coal, oil and natural gas). Currently severe supply constraints exist. The precarious low margin between installed capacity and peak demand leads to load shedding and the power utility having to request large industrial users to shut down or cut back operations during peak periods. According to the Southern African Power Pool 2013 Annual Report the peak demand forecast is expected to reach 53, 900 MW by 2025. South Africa is intending to meet this expected demand through new coal fired power stations and nuclear proposals as outlined above.

Further research has highlighted that "with increasing interest in renewable energy deployment in the country, existing grid infrastructure problems have come to the forefront. In 2010, the Department of Energy and National Treasury, in consultation with Eskom, mapped investor plans against existing Eskom infrastructure and grid planning, and indicated that there was sufficient grid connection capacity for IPPs until 2016. However, in 2011, Eskom did admit that it does not have the capacity to build the infrastructure needed to connect all IPP's to the grid. IPP's have, therefore, undertaken connection requirements themselves and at their own costs." (Doyle, 2015). Despite these commitments, existing maintenance backlogs in the country's electricity grid are putting severe constraints on the development and deployment of renewable energy. In efforts to alleviate the challenge, Eskom has initiated a smart grid pilot project network to enable demand side management through load limiting technology. It is the constraint in supply and grid connectivity problems, the peak demand forecast in 2025, and the planned development of renewable energy supply that opens the market opportunities for renewable energy IPP's and Energy Traders.

In looking to the urgency of the energy supply problem, CTC has also considered the likelihood of a 'wildcard' event using Oliver Markley's (2011:1080) Typology of Wildcards. The identified 'wildcard' is that of a national grid shutdown, which would have economic and social repercussions for the whole country. There exists a possibility of a Type II event: High Probability, High Impact, Low Credibility. Lack of credibility that may still be perceived to exist is of either, disinformation from utility sources camouflaging relevant knowledge, or censorship in which an attempt is made by government to suppress relevant information. (Markley, 2011:1085). Public acknowledgement of the possibility of this 'wildcard' event would render the credibility as High, rendering the 'wildcard event' a Type IV.

The various GHG trading schemes exist as a source of funding as well as the opportunity to have a CTC type project classed as a 'World Leading Project' in terms of carbon emission reductions and carbon offset trading. The data and information required by these GHG trading schemes is extensive, however the historical data is available for forecasters to compile the detail required for verification of such projects.

Table 2 below outlines these stakeholders and the data required that would inform their decision in the switch to a renewable energy provider.

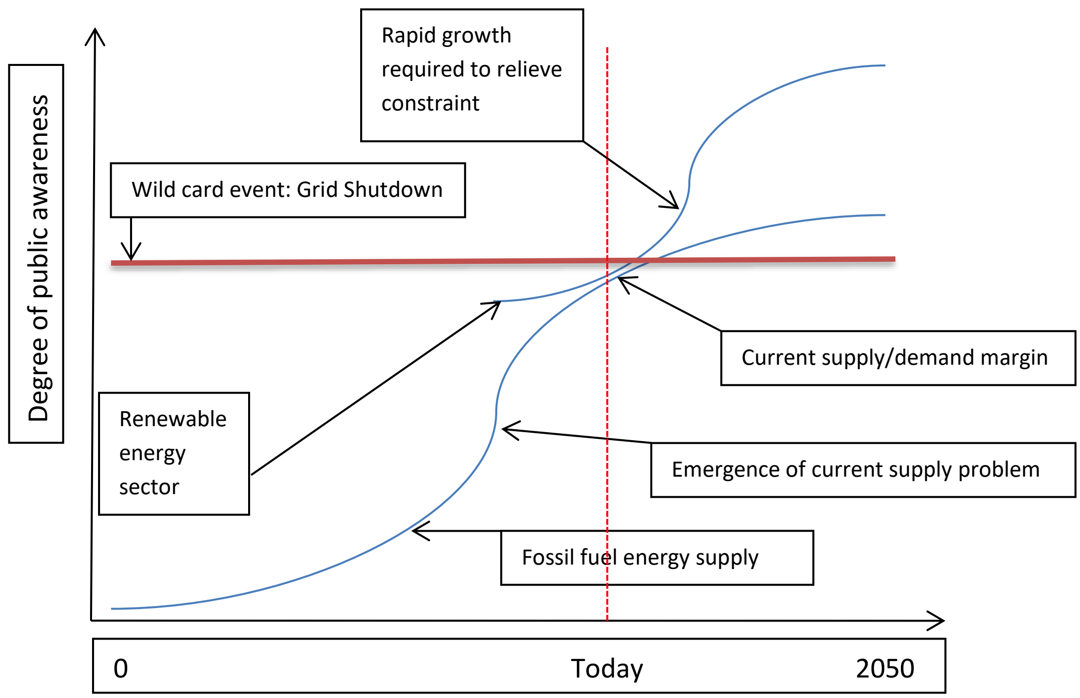
3. Managerial (Stakeholder) Dimension

The qualitative history of the reasons for reduction in carbon emissions is no longer a debate. With a 97% scientific consensus (Intergovernmental Panel on Climate Change (IPCC)) on the anthropogenic causes of climate change and the effects therefrom, the vast amount of credible information and the mitigation and adaptation strategies required are well known and widely published. One of the most important steps in developing successful strategies for CTC and its supply chain stakeholders is the production by CTC's managerial team, of the correct aggregation of forecasting data to inform stakeholders' decision making process.

In Business Forecasting with ForecastX™ (BFF) (2009:1) Al Enns is quoted: "…if you can get the forecast right, you have the potential to get everything else in the supply chain right. But if you can't get the forecast right, then everything else you do essentially will be reactive, as opposed to proactive planning." While stakeholders will rely on judgement calls based on experience and personal intuition, sound quantitative data analysis and forecasting in today's rapidly changing world form a key component in making these calls.

Learning organizations' key focuses have traditionally been on the core educational components of their business. CTC needs to provide managerial justification for the stakeholders to firstly, understand the global requirement for a shift to renewable energy, secondly, the necessity to internalize the current external costs of environmental damage their activities cause, and thirdly, to provide the sound and 'lean' financial justification for adopting the CTC model. "In a competitive environment businesses are forced to operate with maximum efficiency and with a vigilant eye towards maintaining firm cost controls, while continuing to meet consumer expectations in a profitable manner." (BFF 2009:10). Learning organizations are knowledgeable on the impacts of climate change; however they also need to take cognizance of the emerging trends within both the current Eskom supply and the renewable energy market. Environmental scanning shows that the emerging trend, besides the already acknowledged carbon emissions problem, is one where Eskom is unable to guarantee supply, and 'keep the lights on'. CTC has adapted the model of Molitor, Schultz and Rogers (Conway 2009:15) to illustrate this trend – see Figure 1. The opportunity exists for learning organizations to become early adopters of renewable energy and remove the uncertainty of supply constraint.

Figure 1: Emerging electricity supply trends



Collaborative Planning Forecasting and Replenishment

In the development and management of a sustainable model, CTC recognizes that development of a successful project will require a cooperative effort in what has become known as "Collaborative Planning Forecasting and Replenishment (CPFR)" which involves "coordination, communication, and cooperation among participants in the supply chain." (BFF 2009:12). In the development of CTC's collaborative forecasting approach, in which the stakeholders will share information, the benefits to stakeholders will be (based on the BFF benefits (BFF 2009:13)):

- Lower capital investment for funders, zero capital investment for learning organizations, and capacity building by bundling projects in order to achieve economies of scale, to allocate funds efficiently and to adopt a variety of sustainable technologies.
- By bundling many learning organizations into a project, there will be fewer delays to the project as a whole due to unforeseen technological or regulatory problems.
- Ensuring the learning organization has its own energy supply will reduce reliance on a service provider suffering from serious supply constraints.
- As the project develops and scales up to all learning organizations, credibility will ensure the project generates a life of its own.
- Increased investment and capacity building in the funding model will allow CTC the option for installing new technologies as they develop.
- Collaborative data gathering among stakeholders will allow CTC to dynamically respond to market changes such as governmental control, diverse cultures, etc.

Since most of this data will be shared via electronic data means utilising the internet, the issue of confidentiality and security must be addresses to ensure stakeholder interests are protected. By ‘bundling’ the learning organizations, the sum will become greater than the whole of its parts.

The Forecast Process

In the development of the CTC project, consideration is taken of the needs of stakeholders who make decisions based on the forecasts, and in particular on ensuring the need for the forecast to inform the learning organizations’ plans and goals. Table 1. below (BFF 2009: Ch. 10:485-489) outlines practical guidelines on the development of the forecast process.

Table 1: The Forecast Process

Forecast Step	**CTC Aims**
1. Objectives of forecast in which the questions asked are: a) Why the need for the forecast, and b) Who will prepare the forecast?	CTC initially seeks to establish the extent of possible participation by learning organizations in the project and then to provide for a decision maker • the justification for the forecast, • data that gives them understanding and faith in the reasons for developing renewable energy forecasting, and • To provide both the qualitative and quantitative reasons for using CTC as their renewable energy provider.
2. What data, to inform the decision maker, needs forecasting?	Due to the complexity of the Climate Change and electricity supply problems, it is necessary for CTC to ensure that relevant data is produced to inform the stakeholder's decision making process. This includes a careful determination of the variables to forecast. Previous research by Doyle (2015) indicates that the qualitative dimensions of Climate Change are well known and understood, however it is the complexity and volume of the quantitative data required that often becomes confusing. CTC will have to ensure that what they produce is a clear and concise, but easily communicable set of data that informs the stakeholder decision maker.
3. Time dimension of the forecast.	1. Length and periodicity of the forecast. Historical annual climate change data will require longer past

	(from the start of measured anthropogenic carbon emissions (1850) and future forecasting to reflect the long term effects of carbon emissions. Medium term annual/monthly/seasonal data will be required to reflect current energy supply realities and future CTC alternatives on a financial basis – historical energy data going back 30-40 years is recommended, and future forecasts to 2050 (time frame set by IPCC in order to mitigate irreversible climate change). 2. The urgency of the forecast. On a global scale, the problem of climate change is an urgent one. In the immediate time frame, energy supply is facing a 'wildcard' event as outlined above. This requires immediate forecasts which limit the model selections to determine the forecast. Fortunately relevant data is immediately available to conduct the required forecasts. However, CTC is well aware of the cognitive 'paralysis' organizations face in making decisions of this magnitude. CTC will need to ensure that it highlights this sense of urgency, and at the same time provides an immediately available, and justifiable, financial option for the decision maker.
4. Data considerations, where the important question of	Consideration of the quantity and type of data available. Due to the embryonic stage of CTC, all data will be from external (to CTC) sources. Readily available data on Climate Change,

‘what’ to forecast is of importance.	past & future energy supply, pricing, demand and expert ‘prediction’ is available in the public domain. Learning organizations should also have internal historical data on their electricity usage from the finance department (if not, then their energy supplier should be able to provide this). If this data is not expressed in the correct format, CTC will be required to assist in preparing the correct format. As the project scales up, CTC will be available to draw from more internal sources of its own as it develops its own database. It will also be able to develop a system allowing learning organizations to easily supply the required data. CTC will also need to ensure that the data is ‘disaggregated’ (BFF 2009:487) in order to ensure the correlation of the variables in the data is correct.
5. Model selection *(Further information: See 6: Model Selection below*.)	The model(s) selected will depend on three criteria: 1. The pattern exhibited by the data, 2. The quantity of historic data available, and 3. The length of the forecast horizon. (BFF 2009:58) The model selection will also take into account (BFF 2009:488): 1. Is the data easily transferable? For the data required for the forecasts, most data is available and readily transferable. Data from learning organizations is

	easily accessed and can be adapted to an aggregated format. 2. Volume of historical data. For the purposes of CTC's forecasts there is generally readily available and in substantial volume. 3. Noticeable trends in past forecasting. The requirement for mitigation and adaptation to the effects of carbon emissions was based on the emergent exponential trend observed by Charles Keeling[1]. It is from the scientific data resulting from his observations that the urgency for the shift to non-fossil fuel based energy resources has emerged. 4. The forecaster's and decision maker's technical skills – the level at which CTC's forecast is to be used will be at the financial level of the learning organization. Management at this level is usually well placed to interpret the relevant data.
6. Model Evaluation	For the subjective and qualitative forecasts discussed above and in 6. below, the data must be well organized and generate a lead into the more quantitative data. The data will be organized in an 'executive summary' format which will encourage the development of the decision makers worldview on the Climate Change problem. Reference will be made to backing quantitative data, such as the Keeling Curve (figure 1.) and its correlation to other data. Reliance

	will be placed on Customer Surveys, and Jury of Executive opinion research data. Quantitative data will be more local to the learning organization in terms of the forecast of what they can expect based on their current reality/future energy supply and uncertainty.

[1]Charles David Keeling. Scripps Institution of Oceanography, University of California, San Diego, first observed the increase of anthropogenic carbon emissions.

4. Data Required

Various types of data and forecasting methods will be required to meet the forecasting aims of CTC and its stakeholders. Due to the complexity of the causes of the climate change problem, and the constraints that exist in addressing the impacts thereof, both a quantitative and qualitative approach will be required. Generally the data most used in quantitative forecasting are time series, which display a “wide variety of patterns when plotted over time.” (BFF 2009:59). A time series display of data will contain some or all of the following components:

- Trends which demonstrate long term changes in the level of the data.
- Seasonal patterns that demonstrate regular variations during the same time periods each year.
- Cyclical patterns of the data around the long term trends.
- Random or irregular fluctuations not evidenced in those above.

Table 2 below outlines the rationale for the required data, the type of data and its variables, whether the data is of a quantitative or qualitative nature, and the time horizon for the forecasts.

Table 2: Types of data required, their purposes, variables and stakeholders

Type of data and variables	**Rationale for Data required**	**Qualitative/Quantitative and time horizon**
Customer (learning organization) survey to establish interest and future plans the organization may already have in place.	Initially CTC needs to conduct research to establish the potential/need for a Renewable Energy Project within learning organizations	• Qualitative and Quantitative data • This initial research has no time horizon for the forecast.
Carbon emissions and temperature records: dating back to the start of the industrial revolution (1750) and the long term forecast for carbon emissions with the correlation to increased temperature forecasts. ***Qualitative assessment reports from experts*** whereby the above data is analysed and contextualized for the decision maker.	In order to demonstrate that there is a requirement to switch from carbon based energy sources in order to mitigate the effects of Climate Change, data is required on the effects of global warming in order to demonstrate the link between carbon emissions and temperature increase.	• Quantitative historical data back to 1850 and a long term forecast of several centuries to demonstrate the danger on non-mitigation. • Linear exponential trend
Historical and forecast electricity prices. ***Historical and forecast electricity demand.***	The Current Reality of National Supply is that electricity price increases are expected to continue, and that current demand is expected to continue placing further strain on	• Quantitative • Forecast required for the immediate and medium term future (20 years)[1]

Historical and forecast capacity provision.	capacity with resultant small peak/base load margins.	• Trend and seasonality
Historical usage of the learning organization: variable - price. ***Forecast electricity costs versus stable renewable usage.***	The current reality for Learning Organizations is that electricity price increases are expected to continue, and that constraints in supply lead to uncertainty. Demand is not expected to continue if learning organization is at maximum learner capacity	• Quantitative • Short to medium term (20 years)[1] • Linear trend with seasonality
Carbon footprint of learning organization. ***Forecast of carbon emission reductions based on switch to renewable energy supply.***	In order to demonstrate that carbon emission reductions for the purpose of trading offsets is viable by enabling a learning organization to switch to renewable energy as a supply source.	• Quantitative • Short/Med/long term (20 years)[1] • Linear trend
Forecast Renewable energy growth – variable: investment by funders	An Ideal Future renewable energy supply to learning organization has financial benefits, demonstrating return on investment for both funders and the learning organization.	• Quantitative • Short/Med/Long term (20 years)[1] • Linear exponential trend
Forecast of renewable energy growth, carbon reduction and offsets to profit share	In order to demonstrate potential profits in the partnership with the energy trader, data showing the benefits of carbon trading is required.	• Quantitative and Qualitative • Short/Med/Long term (up to 20 years)[1]

Demographic data (www.indexmundi.com) [2]	Data to reflect the growth in independent schools in order to demonstrate that the potential for supply of renewable energy into this sector has a growth path	• Quantitative • Short/med/long term (minimum 20 years up to 100 years)[3] • Linear

[1] 20 year forecast period used to reflect the life of a renewable energy project before replacement of technology is required

[2] The correlation between growth of emerging middle classes and the growth in independent schools. The age structure of South Africa is also changing – 86.7% of the population is under the age of 55, of which 28.3% are still of schooling age.

[3] Figure 1: Emerging Electricity Supply Trends indicates an exponential growth in the long term for renewable energy.

5. Data Sources

The complexity and variability of the data required appears to be an onerous task to collate. However, due to the credibility of readily available data sources, as outlined below, the data mining task is more one that is time consuming than disaggregation.

Table 3: Data required for stakeholders and data sources

Data Required	**Data Source**
Learning organization interest in the CTC project	• Learning organization • ISASA and a customer survey of its members
Climate Change assessments and impacts	• Intergovernmental Panel on Climate Change (IPCC) www.ipcc.ch • Web sources for expert assessments • NGO's working within the climate change and energy sector

Global Carbon emissions records	• World Bank – Climate Change http://sdwebx.worldbank.org/climateportal/index.cfm?page=climate_data • IPCC
Global Temperature records	• National Aeronautics and Space Administration (NASA) • http://data.giss.nasa.gov/gistemp/ • IPCC
National Electricity price history	• Statistics South Africa • Eskom • National Energy Regulator of South Africa (NERSA)
National Electricity demand history	• Eskom • National Energy Regulator of South Africa (NERSA)
National Electricity capacity and peak/base load history and load shedding	• Eskom • National Energy Regulator of South Africa (NERSA)
National Electricity future prices	National Energy Regulator of South Africa (NERSA)
Learning organization electricity usage history	Internal accounts department of learning organization or if not available, their utility provider (with permission)
Demographic data on the growth of the middle classes in South Africa and the need for, and growth of, quality	• Statistics South Africa • ISASA

education (independent schools)	
Learning organization carbon footprint	Internal accounts department of learning organization. Use of any of a multitude of readily available carbon footprint calculators based on quantitative electricity consumption data from the learning organization.
Demographic data showing growth in middle classes	Statistics South Africa
Growth in Independent Schools	ISASA
Cascade effects of investment for communities	National Treasury

6. Model Selection

When considering model selection, CTC has borne in mind that the stakeholders will be relying on information (based on credible data models for generation) that already exists in the public domain. It is the Collaborative Planning Forecasting and Replenishment (CPFR) process as outlined above that will allow access to, and for the compilation of the relevant information. Due to the number of different models proposed and the space constraints in this research, only 2 models are examined in further detail – Time-Series Decomposition for Carbon Emissions and the Social Accounting Matrix.

Table 4: Model Selection

Data required	**Model selection**
Learning organization interest in the CTC project	Customer surveys where the primary aim is to forecast interest in the development of a practical project on a subject that is well researched and used for theoretical application within learning organizations.
Climate Change assessments and impacts	Jury of executive opinion (JEO). Historical data patterns will be reflected in the opinions expressed, requiring a substantial base of expertise. In the case of Climate Change this information exists in the IPCC database which draws its assessments form thousands of experts in the field of Climate Change. The IPCC assessments would forecast using trends based on General Circulation Models.
Global Carbon emissions historical records and forecast where the correlation is sought with increases in global temperatures	This data is analysed using a Time-Series Decomposition model where the short-term fluctuations, such as seasonal patterns or irregular variations, are removed through the calculation of a moving average for the series. This will then allow the long term trend and cyclical components to be identified. See Keeling Curve Figure 2.
Global Temperature history and forecast	The change in temperatures would be demonstrated with a Time-Series Decomposition Model showing the correlation to changes in Global Carbon Emissions. See Keeling Curve Figure 2.
National Electricity price history and forecast	Time-Series Decomposition Model: Linear trend showing positive increases

National Electricity demand history and forecast	Time-Series Decomposition Model: Linear trend showing positive demand
National Electricity capacity and peak/base load history and load shedding	Time-Series Decomposition Model
Demographic data showing growth in middle classes and forecast	
Growth in Independent Schools and forecast	Time-Series Decomposition Model: Simple Trend Analysis
Cascade effects of investment for communities	• This is a complicated analysis that requires access to the National Accounts of the country. A model such as the Social Accounting Matrix[1] or Environmentally Extended Input - Output Model can be used.

{ Indicates demonstration of correlation between sets of data

1. Social Accounting Matrix (SAM), Input-Output model

These models are very widely advocated by the World Bank as analysis tools to represents flows of all economic transactions (macro or micro) within the economy of a country. It can be filtered to regional and national representation of economic statistics. Although it represents and depicts National Accounts it can also represent in its flow chart the non -accounting statistics flowing from regions to national total and created for whole regions or area. SAM's reflect a single year with year on year projections. It has however limitations in bench marking and adjusting for flow improvements and projection. If CTC wishes to portray the current poverty line status and spend per household and then reflect the income injection through carbon offset trading with its cascade effect of increased benefits, it requires some manipulation. CTC's SAM analysis is to show positive returns which are deployed into the next level, “the discounted cash flow”, to the actual future incremental trend. The sensitivity analysis would be a separate exercise, but each offered conclusion would be projected in separate SAMS, so we may have to do two or three models. In the field of Energy/Water, waste and re-forestation where we wish to prove we can design a suitable useful analytical framework for modelling, a normal Cost Benefit analysis of projects would not show the local economic development impacts of such projects. Market benefits are: output revenues, avoided fuel costs and avoided GDP losses, while non-market benefits are the avoided emissions of CO2.

7. Summary

The Ideal Future for the learning organization is one where their sustainability education is echoed in their sustainability practices. Their future reality will be informed by their currently reality of financial and supply constraints. The leverage point in creating their Ideal Future is by enabling the learning organizations to remove the financial constraints of installing renewable energy. CTC seeks to allow them to put into practice their sustainability education and remove the problematic of disconnect that currently exists. The CTC forecasting process needs to ensure that the learning organization has both the qualitative and quantitative data to inform the decision maker in the cascade effect and benefits to be gained in the switch to a renewable source for their energy needs.

By 'bundling' the learning organizations, the sum will become greater than the whole of its parts. In using the CTC model as its leverage point, the Ideal Future comes into play and the current reality problem/disconnect created by financial and supply constraints disappears. The cascade created is one where learning organizations sustainable education theory is reflected in practice, carbon emissions are reduced to the benefit of the natural ecosystems, CSR projects have impact through their purchase of carbon offsets, and the CTC financial funders achieve 'green' profits.

'Collaborative Planning Forecasting and Replenishment' will enable stakeholders to develop the long term vision of a green, renewable energy based future.

Annexure1: The Route to Sustainability Leadership (Doyle, 2013)

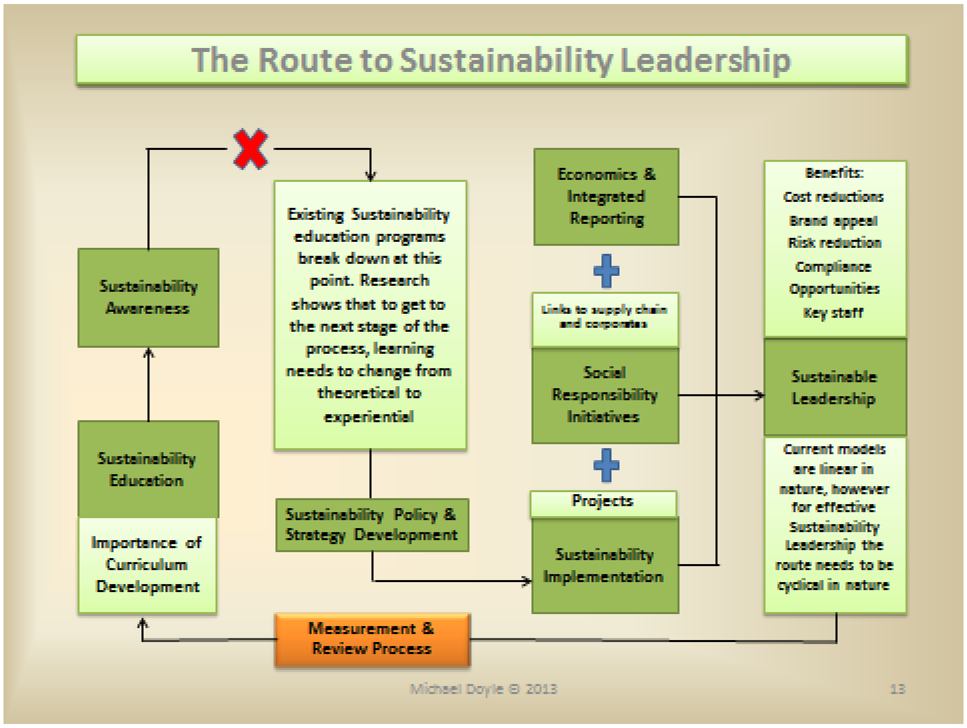
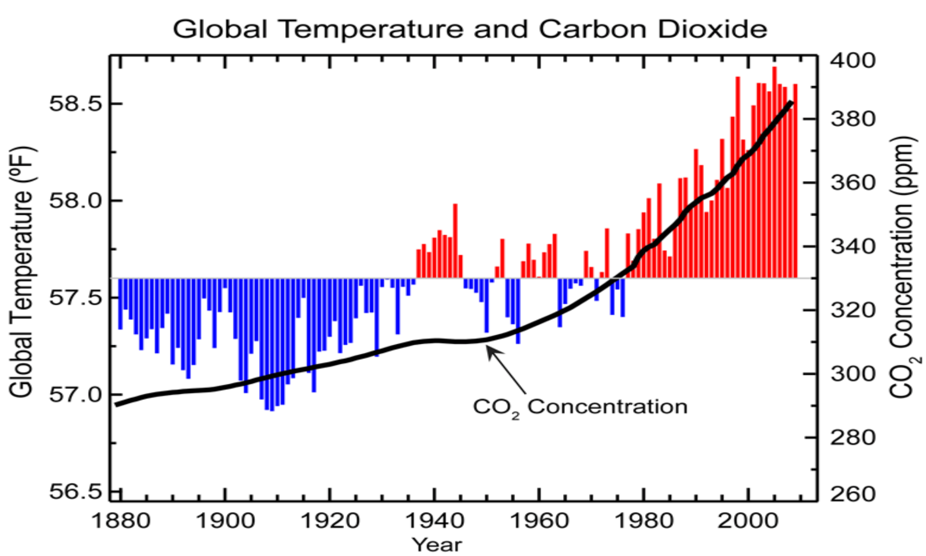


Figure 2: Keeling Curve. www.climiatechange.procon.org Charles David Keeling. Scripps Institution of Oceanography, University of California, San Diego



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