Cement sector: Life Cycle Optimisation Service

Emerging climate-smart business opportunities
A snapshot of the opportunity

A Life Cycle Optimisation Service can improve the carbon footprint of cement manufacturers by optimising the sourcing and distribution of raw materials used for the production and distribution of cements with lower environmental impact (‘eco-blends’). The service will help to minimise costs and achieve greater greenhouse gas emissions savings on a life cycle basis and at a sector level than would otherwise be achieved by the sum of individual producer efforts.
The case for investment

- **Minimise costs and increase the value:** optimising the sourcing and distribution of industrial wastes that can be used as Supplementary Cementitious Materials (‘extenders’), and of low-carbon alternative fuels to be in used in kilns instead of coal, will minimise the procurement costs of these raw materials and improve supply-side efficiency.

- **Reduce cost of compliance with climate mitigation legislation:** carbon pricing legislation will increase the use of Supplementary Cementitious Materials and alternative fuels.

The offtake market

- **Market size:** the South African cement industry is the largest in Southern Africa, with six major producers accounting for approximately 71% of market production capacity.

- **Potential market capture:** eco-blends provide a low-carbon substitute for traditional/conventional Portland cement; and can potentially capture 90% of the market.

Socio-economic benefits

- **Job creation:** developing waste-based industries will create jobs in collecting, sorting, pre-treating and transporting of waste products.

- **Economic gains:** using industrial waste supports the National Waste Management Strategy, contributes to the circular economy and creates new employment opportunities in the sector.

- **Recover and reuse waste:** substituting waste and alternative fuel for coal prevents landfill emissions and contributes to a ‘zero-waste’ society.

Climate change benefits

- **Reduce greenhouse gas emissions by up to 50% per tonne of cement:** by improving energy efficiency, using alternative waste fuels in cement kilns and increasing clinker substitution.

- **Additional sector level emissions savings:** an optimisation service will minimise emissions associated with the logistics of Supplementary Cementitious Materials, eco-blend cements and alternative fuels on a sector level, bringing the total savings beyond what would otherwise be achieved by the sum of individual producer efforts.
Greenhouse gas mitigation in the cement sector

Cement production is a high energy and greenhouse gas emissions intensive activity because of the extreme heat involved in the processing of primary components and the chemical reactions needed to give cement its structural qualities. Without any mitigation effort, emissions levels from global cement production are projected to reach 4.3 Gigatonnes (Gt) CO$_2$e per year by 2050 – an increase of 260% over their 1990 levels.

To meet the Paris Agreement commitment target, the global cement sector must reduce greenhouse gas emissions to around 1.7 Gt by 2050 – a 0.4 Gt reduction from the 2010 emissions levels of 2.1 Gt.\textsuperscript{1}

5% of global CO$_2$ emissions from global cement sector

1.7 Gt by 2050
Cement production at a glance
Share of total CO₂ emissions across the Portland cement production process

1. Extreme heating (up to 1 400 °C) of primary components such as limestone and other clay-like materials.

2. Grinding of primary components to form a solid substance called clinker and combining this with gypsum to form cement.

3. PYROPROCESSING, 85% (50% FROM CALCINATION)

4. TRANSPORTATION, 3%

Four key mitigation measures to reduce greenhouse gas emissions:

1. Adopt new technologies, such as Carbon Capture and Storage
2. Improve energy efficiency
3. Use alternative fuels in cement kilns
4. Increase clinker substitution and the use of Supplementary Cementitious Materials in traditional Portland cement mixes.

**Carbon Capture and Storage** is the process of capturing waste CO₂ from large sources and transporting and depositing it where it will not enter the atmosphere, such as underground.

**Supplementary Cementitious Materials (SCMs)** are clinker substitutes, such as industrial by-products and waste, like fly ash from coal and blast-furnace slags from steel.

**Eco-blends** are cement products produced with high levels of clinker substitution, using various SCMs, to reduce the carbon footprint of those products.

By combining the four mitigation measures, greenhouse gas emissions per tonne of cement can be reduced by 80%; or by approximately 50% without Carbon Capture and Storage (which does not yet offer the possibility for investment planning).

Fuel-related emissions can be reduced through switching from fossil fuels to alternative fuel sources, such as municipal waste or tyres. Specifically replacing coal as a fuel source in cement kilns will reduce cement’s direct carbon footprint and avoid landfill emissions.

A cement sector Life Cycle Optimisation Service will optimise the sourcing and distribution of Supplementary Cementitious Materials and alternative fuels for eco-blends production.
Cement emission characteristics and potential in South Africa

The South African cement industry contributes approximately 1% towards the country’s total greenhouse gas emissions.4

Since the 1990s, South African cement producers have steadily increased their mix of clinker substitutes to an average of between 30% and 40%.5 This has resulted in a reduction of emissions in the cement sector on a year-to-year basis.

However, there is still more to be done. According to the Department of Environmental Affairs (2014):6

- Between 2000 and 2010, annual greenhouse gas emissions from cement production increased by 27% – from 3.3 Megatonnes (Mt)CO₂e to 4.2 MtCO₂e.
- By 2020, the annual mitigation potential will be 1.26 MtCO₂e, reducing emissions from the sector by 12%.
- By 2030, the mitigation potential is expected to increase to 3.65 MtCO₂e; and by 2050, to over 15 MtCO₂e.7
Efforts to reduce greenhouse gas emissions

Over the last decade, South African cement producers have made a conscious effort to improve their energy efficiencies and use Supplementary Cementitious Materials, and to reduce the clinker content in cement mixes, while maintaining its structural qualities.

Increased clinker substitution

Different Supplementary Cementitious Materials are available to reduce the carbon footprint of traditional Portland cement, and to produce high substituted, low-carbon alternatives or eco-blends. Researchers suggest varying carbon emissions’ reduction potential: between 6% and 50%. Actual reductions will vary according to the location, climate and geological conditions at the source of raw materials; the quality and quantity of Supplementary Cementitious Materials (fly ash and slag specifically); and the location and logistics of its usage – the manufacturing facilities, energy sources and transportation requirements.8

Three recent construction projects – the Portside Building in Cape Town, Transnet’s City Deep Container Terminal in Johannesburg, and the Loeriesfontein Wind Farm in the Northern Cape – experimented with 85%, 95% and 100% clinker substitution using fly ash and slags, in selected concrete panels. This resulted in carbon emissions reductions of between 30% and 50% across the projects.9

Unlike in the rest of the world, industrial by-products like fly ash and slags, are relatively abundant in South Africa given the country’s sizeable coal and steel industries.10 This presents an important opportunity for the local production of eco-blend cements.

Portside building in Cape Town – rated by the Green Building Council of South Africa as the country’s only 5-star green tall building

Implementing mitigation measures have resulted in significant reductions in CO₂ emissions intensity per tonne (t) of cement. In South Africa, most cements have an emissions intensity of between 625kg/t and 400kg/t.11 There is still room for improvement to reach the global average emissions intensity which was approximately 368kg/t in 2010.12 13

Emission intensity of cement

PHOTO: RMB
Virtually all the cement producers in South Africa are extending their cements to different degrees, both to reduce their greenhouse gas emissions and to improve the quality of the concrete for a lot of applications. The extenders used include fly ash, ground granulated blast-furnace slag and ground granulated corex slag, which are secondary products from other industries, and limestone. The extent to which cement is extended at each factory is dependent on a number of factors including, availability of extenders, the distance from sources of extenders, the cost of such material and the demand for a particular cement for specific projects.

Bryan Perrie, Managing Director: The Concrete Institute (TCI), 2018

An abundance of ash

South Africa produces approximately 40 million tonnes of ash every year. Sasol alone produces about 8 million tonnes of gasification ash, while Eskom produces 35 million tonnes of ash (10% bottom and 90% fly ash). Only 5% of this fly ash is used productively, with the rest being deposited in ash dams and landfills. This runs the risk of toxic elements seeping into the soil and groundwater. This ash could be used as Supplementary Cementitious Materials in eco-blend cement production.
Using industrial by-products will not only reduce carbon emissions from cement production, it will also improve resource-use efficiency and reduce additional environmental impacts from disposing of these as waste in landfills and dams. However, industrial waste producers in South Africa will need to invest in waste management and handling to ensure the consistency and quality of the raw material.

Geopolymer cement and limestone calcined clay cement (LC3) are other low-carbon alternatives to traditional Portland cement. They are less attractive to the South African cement sector because geopolymer cement doesn’t necessarily achieve the same level of emissions savings as extended eco-blends, and there are very few clay deposits in South Africa, which are required for producing LC3 cement.15

Fuel switch
In South Africa, cement kilns are predominantly fired by coal.16 Some producers are experimenting with alternative fuels, like municipal solid waste and old tyres in a few of their kilns. This presents an important opportunity for a service which would facilitate and optimise fuel switch in cement kilns in favour of alternative fuels.

Low-carbon transition in the cement industry
This technology roadmap (a “techno-economic-based evaluation of least-cost technology pathways for cement production”) outlines processes and technologies that have the potential to decrease the global cement industry’s CO2 emissions by 24% below current levels, by 2050. It addresses the same mitigation interventions as we consider, including alternative binding materials, and outlines policy priorities, regulatory recommendations, investment stimulating mechanisms and technical challenges.

While recognising the potential emissions reduction benefits of alternative binders, it does not include them in the roadmap because “there is currently no independent, publicly available and robust life cycle analysis for any of the discussed alternative binders, or associated comparative quantification of production costs, and their versatility in terms of commercial applicability differs widely”.

You can find out more at: www.wbcsdcement.org/index.php/key-issues/climate-protection/technology-roadmap

90%
The potential South African cement market that eco-blend cement products can capture.

“ It is possible to produce 100% extended cement using Supplementary Cementitious Materials such as fly ash and blast-furnace slags, without a loss in strength and durability. In fact, in some cases, highly extended cements have outperformed traditional Portland cement. However, highly extended cements should initially be marketed for niche applications and environments to gain a track record and to encourage regulators to consider allowing for higher substitution levels in cement regulations. ”

Cyril Attwell, Director: Arc Innovations, 2018
Market overview and outlook

The South African cement industry is the largest in Southern Africa and one of the largest on the continent:

- Although the data is somewhat contested, the cement market is estimated to have more than tripled in size from R15 billion in 2008 to R48 billion in 2014, and is expected to stabilise at R46 billion by 2019.\(^7\)
- Cement sales have been relatively resilient in recent years, increasing by a compound annual growth rate of 3.9% between 2012 and 2015.\(^8\)
- Cheap imports have however adversely affected domestic production.\(^9\)
- Retailers, instead of cement producers, now account for almost 70% of cement sales – an increase from 40% in 2011.\(^20\)

Cement market analysis

The pre-1996 legal cartel

Prior to 1996, the Cement Distributors of South Africa assisted with the sourcing and optimisation of cements, and the Central Marketing Organisation assisted with the geographical allocation of the market, based on demand. While the cartel optimised supply-side efficiency and minimised costs for producers, there was one cement price, which meant that consumers had limited choice and bargaining power. Due to its anti-competitive nature, in 1996 the cartel was dismantled by the Competition Commission of South Africa.
Six major South African cement producers account for approximately 71% of market production capacity.

Other customer segments include concrete product manufacturers, ready-mix concrete suppliers and construction companies.

Increased competition has led to significant price reductions. Prices are currently at an average of R790/t, which is unsustainable because returns on capital are below the industry cost of capital. This has prompted cement producers to go on a cost-optimisation drive.

Historically, Portland cement is the most popular cement product, having dominated more than 50% of the market since 2008. It is expected to grow to 90% by 2019.

A significant opportunity exists to optimise the sourcing and distribution of Supplementary Cementitious Materials for the production of eco-blends. A shared service across the industry could reduce costs for cement producers.
The Life Cycle Optimisation Service

Operating at an industry-wide level the proposed service will:

- Provide optimisation services across the full spectrum of the cement life cycle and value chain, by mapping, sourcing and optimising the logistics of Supplementary Cementitious Materials, eco-blend cement products and alternative fuels for cement kilns
- Address barriers that firms face
- Offer a ‘one-stop-shop’ to support the sector as a whole – whereas existing services only perform a partial optimisation for a single producer
- Facilitate the achievement of the largest possible emissions reductions from supplier to end user, and at a sector level than would otherwise be achieved by the sum of individual producer efforts.

Implementing two key mitigation options

Increased clinker substitution for eco-blend cement production

The main activities of the Life Cycle Optimisation Service in this area of mitigation would be to:

- Explore, map and optimise, in real time, the sourcing and distribution of Supplementary Cementitious Materials across the country, from source to cement plant, to produce eco-blend cements
- Map and optimise the sourcing and distribution of eco-blend cement products from plant to construction site and other points of demand, taking application requirements into account.

Fuel switch

The main activity of the Life Cycle Optimisation Service in this area of mitigation would be to explore, map and optimise, in real time, the sourcing and distribution of viable alternative waste fuels or Refuse-Derived Fuels for cement kilns, from source to plant.

Refuse-Derived Fuels are fuels from various types of waste, such as municipal, industrial or commercial waste

The South African cement sector has, over the past years, proactively addressed climate change by introducing energy efficiency measures as well as using alternate fuels and resources. A thrust to the use of alternate fuels is being up-scaled to further reduce dependency on coal as part of our climate change response which would simultaneously support the National Waste Management Strategy by reducing landfilling of calorific waste streams, as well as creating jobs in the waste sector.

Dr Dhiraj Rama, Executive Director, The Association of Cementitious Material Producers
Scope and structure of an optimisation service

The service can offer either real time data sharing only; and/or a value-add and transport service. The role will dictate the structure of the service.

Real time data sharing service
- This can be conducted by an existing sector organisation that has the scope and resources to provide such as service at minimal cost – hiring a few experts and purchasing a supply chain optimisation software package or license.
- Or, a new or existing logistics company could integrate such a service into their offering.

A value-add and transport service
A value-add and transport service would go beyond simply supplying real time data but would also ensure that various waste products are of a high enough quality to produce eco-blends or to be used as a fuel source. The service would establish joint ventures with Supplementary Cementitious Materials producers to process waste products to a certain standard, before transporting them to where they are needed.

A private company structure would best suit this scenario. There is scope for existing logistics and optimisation companies to fill the gap.

Recommendations
WWF South Africa recommends that if the optimisation service is limited to a data sharing service, it be conducted by industry associations like the Association of Cementitious Material Producers or The Cement Institute to take advantage of their position within the sector and their relationships with cement producers, and because of minimal additional costs involved.

SERVICE EXAMPLE
Sourcing and transporting fly ash

Step 1: Map all available sources of fly ash countrywide and monitor the quantity and quality from each coal-fired power plant.

Step 2: Distribute fly ash across demand centres based on proximity, to minimise transport costs and emissions. Cement producers that are closer to steel works, like those near Saldanha Bay in the Western Cape, would be supplied with blast-furnace slags.

Step 3: Distribute final eco-blend cement products. This includes mapping demand locations and taking specific elements into account which might dictate the type of cement required, for example, specific application and the environment, such as a need for a more acid-resistant product for use in a waste-water treatment plant.

The Life Cycle Optimisation Service would map points of demand, and suggest (in the data sharing service only model), and/or source (in the value-add and transport service) the correct cement product for the particular application from the closest production point. This will achieve additional emissions and cost savings across the sector than would otherwise be achieved by the sum of individual efforts.
Financial analysis

*Size of opportunity*

The potential emissions and cost savings the Life Cycle Optimisation Service could provide across the sector is based on the following assumptions:

- Average annual total operating costs are approximately R910 million (2018 prices).[^28]
- The cement sector is operating at a maximum capacity of approximately 21 Mt of cement production per annum.[^29]
- In 2010, the cement sector average emissions intensity was approximately 0.57 tCO₂e per tonne of cement produced (not including transport emissions).[^30] This corresponded to an average clinker substitution level of 30%,[^31] and is used as an emissions intensity baseline.
- The 2010 total cement sector emissions of 11.97 MtCO₂e is used as a baseline.

**Emissions and cost savings potential**

Based on the above assumptions, the Life Cycle Optimisation Service can potentially reduce sectoral emissions because it would:

- **Facilitate the further increase of Supplementary Cementitious Materials usage or clinker substitution levels.** Increasing clinker substitution level across the sector by another 5%, to an average of 35% will reduce emissions per tonne of cement by almost 22kgCO₂e and result in additional emissions savings of approximately 457 000 tCO₂e across the sector. Depending on the level of tax-free allowances that will determine the effective tax rate, this alone could provide the sector a carbon tax saving of between R2.7 and R21 million for an effective tax rate of R6 tCO₂ and R48 tCO₂, respectively.

- **Replace coal in cement kilns with alternative fuels.** A 5% and 10% replacement of coal with various waste or waste derived fuels would achieve gross emissions savings[^32] of between 233 000 tCO₂e and 467 000 tCO₂e respectively, across the sector. Depending on the alternative fuel used, the net emissions savings would further reduce the carbon footprint of the sector, as well as its liability under the carbon tax regime.

- **Optimise the logistics of Supplementary Cementitious Materials, eco-blend cement products and alternative fuels.** This benefit will be significant, assuming transport and logistics costs typically account for 30% of total operating costs.[^33] A 5% reduction in transport costs is estimated to potentially offer the sector operational savings of approximately R10 million annually.

**Estimated expenses**

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<th>Description</th>
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<td>System software licenses</td>
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</tr>
<tr>
<td><strong>Total estimated expenses</strong></td>
<td></td>
<td><strong>R1 570 000</strong></td>
</tr>
</tbody>
</table>

**Estimated revenue stream**

- If only the largest six cement producers subscribed to its services: the Life Cycle Optimisation Service would need to charge each approximately R260 000 in annual membership fees to cover its costs. This is less than the costs of a staff member to provide a similar set of services. It is also in line with the cost of membership of other industry associations.

- Producers of waste materials that can be used as Supplementary Cementitious Materials, engineering companies and ready-mix companies are likely to be interested in membership. This could reduce membership fees or establish different tiers of membership, aligned to different benefits.

[^28]: Average annual total operating costs are approximately R910 million (2018 prices).
[^29]: The cement sector is operating at a maximum capacity of approximately 21 Mt of cement production per annum.
[^30]: In 2010, the cement sector average emissions intensity was approximately 0.57 tCO₂e per tonne of cement produced (not including transport emissions).
[^31]: This corresponded to an average clinker substitution level of 30%.
[^32]: Gross emissions savings are the total emissions avoided due to the replacement of coal with waste fuels.
[^33]: A 5% reduction in transport costs is estimated to potentially offer the sector operational savings of approximately R10 million annually.
Drivers of a Life Cycle Optimisation Service

Reduced procurement and operational costs
Optimising logistics of Supplementary Cementitious Materials, eco-blend cement products and alternative fuels will improve supply-side efficiency, and therefore minimise costs associated with the procurement of these materials. It will also stop individual cement producers duplicating similar efforts and lead to operational savings.

Reduced carbon tax liability
Companies may reduce their carbon tax liability because of the additional savings achieved at a sector level, over and above what individual efforts would deliver. How the additional savings are allocated must be worked out with National Treasury.

Supportive policies
- The carbon tax, expected to increase over time, will encourage cement producers to use alternative fuels and to produce products with lower emissions, to minimise their carbon tax liability.
- Various tax-free allowances are built into the carbon tax scheme that encourage the use of alternative fuels, improved energy efficiency and beating sector level ‘best-practice’ emissions benchmarks. All of which will be more achievable for cement producers utilising the proposed optimisation service.

However, this could potentially ‘reward’ some producers based on their geographic location and not necessarily for any of their mitigation efforts. So, mechanisms of distributing additional emissions savings across the sector (i.e. those over and above what individual producer efforts have already achieved) must be worked out to incentivise optimal allocation of alternative fuels and extenders.

Tracking availability of Supplementary Cementitious Materials
While recent investments in new coal-fired power stations will ensure sufficient availability of raw material in the 20-30-year timeframe, variability in source materials for Supplementary Cementitious Materials is of greater concern, given that fly ash characteristics can vary between coal mines and power stations. This can be resolved with a relatively modest investment in waste collection and treatment by a value-add optimisation service.

Socio-economic benefits
Creating waste-based industries that can provide the cement sector with Supplementary Cementitious Materials, eco-blend cement products, and alternative fuels, can generate a number of jobs. Associated jobs would include collecting, sorting, pre-treating and transporting waste products.

Employing industrial waste streams as Supplementary Cementitious Materials contributes to the circular economy. These waste products are utilised (instead of going to landfill) and generate value for the duration of the construction/building’s lifespan.

While recent investments in new coal-fired power stations will ensure sufficient availability of raw material in the 20-30-year timeframe, variability in source materials for Supplementary Cementitious Materials is of greater concern, given that fly ash characteristics can vary between coal mines and power stations. This can be resolved with a relatively modest investment in waste collection and treatment by a value-add optimisation service.
Barriers to a Life Cycle Optimisation Service

Competition policy
While the Competition Commission allows for applications for efficiency provisions, it is necessary to prove the collaboration required by the Life Cycle Optimisation Service has benefits that outweigh the competitiveness risks.

Eroding competitive advantages
There is some concern that a shared optimisation service will undermine existing efforts undertaken independently by firms, as others would benefit off the back of their investments. The Life Cycle Optimisation Service would need to ensure in its design that it does not undermine existing supply contracts.

Cheap coal
As long as coal is cheap, cement producers will have limited incentive to look for alternative fuels. The forthcoming tax legislation will go some way towards reducing the attractiveness of coal as fuel in cement kilns.

Unsupportive laws, regulations and policies
There is slow progress in the review of cement standards and regulations that currently limit clinker substitution levels to 35% of the total mix, in addition to other quality control regulations. Schedule 3 of The Waste Management Act (2008) regulates the disposal of industrial waste. It does
not encourage the use of industrial by-products or waste for economically productive activities, including eco-blends. Limiting the choice of available waste streams increases the imperative of their optimal allocation. Possible amendments to the Waste Management Act (2008) will influence the availability of industrial waste for both eco-blend cement and sources of alternative fuels, creating more policy uncertainty.

**Technology, data and demonstration**

Despite a number of successful applications of highly extended cements, there is a lack of long-term durability and field performance data to create confidence in these new products, hindering their further uptake. Civil engineering firms fear litigation if extended cements do not perform as planned.

**Skills shortage**

In South Africa, as in the rest of the world, there is a shortage of skills required to design and develop suitable eco-blend admixtures, especially for chemists and chemical engineers.

**Macro-economic environment**

South Africa’s unstable macro-economic setting and poor economic growth threatens cement and concrete demand. Continued fiscal consolidation limits government spending and investment in large construction and infrastructure projects. Recent debt status downgrades may result in higher costs of borrowing, thereby limiting firms’ investments in research, development and implementation of alternative technologies. Continued exchange rate fluctuations threaten trade exposed businesses. The outlook for 2018 has improved somewhat and may help mitigate certain of these broader economic and fiscal constraints.

**Limited awareness**

Lack of environmental consciousness and general resistance to change may prevent consumers from purchasing new products other than traditional Portland cement.
Action points

Investors and lenders
Development finance and climate finance institutions could fund the establishment and early operations of a Life Cycle Optimisation Service or elements of its offerings, helping to ensure its financial viability.

Cement producers
A centralised, sector-level capability needs to earn membership fees from cement producers that ‘subscribe’ to its services. Industry players will need to see value in the service and provide it with support so that it can create the value it intends.

Unions
Unions could work with the Life Cycle Optimisation Service to understand what the potential risks might be to employment, and where opportunities exist in the proposed new approach. These might be in waste and waste-related industries.

Policy-makers
- The Competition Commission needs to provide clear guidelines on how to manage anti-competitive risks.
- Changes are required to waste legislation to ensure that it supports the use of appropriate waste streams as materials for Supplementary Cementitious Materials and sources of alternative fuels.
- Clarity and finality is needed on climate-friendly legislation, and on an appropriate carbon budget and taxes to drive the introduction of Supplementary Cementitious Materials in the industry.
- Standards need to be adapted for construction to allow for greater uptake of Supplementary Cementitious Materials and higher levels of clinker substitution, above 35%. Work being done in this area needs to be expedited.

Research houses
Research houses would need to make any relevant data and technical inputs available to the Life Cycle Optimisation Service to ensure that it provides a credible offering to cement producers. Increased investment in pilot projects using highly extended cements would help to build confidence in their structural viability.
that would seek to achieve deeper emissions cuts at a life cycle basis.

A need was identified for an optimisation service at a sector level by optimising the cement value chain. However, the following soon became evident:

- Focusing only on one alternative cement product left out a whole portfolio of lower-carbon binders
- Geopolymer cement does not necessarily achieve significant emissions reductions when assessed on a life cycle basis
- Many alternatives, especially in the form of extended cement products (with lower clinker content) are already accepted and in use by the local industry, but there remains room for further improvement.

A need was identified for an optimisation service that would seek to achieve deeper emissions cuts at a sector level by optimising the cement value chain on a life cycle basis.

Endnotes

2. These options are outlined by the IEA Cement Sustainability Initiative (CSI) study for the World Business Council of Sustainable Development (WBCSD), IEA & WBCSD, 2009.
13. It is extremely difficult to get accurate intensity measures, and it is not always clear what is included in each measure, for example whether emissions associated with logistics are included or not.
16. Personal communication with Dr D. Rama Executive Director at the Association of Cementitious Material Producers (ACMP), 2017.
The climate change mitigation debate in South Africa needs to move from improving efficiency within a projection of the existing economy, to innovation and options beyond the constraints of the current dispensation and structure of the economy. It may take step changes in the development path to achieve mitigation adequate to South Africa domestic and international commitments, and to maximise economic development and social wellbeing. Business models presently unconsidered may be waiting in the wings.

The ‘Low-carbon development frameworks in South Africa’ project seeks to deepen understanding of, and reveal opportunities for, transitions to a low-carbon economy. It facilitates and develops contributions at the intersection of climate change mitigation, economic development and socio-economic dimensions, across immediate, medium and long-term horizons.

Working variously with government, business and labour, the project reaches from providing input to emerging government mitigation policies and measures; through investigating the business and socio-economic case for selected mitigation initiatives which hold growth potential in energy, transport, industry, waste, and land use; to analysing potential future economic trajectories and the systemic opportunities offered by these.

The project is funded by the International Climate Initiative (IKI) of the Federal Ministry for the Environment (BMU) of Germany, and implemented by WWF South Africa.

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WWF’s Policy and Futures Unit undertakes enquiry into the possibility of a new economy that advances a sustainable future. The unit convenes, investigates, demonstrates and articulates for policymakers, industry and other players the importance of lateral and long term systemic thinking. The work of the unit is oriented towards solutions for the future of food, water, power and transport, against the backdrop of climate change, urbanisation and regional dynamics. The overarching aim is to promote and support a managed transition to a resilient future for South Africa’s people and environment. The organisation also focuses on natural resources in the areas of marine, freshwater, land, species and agriculture.

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To stop the degradation of the planet’s natural environment and to build a future in which humans live in harmony with nature.

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Acknowledgements:
Thanks to Bryan Perrie, Cyril Attwell and Dr Dhiraj Rama for their assistance.

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Farm Design, www.farmdesign.co.za

Available at:

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