1st Southern African Life Cycle Assessment Colloquium

7th – 8th November 2016, Cape Town

Programme & Book of Abstracts
Foreword and Acknowledgements

It is a pleasure to put a foreword to this programme and abstracts booklet for the 1st Southern African Life Cycle Assessment (LCA) colloquium. LCA research and practise has a long history in Southern Africa, and there have been exchanges between researchers and practitioners before. Workshops have also been held. However, this is the first time we are running an event dedicated to show-casing our LCA research and industrial usage.

This event is organised by the University of Cape Town and the National Cleaner Production Centre of South Africa. Together, these entities are hosting the Southern African Regional Coordination Centre (SARCC) for the LCA activities of the Sustainable Recycling Industries (SRI) programme (sustainable-recycling.org), funded by the Swiss State Secretariat for Economic Affairs (SECO) and implemented by the ecoinvent Centre. The SARCC has the following goals:

- Develop Life Cycle Assessment (LCA) capacity and knowledge in Southern Africa;
- Promote LCA for quantitative sustainability assessment, in South Africa and in the surrounding Southern African region;
- Build a national and regional network of LCA and LCI data experts;
- Organise and participate in LCI data collection at a national and regional level.

The Colloquium is focussed on LCA research and the programme provides good time for peer critique. Industry use of LCA will also be presented, alongside current efforts towards creating regional LCI data and a national LCA network.

In this electronic booklet, you will find the final version of the programme, as well as abstracts for each of the presentations.

The organisers thank the funders, and particularly the ecoinvent centre in Switzerland for their support and encouragement. The work of the scientific committee and the feedback which it provided to the authors is gratefully acknowledged. We also thank the speakers for their efforts in preparing their presentation, and wish them rich feedback from their peers!

Professor Harro von Blottnitz on behalf of the organising committee.
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Abstracts
Potential for reducing greenhouse gas emissions in the South African construction sector

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Most greenhouse gas emissions in the world come from buildings. These emissions consist of operational and embodied emissions. The operational component accounts for about 33% of total annual global GHG emissions and is attributable to the use of energy in buildings. The embodied emissions, which may constitute 7%-10% of total annual global GHG emissions, arise from the use of energy in the building material life cycle.

Near zero energy buildings (NZEBs) have emerged in recent years in response to regulation of the dominant operational GHG emissions component. However, as NZEBs are mainstreamed internationally, the embodied GHG emissions component, which has to date received limited policy attention in South Africa, is likely to dominate the total GHG emissions from future buildings. Measuring the embodied GHG emissions component at national level has therefore become an important means to plan for an effective reduction strategy.

A previous South African study investigated only two major building material groups (MBMGs) – steel and concrete - and concluded that the manufacturing of building materials contributes about 5% of total national GHG emissions. This presentation reports on a greenhouse inventory compiled on the basis of eighteen MBMGs. The study, which was funded by the Development Bank of Southern Africa (DBSA) Green Fund, was undertaken as part of an input to a policy brief.

A baseline GHG inventory, limited to cradle-to-gate analysis, was calculated using carbon emission factor (CEFs) and the 2014 market size of each major building material group. The total GHG emissions associated with production of the eighteen MBPGs in 2014 was 12.2 million tonnes CO₂ equivalents (mtCO₂eq). The baseline inventory amount of 12.2 mtCO₂eq represents only 2.1% of the estimated total national GHG emissions of 590 mtCO₂eq for 2014. The reasons for the very low baseline inventory result are discussed.

**Keywords:** building materials, embodied greenhouse gas emissions, South Africa.
Barriers to the adoption of Life Cycle Assessment methodology for buildings in the South African construction industry

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Purpose: Life cycle assessment (LCA) is one of the tools developed to determine the holistic environmental impacts of a product or service or activity or process, and thereby inform decisions that will help reduce such impacts. The objective of the study was to identify the barriers to the adoption of life cycle assessment for buildings in the South African construction industry.

Methodology: A critical review of literature was done which was followed by the use of a questionnaire to collect primary data on the possible barriers to the adoption of LCA methodology for buildings. Eight barriers to the adoption of LCA for buildings were identified from literature, which were subsequently explored with the use of the questionnaire survey. The questionnaires were distributed to construction professional team i.e. Quantity Surveyors, Architects, Facilities Managers, Construction Managers, Civil Engineers, and Site Engineers in the South African construction industry.

Findings: Findings emanating from the study revealed that lack of knowledge and awareness of LCA methodology in the building construction sector was identified as a major barrier to the adoption of LCA for buildings. Those ranking among the lowest included; geographical issues such as the site-specific nature of the building, and long building life span.

Conclusion and value of study: The study contributes to the body of knowledge on the barriers towards the adoption of life cycle assessment methodology for buildings in South Africa construction industry. The study therefore is valuable to the SA construction industry, built environment, infrastructure development, and/or sustainable urban development.

Keywords: Barriers, Buildings, Construction industry, Life cycle assessment, South Africa
Environmental impacts from the manufacture and operation of clay brick structures were assessed in this Life Cycle Assessment (LCA). The environmental impacts were determined using the Impact 2002+ LCIA methodology, as it reveals the most useful results for the industry, in order to ultimately aim to improve the environmental impact of the industry.

For the cradle-to-gate phase, a full population survey data collection was carried out, acceptable data were recorded for 85% of the population, representing 95% of the clay bricks manufactured in South Africa. The study included primary data collected from all firing processes and kiln types representing manufacturers from all regions in South Africa. Data were collected for the 2012 year of output in the country. Primary data was collected for extraction of raw materials, manufacturing of brick products, and on site fuel sources. Secondary data were collected for fuel burning emissions, adapted from Ecoinvent, and actual field testing studies. Selected unpublished and preliminary findings suggest that for the 9 611 178 437 kg clay brick manufactured during the study period, 2 614 590 680 kg CO₂-eq contributed to global warming. For the same production, 33 463 866 964 MJ of non-renewable energy was consumed.

For the operational stage of the clay brick, a 50-year lifespan was assumed. Three different clay brick walling types (220mm double brick wall, 280mm cavity brick wall and 280mm insulated cavity brick wall) were tested in the SANS 204:2011 Part XA climatic zones. The 280mm insulated cavity brick wall had the best performance for zones 1,2,3,4 and 6. For zone 5, the lowest environmental impacts can be expected from the 220mm double brick wall.

For the demolition, waste and recycle and re-use phase, data were collected by means of a desktop study of available literature. Reliable literature is limited in this sector, however, evidence from other countries indicate that there is a huge potential for recycling clay bricks in South Africa.
The Clay Brick industry perspective on Life Cycle Assessment: a case study

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The Clay Brick Association’s (CBA) Lifecycle Assessment (LCA) seeks to establish definitive data on sector energy consumption in South Africa as well as the impact of Clay Brick in the South Africa society and economy. The project comprises three separate LCA studies, each with a different focus. Preliminary findings are presented in other sessions:

• The Environmental LCA assesses all four phases of the lifecycle of bricks – production, construction, building performance and demolition/recycling;

• The Social LCA analyses the social and socio-economic impact of clay bricks and provides a practical tool for both individual brickmakers and the industry as a whole;

• The Economic LCA, which still need to be finalized, calculates the economic added value of the brick sector to the broader country economy;

Together, the three research studies allow brick-makers to draw comparisons against international sector consumption and best practice. It establishes a benchmark from which they can identify and upgrade to technologies that reduce emissions and the use of resources like fossil fuels and water. By taking a lifecycle perspective, our members reduce risk while reaping the benefits of improved environmental management, health and safety, quality and brand value.

We hope that this study will become a model for assessing the relative lifecycle environmental implications of both traditional and alternative building materials and technologies. It is intended for use by architects, construction professionals, researchers and policy analysts as a decision support tool that complements and augments other environmental assessment paradigms. It also takes into consideration the socio-economic impact of brick-making locally and nationally.

Our ultimate goal is to foster global responsibility and governance for all players who create and maintain built environment as well as raise public awareness of sustainability. The LCA project demonstrates the clay brick industry’s commitment to meeting the conservation and job creation challenges of the future.

S-LCA for the Clay Brick industry: a practical approach

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S-LCA aims to assess social and socio-economic aspects and impacts of products along their life cycle. For this purpose, inventory indicators are assessed in a number of impact categories for different stakeholder groups. The international social hotspots database is often used as benchmark to compare indicators globally. This approach works well for a multi-national company that sources and distributes globally, but not so much for an industry that sources and distributes locally. In addition, when conducting an E-LCA the variable that is being assessed is usually expressed in relation to a functional unit, which is not possible with some variables used in S-LCA. The clay brick industry required an S-LCA for the industry to complement an E-LCA that was done for the industry. This posed the following challenges: a) Which benchmarks to use to assess indicators as the whole of the product life cycle takes place locally; b) how to make sense of indicators that should/could not be quantified; and c) how could the report be used as a practical tool for the industry instead of being merely an academic exercise?

To meet these challenges a practical approach was followed that included identifying relevant local reference criteria that could be used to benchmark industry and individual performance; using a customised scales-based approach, and making specific recommendations per subcategory and stakeholder group instead of a general paragraph at the end of the report.

This resulted in a report for the Clay Brick industry that not only assessed the social and socio-economic aspects and impacts of the industry, but could in addition be used as a practical tool for the development of the industry as a whole or individual companies in the industry to improve their performance against the selected benchmarks.
Sustainability Metrics for the Assessment of Textile Value Chains in South Africa

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Purpose
The development of sustainability metrics represents an integral aspect of a Life Cycle Sustainability Assessment (LCSA). Metrics provide a quantitative indicator for sustainability issues, allowing for the consistent and credible communication of the impact of a value chain. The choice of appropriate sustainability metrics is influenced by the nature of the value chain in addition to the social and geographical context in which it operates. This paper provides an overview of the process followed to arrive at a set of sustainability metrics applied in a life cycle assessment of two textile value chains in South Africa.

Methods
The development process utilized a wide range of sources, combining input from existing reviews and standards with the insights of industry experts and other stakeholders. Background research included a literature survey of environmental life cycle and social impact assessment studies and a review of sustainability standards. The global focus of these reviews was complemented by research identifying material issues in the South African textile industry. Stakeholder input on the proposed metric set was elicited through two workshops. The workshop outcomes were synthesised with the research component to develop a final set of sustainability issues relevant to the South African textile industry.

Results and Discussion
A core requirement for an issue to be included in the set of metrics to be applied in the life cycle assessment was that it be measurable (either fully quantifiable or able to be put on a semi-quantitative scale). The large number of sustainability issues also needed to be reduced to a manageable number. The identified sustainability issues were thus delineated into industry-wide issues, issues for standards and issues suitable as metrics for value chain assessment, allowing a small number of core issues to be distilled. These issues were grouped into ten categories, with a number of sub-categories, appropriate to be linked to a quantitative indicator. The metric set was applied in a case study of two pilot cotton textile value chains in South Africa. Constructed scales were used to combine the more quantitative environmental indicators with the more qualitative socio-economic indicators, allowing a visual summary of the environmental and socio-economic sustainability of the value chains to be obtained.

Conclusion
The objective of the study to develop a set of metrics suitable to assess the sustainability of South African textiles, and to apply these in a life cycle assessment of two textile products (cotton t-shirt and cotton towel), was achieved.
An iterative approach to the full life-cycle assessment (LCA) of liquid petroleum products in South Africa

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Global consumption of petroleum liquid fuels currently resides around 95.98 million barrels per day and is expected to increase to approximately 97 million barrels per day by the 4th quarter of the year 2017. Given the large pollution potential of South Africa’s coal based fuel, the use of life-cycle assessment (LCA) could aid in making better environmental decisions. Such an analysis could prove to be instrumental in improving energy resources as well as act as the background information for many other LCAs. However, no proper inventory exists for liquid petroleum products in South Africa.

The overall objective of this study is to quantify, with the aid of a LCA, the environmental loads associated with the production of certain South African oil-based liquid petroleum fuels (metal-free 95 unleaded petrol and standard diesel). The analysis will entail iteratively comparing and modifying LCA data from an established database (EcoInvent) such that it resembles South African data. The desired outcomes and/or results can potentially be used to mitigate the adverse environmental effects associated with current production techniques concerning oil-based liquid petroleum fuels, both nationally and internationally.

**Keywords:** Life-cycle assessment (LCA); Liquid petroleum fuels; South Africa
Factoring End-of-Life Treatment of Plastic Packaging in Developing Countries into Life Cycle Assessment: What Matters and Why?

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In light of continuing unsustainable patterns of human development, improving the sustainability of consumption and production patterns has been recognised as a global development goal. Consequently, the life cycle management of products has become a regulatory requirement in many countries, informed by life cycle assessment. While it has been recognised that the end-of-life stage is somewhat neglected in LCA modelling, this limitation is particularly prevalent within developing countries. Within this context, not only does end-of-life modelling represent the generic challenges associated with this stage, but additionally requires the representation of waste management practices that may differ significantly from those in which LCA methods are well established and for which there are representative datasets. Thus it has been suggested that products sold in emerging markets originating from a global supply chain that have been designed on the basis of a LCA, might be accurate for the upstream part of the life cycle but inaccurate for the end-of-life stage.

Within a South African context, the fate of plastic packaging provides an interesting case study for this problem, given that it is particularly prone to leakage, leading to a high proportion of waste entering so called ‘mismanaged’ waste streams. While it has been suggested that up to 56% of South Africa’s waste should be considered ‘mismanaged’, this figure is contentious. This work therefore aims to provide a more realistic estimate of the end-of-life fate of plastic packaging in South Africa through the analysis of relevant reports detailing the fate of plastic waste in the country. Like most developing countries, plastic waste in South Africa is split between formal and informal management options, with landfill disposal accounting for the largest proportion of the formal waste stream. Developed countries by contrast tend to reflect a more even distribution of treatment between landfill, incineration and recycling with a notably lower ‘mismanaged’ fraction. The discrepancy in the end-of-life fate of plastic packaging between developed and developing countries coupled to the geographic imbalance in the distribution of LCA studies suggests the need for the development of life cycle data sets and methods to provide a broader representation than is currently available.
Carbon intensive but decarbonizing quickly? A Life Cycle Assessment of South African pome fruit

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The South African economy is categorised as carbon intensive due to the legacy of capital intensive mining and heavy industry, known as the ‘minerals energy complex’. Since the mid 1990’s there has been a decoupling of the economy from greenhouse gas emissions. However, even with this decoupling effect, South Africa ranks as the 12th most carbon-intensive economy in the world in 2009, emitting 0.80 kg/$ GDP PPP (2005) compared to a global average of 0.44.

The South African pome fruit industry also has a relatively high carbon intensity due to the extensive use of grid electricity, diesel and fertilizer use at farm level and packaging and refrigeration leakages at the agro-processing level. These carbon emissions are being exported in the fruit destined for the EU and other developed countries where there is a growing awareness and demand for products with minimal impact on the environment and climate. The sustainability of the fruit industry is therefore dependent on the mitigation outcomes at every stage of the value chain.

The objective of this research is to test the hypothesis that the pome fruit industry is on a decarbonising trajectory (kg CO2e/$ industry revenue PPP (2005)). Using the Attributional Life Cycle Assessment (ALCA) methodology, the Global Warming Potential (GWP) impact category is determined at points in time over a 20 year period for the years 2000, 2010 and 2020. The functional unit is 1 kg of pome fruit and the scope of study includes activities at farm level, fruit processing and packaging and lastly delivery at an international port in the EU over the period of one year. The 2010 LCI is based on actual data records for the pome fruit value chain offering a high level of accuracy and certainty. The results from the 2010 LCA will inform as to which high GWP materials and processes will be the focus in the 2000 and 2020 LCIs.

If it is found that the industry has indeed decarbonised and is continuing to do so, this will create a promising future picture with regard to mitigating the risk of potential trade barriers and ensuring the ongoing economic, social and environmental welfare of the industry.
Life Cycle Assessment of Maize Cobs and Other Energy Crops for Energy Production Compared to Conventional Methods

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Coal is currently the most widely used feedstock for electricity generation in the world (Sengül et al, 2016: 129). According to Eskom, about 77% of South Africa’s electricity needs are met by coal power. Emissions related to this method include nitrogen and sulfur oxides, heavy metals, radioactive elements, organic compounds, greenhouse gases and a significant amount of ash. These wastes result in pollution of air, water and land. The demand for electricity continues to increase with rapid economic development and population growth. It is therefore necessary to explore and assess alternative methods of electricity production.

The conversion of biomass to electricity could play a vital role in reducing the dependency on coal power in South Africa. As such, the use of maize cobs and stover and wheat stalks, as well as other agricultural residues, could offer promising opportunities for renewable energy production. However, there are few environmental impact studies in South Africa addressing the production or preparation phase of energy feedstocks for such.

This study used Life-cycle Assessment (LCA) to evaluate the environmental burdens associated with the production of maize and wheat, and extraction of maize cobs/stover and wheat stalks for the purpose of producing electricity through gasification. The assessment includes the entire life cycle of the energy feedstocks, agricultural activities, transportation and conversion into electricity, but excludes seed production, electricity distribution and waste management. The impacts associated with the production and use of maize cobs in electricity production are compared with those of maize stover and wheat stalks. The study also compares the environmental impacts of these processes with coal power.

Keywords: Biomass; Electricity production; Energy feedstsaliks; Environmental impacts; Gasification; Life-cycle assessment; Maize; South Africa
Development of regional LCAs for agricultural products: Feasibility and challenges of using Commercial Enterprise Budgets

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The Western Cape seeks to ensure the long-term productivity of its agriculture sector. Thus strategies need to consider the resource intensity of products and their economic opportunities and environmental impacts. This is important to ensure access to global markets where consumers are increasingly concerned with the sustainability of purchased goods.

To support this, GreenCape explored the feasibility of using Life Cycle Assessment (LCA) for regional analyses by developing cradle-to-farm gate LCAs for wheat in the Western Cape. Four representative farms spanning a range of agricultural practices were examined as case studies. Input data for Life Cycle Inventories (LCIs) was primarily sourced from Commercial Enterprise Budgets (Combuds) produced by the Western Cape Department of Agriculture (DoA). The Combuds are suited for regional analyses as they are publically available, based on representative farms and provide a partial mass balance for the production of crops.

This paper outlines the type of information that Combuds contain and the challenges associated with using Combuds for this purpose. For example, due to the lack of detail and transparency of Combud information, significant time and several assumptions would be required to create LCIs.

Recommendations have been made to the DoA for improvements to enable Combuds to be more readily used for LCAs. Consequently the budget models are being updated to include information to support LCI development. Improvements include: (a) specifying the active ingredients for applied chemicals and the composition of fertilisers; (b) providing greater detail for machinery activities; and (c) incorporation of irrigation and electricity models.

The paper also discusses the potential benefits of using Combuds for the development of regional LCIs. Strategic benefits include supporting agri-businesses and industries to access international markets and for benchmarking for responses to carbon mitigation requirements.
Life Cycle Assessment For Water Treatment – A Comparison of Sea Water Desalination and Mine Water Reclamation in South Africa

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Water is becoming a scarce resource in many parts of the South Africa and therefore numerous plans are put in place to satisfy the increased urban demand for this resource. The research project focuses on two water-processing plants that use alternative feed sources namely seawater and mine affected water. The objective of the study is to quantify the environmental impacts of each of the water treatment technologies.

The first case study is based on the proposed desalination plant, which will be located on the South Coast of KwaZulu-Natal. This plant is set to process 150 Ml/d of potable water and will be managed by Umgeni Water. The second case study revolves around a mine affected water reclamation plant situated near eMalahleni in Mpumalanga. Detailed design and commissioning of the modular plant, which treats a total of 15 Ml/d, has been undertaken by Prentec. To allow comparison between the two treatment processes, the functional unit of one kilolitre of potable water was specified. The results from the first case study indicated that the operation of the desalination plant carried a greater environmental burden than the materials required for the infrastructure. A further analysis comparing the various operational stages revealed that the reverse osmosis process accounted for the majority of the environmental impacts that arose from the system. This can be attributed to the large electricity input required for the high pressure feed pumps. Due to the conventional electricity mix in South Africa which relies highly on coal-fired power stations, the energy consumption within the process contributed significantly to several impact categories such as global warming, photochemical oxidation and acidification.

**Keywords**: water treatment, desalination, mine water reclamation
Life-cycle assessment of an Acid Mine Drainage (AMD) remediation technology

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Acid mine drainage (AMD) is a prevalent problem threatening water resources in South Africa. A life cycle assessment (LCA) will be conducted to investigate the environmental impacts of a remediation technology. This uses indigenous grass to reduce the sulfate concentration and contaminants in AMD. It is necessary to perform an LCA investigation to evaluate environmental impacts with regard to materials and energy, operation, production, and emissions of the process. The investigation will provide an objective insight into the implications of the process and its influential parameters, in order to evaluate the process. The LCA will be implemented by consideration of different process inputs and emissions, using a functional unit of 1 kg of grass, such that key environmental stressors may be identified, classified and interpreted from the acquired results. A sensitivity analysis will be conducted on the initial findings by variation of significant inputs (e.g. electricity and transport). This is necessary for comparison and substantiation purposes to ensure adequate impact interpretation and assessment, and reduction of uncertainty. Four primary scenarios will be investigated for midpoint and endpoint LCA impact categories in the sensitivity analysis. Comparison of the results will indicate the environmental impacts of the process and potentially help reduce the impact of the process.

Keywords: Acid mine drainage, Life-cycle assessment (LCA), South Africa, Midpoint assessment
Life cycle methods for the quantification of water use in minerals processing facilities

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Growing water availability pressures are making numerous industries vulnerable to water limitations throughout their operations and supply chains. These pressures can directly threaten the feasibility of a company’s activity in terms of production levels, profit margins and even a company’s capacity to operate, especially in water-stressed areas. The mining industry consumes 3% of the total South African water consumption and is one of the industries responsible for the deterioration of water quality in water bodies. Water requirements in the mining sector can be reduced with the correct improvement and/or implementation of appropriate mine water management strategies. Any reduction in the water requirements throughout the mining sector will reduce the demand on current water resources and hence the impact on water quality.

This study focusses on the applicability of the life cycle assessment (LCA) to quantify and analyse the impacts the mining sector has on ecosystems, human health and the availability of water for future generations, using the methods of WULCA, including AWARE (Available Water Remaining). The outcome of the study would be the assessment of the following key issues: (1) the applicability of LCA in the South African mining sector; (2) the availability of South African water resources; (3) whether the sector is using water in an efficient manner; and (4) whether the sector is managing wastewater to limit negative environmental and health impacts.

**Keywords:** Life-cycle assessment (LCA), Mining, Scarcity, South Africa
Water Footprint Analysis of the South African Paper and Pulp Industry

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The water footprint of eleven major paper and pulp producing mills in South Africa was calculated by the Water Footprint Network (WFN) method of Hoekstra et al. (2011). The use of the green water footprint as defined by the current water footprint model (Hoekstra et al, 2011) was found to be erroneous for South African forestry. With the current water footprint model, a significantly large portion of the green water footprint that is allocated to a forest would have been consumed by pre-existing natural vegetation without any human intervention (Gush et al, 2002). The green water footprint for a forest is better defined as the increase in ground water use when compared to pre-existing natural vegetation. This difference is equal to Stream Flow Reduction (SFR), which is an important issue that has significant impacts in South Africa (Albough et al, 2013). The water footprint sustainability assessment showed that during the wet season, all sites were sustainable, but during the dry season, one site had an unsustainable grey water footprint. It was also seen that four have an unsustainable blue water footprint during the dry months when surface runoff is at its lowest. However, these sites have store water, which increase the blue water footprint sustainability in the dry months. Most of the sites have already taken some action to increase the sustainability of its operations; however, considering other options is advised. These options may include adopting advanced oxidation processes for COD (chemical oxygen demand) and AOX (adsorbable organic halides) treatment, thereby reducing the grey water footprint.

Keywords: Paper; Pulp; Water footprint; Sustainability.
Authors/Presenters Bio-sketch
Ampofo-Anti, Naa Lamkia

Naa Lamkai Ampofo-Anti is currently employed by the CSIR in its Built Environment Unit as a Senior Research Architect at the Scientia Campus in Pretoria. Naa Lamkai is a Professional Architect, born in Accra, Ghana in 1953. She acquired South African citizenship in 1999. Naa Lamkai obtained her degree in Architecture from the University of Science and Technology, Kumasi, Ghana in 1979. She practised in Ghana, Cameroon and Nigeria before immigrating to South Africa in 1990. Naa Lamkai worked as an in-house Architect for about 15 years at the North West Provincial Department of Public Works, Mafikeng. She left her position as Chief Architect in that department to join the CSIR in June 2005.

Aucamp, San-Marié

She is a registered Research Psychologist with extensive experience in both the practical and theoretical aspects of social research. She has more than 20 years’ experience in social research. Her experience includes social impact assessment, social and labour plans, social life cycle assessment, training, group facilitation as well as social and marketing research in a range of sectors such as mining, manufacturing, utilities, government, automotive, financial services, telecoms and IT as well as FMCG. She occasionally presents guest lectures at tertiary institutions. San-Marié is a contributor to the international guidance document on assessing and managing social impacts for projects that was published by IAIA International in 2015. She is a past council member of the Southern African Marketing Research Association (SAMRA) and the Services SETA National Council, and a current member of SAMRA and the Psychological Society of South Africa (PsySSA).
Burman, Nicholas

I graduated with a BSc in Chemical Engineering from UCT. I am currently doing my Msc in Chemical Engineering at the University of Witwatersrand. My research is focussed on the design of a process to remediate acid mine drainage using sulfate reducing bacteria and indigenous South African grasses as a substrate.

de Kock, Lorren

I trained as an Industrial Engineer and worked for 15 years in industries such as Transport/Logistics, Automotive Warehouse and Supply Chain Optimization, Project Management, Business Analysis and Information Technology. Later in my career I discovered a passion for Sustainability, especially the environmental side and I made a career shift to this industry through an opportunity in Agricultural Sustainability. I have been involved with Sustainability Metrics at farm level, various Supply Chain projects and the Confronting Climate Change initiative including the development of tools to measure carbon emissions and carbon sequestration.

With my current research, based on measuring the carbon intensity of the pome fruit value chain, I have developed an interest in the Life Cycle Assessment methodology as a quantitative method to measure environmental impacts of any product or process.
Dumani, Zonke

I am currently employed at CSIR in the Built Environment as a Researcher at the Scientia Campus in Pretoria. I completed both Bachelor of Science and Master of Science in Chemical Engineering at the University of Cape Town. I work primarily on performing Life Cycle Assessment of building materials.

Goga, Taahira

Taahira obtained her BSc degree in Chemical Engineering from the University of KwaZulu-Natal (UKZN) in 2012. After the completion of her undergraduate studies, she was employed at LignoTech South Africa as an Engineer in Training and thereafter as the Junior Projects Engineer. She returned to UKZN in August 2015 to pursue her MSc which focusses on conducting a series of Life Cycle Assessments (LCAs) on various water treatment plants that use alternative water sources (sea water and mine affected water). Her research project is sponsored by Umgeni Water as well as the South African Water Research Commission (WRC). She looks forward to a career that incorporates both environmental engineering and project management in the water sector.

Conference Contribution
Govender, Velin

Veling got all his training from University of the Witwatersrand: BSc (Hons.) Chem Eng, and and MSc Chem Eng (Study Objective: To determine and optimise the current state of water usage of the paper and pulp industry of South Africa). He was awarded from University of Twente and The Water Footprint Network Certificate on a study focused on “Concepts and application of the water footprint assessment.”

To date he’s got different work experiences:

- MacOne Technologies, January 2011 to 2013 Research and design of thickeners, filters and clarifiers, based at Mintek;
- Ecotelligent Engineering, January 2015 to present (Founder and Owner).

Publications

Harding, Kevin

Dr Harding holds PhD in Chemical Engineering from the University of Cape Town. He previously worked at Environmental Resources Management on industrial risk assessment projects in South Africa, China, Kenya and Nigeria. He is currently employed at the University of the Witwatersrand, Johannesburg as an LCA and water footprinting researcher and senior lecturer in Chemical Engineering.

Since joining WITS Dr Harding has taught 2nd and 3rd year engineering students. He has also taught the Life Cycle Assessment component of various postgraduate courses in the faculty of Engineering. He has had papers presented at over 25 peer reviewed (local and international) conferences and published in several peer reviewed journals. He is member of the South African Institution of Chemical Engineers, the Institution of Chemical Engineers (UK) and various other bodies.
Miene, Nico

Studied Ceramic Engineering at the Technicon Natal. In the brick industry from 1987, so 30 years’ experience in the Clay brick industry in a technical, operational and mostly management capacity. Currently owner and Managing Director of Algoa Brick, one of the largest clay brick manufacturers in the Eastern Cape. Past President of the Clay Brick Association of South Africa and currently serving on the board of the CBA as well as the Technical Director for CBAs.

The Clay Brick Association of South Africa expands awareness, knowledge and support for clay brick masonry. The CBA provides strategic direction for members through its investment in research and educational initiatives regarding energy efficiency, reduced emissions, green building and sustainable construction. As the industry watchdog, the CBA lobbies for improved building and manufacturing standards.

Mohlala, Faith T.

Faith Tokologo Mohlala Mdhluli studied Agricultural Engineering at the University of KwaZulu Natal. She is currently studying towards a Master’s degree in Chemical Engineering at Wits University while working for the Mpumalanga Department of Agriculture, Rural Development, Land and Environmental Affairs.

Faith is a member of the South African Institute of Agricultural Engineers and serves in the regional committee. Faith is passionate about education, food security and improving the lives of people in poor communities, as someone who spent much of her life in a small village in Mpumalanga.
Her goal is to establish a firm that will help small-scale farmers to process their agricultural produce into marketable products and using the agricultural wastes to generate electricity for their homes and businesses. Her job allows her to interact with many of the communities she wants to work with. She runs a small tutoring and mentorship program in her spare time.

Nadasen, Varshan

My name is Varshan Nadasen. I am 24 years old and was born in the City of Durban, KwaZulu-Natal. I was raised in Durban in a family of 6, where I completed my schooling career at Falcon Park Primary and George Campbell School of Technology for primary school and high school respectively. It was during these years, where my educators, family and friends had helped ignite my spark for maths and science, which ultimately persuaded me to pursue a career in engineering. My interest in the application of mathematical and scientific principles to practical ends within the context of production and transformation specifically concerning energy materials and resources ultimately enticed me to study chemical engineering at the University of the Witwatersrand. I completed my undergraduate degree in chemical engineering in 2015 and thereafter pursued a master’s degree in petroleum engineering which I am currently completing. My studies currently is focused on the production and use of hydrocarbons to produce petroleum fuel sources and comprises of two components; coursework together with exams, which I have already completed, and a research component.

The research aspect of my postgraduate studies aims to address the environmental controversy surrounding the use of bio-fuels over conventional petroleum fuels.
Ngwepe, Lusca K.

My name is Lusca Ngwepe. I am a Candidate Quantity Surveyor with the SACQSP, but unemployed. I studied B-Tech: Quantity Surveying at the University of Johannesburg for the period 2011 until 2014. I am currently registered for M-Tech: Construction Management with the University of Johannesburg, and Honours: Quantity Surveying with the University of the Witwatersrand. For my M-Tech Thesis, I am researching on Life Cycle Assessment for buildings in the South African construction industry. My study is more of an overview, on what life cycle assessment is in general, whether or not it is being used in the construction industry, what hinders its use in the construction industry, what the construction industry can benefit from making use of the tool, and how to encourage the more use of LCA. This study is therefore not into detail about life cycle assessment. The study is at the moment undergoing evaluation by my supervisor, in preparation for final submission.

Patel, Ilhaam

Mrs Ilhaam Patel is a consultant at The Green House. She has an undergraduate and MSc in Chemical Engineering from the University of Cape Town. She has been involved in research and analysis projects relating to the manufacturing, agriculture, energy, mining and dairy sectors in South Africa, with a particular focus on product LCAs and environmental product declarations. Ilhaam’s academic background is in Life Cycle Assessment (LCA) of bioenergy technologies.
Cathy Pineo is the Manager of the GreenCape’s Agricultural Sector Desk, as well as an Analyst in GreenCape’s Bioeconomy Programme. GreenCape is a Western Cape-based sector development agency that supports businesses operating within the green economy. GreenCape’s Agricultural Sector Desk acts as an interface between government, green technology providers and farmers to support the uptake of green technologies in the agricultural sector. As analyst in the Bioeconomy Programme, Cathy provides strategic direction and technical expertise into GreenCape’s industry engagement and research activities related to resource productivity, with a particular focus on agriculture and agri-processing. In this role, Cathy has done analytical work (including water footprinting, carbon intensity benchmarking and life cycle assessments) to identify key areas for intervention to enable increased resource efficiency and reduced carbon intensity within key agricultural sectors (e.g. livestock and game) and commodities (e.g. wheat). To support the uptake of green technologies to reduce resource intensity of food value chains more generally, Cathy and the project team have also developed a number of business cases for green technologies in particular sectors (e.g. fruit and wine) and identified a range of actions to remove barriers to the uptake of green technologies in Western Cape food value chains. Value retention in Western Cape food value chains and value-add to organic residues are current focus areas.

Greg has great interest in recognising sustainable architecture in South Africa. His background in architecture has informed his passion in environmental design, from water use to energy conscious floor layouts. In the early stages of his education, he was exposed to architectural design, ranging from small-scale residential projects to large-scale futuristic commercial designs. After completing his undergraduate Architecture degree at the University of Pretoria, he established a desire to explore the
environmental impacts and energy use associated with the production and operational energy associated with building materials.

Greg joined WSP | Parsons Brinckerhoff’s South Africa sustainability team in 2013, while he was completing his Masters dissertation. Greg has now completed his Masters after presenting his research at the biennial conference Eco-Architecture hosted by the Wessex Institute of Technology in Siena, Italy. Together with the team of sustainability professionals, Greg has worked on over 13 Green Star Buildings in Southern Africa, and currently leads various sustainable building developments in Southern Africa, through the use of the green building rating system ‘Green Star South Africa’. Greg was awarded the “Rising Star South Africa” Runner up award at the 2016 Green Building Council Awards.

Rodseth, Clare

I am currently completing my MSc (Eng) in chemical engineering having graduated from UCT with first class honours at the end of last year. My current research is centered within the field of life cycle assessment (LCA) and aims to investigate the extent to which current LCA models and datasets are capable of representing the end-of-life stage of plastic and organic waste in a South African context. It has been suggested that current LCA models for waste management scenarios typically do not reflect South African realities, meaning that products designed for the best environmental outcomes in one context, do not necessarily translate as such in South Africa. This research is driven by the importance of holding companies and the state to account for the environmental burdens of their waste, hence necessitating environmentally conscious design, which lies in support of the principles of sustainable development.
Scientific Committee

Dr Clinton Aigbavboa (University of Johannesburg)
Dr Kevin Harding (University of Witwatersrand)
Dr Philippa Notten (University of Cape Town, The Green House)
Dr Valentina Russo (University of Cape Town)

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