Novacem – carbon negative cement to transform the construction industry

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The Novacem proposition

Novacem will transform the construction industry with a new carbon negative cement that will replace Portland cement

- Portland cement is a pervasive and important material (US$150Bn/year) but accounts for about 5% of man-made CO_2 emissions. Novacem has the potential to achieve cost and performance parity with Portland cement
- Best of all, our cement emits less CO_2 in its manufacture and becomes carbon negative in use. For every tonne of ordinary Portland cement replaced by Novacem, CO_2 emissions will be reduced by around 0.75 tonne
- Spin-out from Imperial College, London
  - £1Mn+ Seed Round from Imperial Innovations, Royal Society Enterprise Fund and London Technology Fund
  - Leads £1.5Mn Technology Strategy Board (TSB) project with partners Rio Tinto Materials, Laing O'Rourke, WSP Group and Imperial College
  - Building world class team under Executive Chairman Stuart Evans. Start-up labs and offices in the Imperial Incubator
  - Five year pipeline agreement with top-rated Civil/Env Engineering Dept

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Royal Society Enterprise Fund a key investor in Novacem

The Royal Society has significant competitive advantage as a early stage investor in science-based start ups. The Enterprise Fund has

- **Savvy Management** – Andrew Mackintosh and Sir Peter Williams
- **Advisory Board:** Adrian Beecroft (Apax), Roger Brooke (Candover), Stephen Brooke (Swarraton), Anne Glover (Amadeus), Hermann Hauser (Amadeus) – all experienced and successful venture capitalists.
- **Fellows of the Society** - a global scientific network of the highest calibre, going back to Isaac Newton. Currently includes nearly 70 Nobel Laureates
- **Time to be patient, and money to follow on**

Novacem was the first investment of the new Royal Society Enterprise Fund – more at http://royalsociety.org/enterprisefund/

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Investment status

Having raised an initial £1Mn Seed Round in mid 2009 and completed our £1.5Mn TSB project, we expect to raise an A Series Round in 3Q2010

- Key planned activities with A Series funding will be
  - an Industrial Pilot Plant,
  - accelerated Business Development activities, and
  - continued product testing and certification
- Existing investors are expected to continue to participate. But we would like to broaden our investor group with international financial and corporate investors/collaborators.
- We have a clear ideal of the 'value added' we want from new investors beyond mere money.

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Significance of cement industry; need for radical change

As the world transitions to a low carbon economy, the significance of the cement industry is recognised at the highest international policy levels

- The **UN Environment Programme** reports
  - Cement already responsible for 5% of GHG emissions worldwide
  - Large and growing market: 2.5Bn tn in 2007, more than 5Bn by 2050. China now about half the world market; then India, US & Japan
  - For each tonne of cement, average CO_2 emissions per country range from 0.73tn to just under 1tn. These come from
    - Converting limestone into cement 50%
    - Burning fuel & electricity 45%
    - Transport 5%
- The **International Energy Agency** has a mandate from G8+ to work with cement industry to tackle this. Just yesterday, IEA/CSI published the Cement Technology Roadmap www.iea.org/papers/2009/Cement_Roadmap.pdf
- Conventional solutions not enough; breakthrough new technologies essential

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Portland cement vs. Novacem cement

Portland - production

- Carbonate feedstock – limestone
- Abundant reserves of raw materials
- Thermal process (1,450^{o}C)
- High CO_2 emissions
- Mature: low capital and operational costs

Novacem - production

- Non-carbonate feedstock
- Abundant reserves of raw materials
- Chemical process (650^{o}C)
- Low CO_2 emissions
- Potential for cost parity with Portland

Portland - use

- Excellent mechanical properties
- Very good durability properties
- Higher pH system – careful selection of aggregates
- Limited possibilities for recycling
- Total footprint: high CO_2 emissions

Novacem - use

- Mechanical/durability already good enough for some applications
- No basic limit on achieving parity
- Adjustable pH system – can use lower cost waste/local aggregates as needed
- Completely recyclable
- Total footprint: carbon negative

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Our initial market plans are based on easily accessible segments while we increase performance of our cement

Field of Use	Load Factors	Priority
Blocks	Compression	High
Ground stabilisation	Binder only	High
Insulation panels	Non load bearing	High
Mortar	Compression	High
Pavers/curbs	Compression/ high wear	High
Ready mix sub base	Compression	High
Reconstituted stone	Compression	High
Screed	Compression	High
Wall panels	Non load bearing	High
Floor tiles	Compression, high wear	Medium
Partitions	Dynamic	Medium
Wall tiles	Non load bearing	Medium
Worktops	Dynamic	Medium
Render	Dynamic	Medium/low
Roof tiles	Dynamic	Medium/low
Ferroconcrete marine applications	Dynamic/suspension	Low
Other precast	Evaluate individually	Low
Precast culverts	Suspension	Low
Precast floors	Suspension	Low
Precast lintels	Suspension	Low
Precast pipe	Suspension	Low
Precast walls	Dynamic	Low
Ready mix concrete	Suspension	Low

PRELIMINARY

Concrete blocks 1.8Mn tn/yr in UK; compared with likely first industrial scale plant at 100/250K tn/yr

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A great start to building a world-class team

Stuart Evans, Executive Chairman. An entrepreneurial business leader since 1984, was founding CEO at Plastic Logic and Cotag International. Early career at IBM & McKinsey following Harvard MBA & Cambridge BA/MA. Full profile at www.linkedin.com/in/stuartevans

Dr Nikolaos Vlasopoulos, Chief Scientist. PhD and MSc at Imperial College, following MEng at Democritus University of Thrace in Greece. Received Technology Venture Fellowship at Tanaka Business School in 2007.

Dr Chris Cheeseman, Senior Scientific Advisor. Reader in Waste Management in Civil and Environmental Engineering at Imperial. Leads large research group in resource efficiency & reuse of materials. Over 100 scientific papers. Oxford DPhil.

Lynne McGregor. Project Manager of our collaborative R&D projects with industrial partners, and also Commercialisation Services Mgr at Imperial Innovations. Previously worked at Stone & Webster and ABB; BSc in Chemical Engineering; MBA from London Bus School

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Leadership of £1.5Mn TSB project with global industrial partners reduces risk and leverages our own resources

RIO TINTO

Leading global mining & exploration company with £30Bn sales and 47,000 employees www.riotinto.com

LAING O'ROURKE

Largest privately held integrated UK construction firm, with 27,000 employees worldwide. www.laingorourke.com

WSP

Engineering & design company serving the built and natural environment ; 10,000 employees www.wspgroup.co.uk .

Imperial College London

World class science-based university focused on science/ engineering and application to industry. www.imperial.ac.uk

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Novacem milestones

Event	Timing
Basic research at Imperial College	2005 onwards
Innovations starts funding in stealth mode	Oct 2007
Novacem wins TSB project	Apr 2008
Two year TSB project	Sept 2008/Aug 2010
Batch Pilot Plant (BPP) operational	End 2009
Upgrade BPP to Continuous Pilot Plant	Summer 2010
Industrial Pilot Plant (IPP) operational	2011
Volume Production Plants	2014/15 onwards

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Business model and investors for platform technologies

- As we further develop and prove our technology, we will require an industrial pilot plant prior to scalable volume production. Still to finalise size/ location, but planning this is an important goal for the TSB project.
- Cement industry is globally fragmented – the top 4 companies are only 14% of industry revenues. Its much more concentrated in the UK, but Novacem is playing a global game. But this is a global problem requiring global solutions
- This is a big job and we can't do it on our own. We aim to build a eco-system of investors and partners that can make a real difference. And governments have an important contribution to make as well.
- But remember, business models usually change in high tech start-ups developing platform technologies. As we develop our technology and get out into the market, we'll learn more about what it takes to win.
- We have a great group of seed investors. From this foundation, we will build a high quality group of global financial and corporate investors/ partners.

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In competitive terms, its still early days with everything to play for

- The traditional cement industry is under serious pressure[1] to tackle the carbon problem. It is following a five-fold strategy:
  - Using pozzolans to blend with Portland cement
  - Including mineraliser additives to reduce process temperatures
  - Lowering the lime saturation factor
  - Energy efficiency/using green fuels
  - CO_2 sequestration
- Other new entrants are emerging. We have a healthy respect for these companies (whose existence reassures us we are onto a good thing), but know our advantages.
- Academic research is ongoing, but Imperial is one of the world's leading groups in this field

Note 1 - see, for example, Cement vs Carbon, Credit Agricole, Sept 2008

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Conclusion

- There is an unprecedented and urgent imperative. As John Doerr[1] put it: *"You can bail out the banks; you can't bail out the environment"*
- Consumers and their governments are demanding the construction industry change its ways
- Many different elements in the emerging value chain need to work together to build an eco-system and deliver the best solution for consumers.
- We welcome the opportunity to discuss these ideas with you, and thank you for your attention!

Note 1 – John Doerr, Partner at Kleiner Perkins speaking at Harvard Business School Centenary in October 2008, after a week of unprecedented financial turmoil and government intervention. Subsequently widely reported in the press.

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Thank you!

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