Phase 3: The environmental, economic and financial implications of green procurement in state-subsidised housing

Case studies on four state-subsidised housing projects that have implemented green procurement and the lessons learnt.

Western Cape Department of Human Settlements

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Phase 3: The environmental, economic and financial implications of green procurement in state-subsidised housing: Case studies on four state-subsidised housing projects that have implemented green procurement and the lessons learnt.

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Executive Summary

Green procurement is a current focus area being developed by the Western Cape Department of Human Settlements to improve the environmental impact of state-subsidised housing. As part of this process, there is a need to learn from projects that have aimed to incorporate environmental considerations in to the design and construction of state-subsidised housing. These, which are not viewed in isolation but rather also as tools for local socio-economic development, include reduced greenhouse gas emissions, reduced resource demand, resource efficiency, and construction waste reduction. This report offers four case studies and an associated reflection on the successes, challenges and gaps of these projects. The case studies cover the Witsand iEEECO housing project, the Kleinmond Eco-housing project, the Delft Symphony Precincts 3 & 5, and the Steen Villa Social Housing Complex. A one page poster that summarises each of these projects and their environmental and financial implications is provided as part of this Executive Summary.

Overall the business case in each project was achieved, at least to some extent, with the most successful project evaluated being the Kleinmond Eco-housing project, followed closely by the Steen Villa Social Housing Project. This can be attributed to a range of factors. The successes to build on, the challenges to overcome and the gaps to fill are summarised in the table below.

Successes to build on
Projects were more successful in the long term where the outcome was not predetermined but rather a set of performance criteria was held to.
Extra care and time taken early on in the design phase to grapple with the design and budget for the best responses to the range of project constraints and opportunities.
A champion for the green business case is key to maintain momentum and ensure that the environmental priorities identified are not side-lined as the project progresses. Good project managers, the appropriate political will, strong inter-governmental cooperation, and the desire to innovate can result in similar projects being implemented elsewhere.
Ensure that environmental considerations, especially no to low cost passive design solutions, are included from the onset of the project.
Where green interventions offer cost-saving through greater time and material efficiencies, they are more likely to be taken forward by private sector role players of their own accord
Interventions that are low-tech and require little maintenance are the most successful both in terms of reducing the impact of the development on the environment and being a valuable contribution
Especially where new systems or designs are being considered, the community needs to be party to the reasons why this is taking place and how it is believed to be beneficial to them and the broader municipality
Funding for green procurement in almost all these projects has made use of multiple sources, subsidies and, at times, partnerships.
For semi-detached units, the space layout should contribute to reduced noise transfer by mirroring the layout of each unit.
One of the most successful environmental impacts across these projects was that of reduced construction waste, when pursued as a goal of the project.
Challenges to overcome

Certain interventions and designs were not successful, as not enough attention was paid to either the social or environmental context in which the project was built. This could include the community dynamics and the micro-climate.
Essential to the design considerations must be the financial realities of maintenance.
Housing subsidies do not make provision for monitoring and evaluation by contractors or the developers (municipalities or the province). Monitoring and evaluation is key to understanding whether the business case is realised so that future housing projects can build on the successes of others
Pilot projects, where it is the first time an innovation is being implemented, must be evaluated in terms of risks to the project programme with the need for extra time or a phased approach to be considered from the onset. Planning to undertake pilot projects must therefore include an investigation in to the market capacity and available technical solutions to gauge supply and determine cost-benefit analysis.
Ensure that the Tender's Terms of Reference make use of terminology and functionality criteria that are sufficiently descriptive to match the requirements of the Western Cape DHS or municipal developer. Key to this could be to make use of existing environmental standards and certifications as procurement and award criteria. These can also be included in contract performance clause.
Working in low income and vulnerable communities necessitates the need that these communities are not the ones to bear the risk of innovation.
The inexperience of construction industry certifying bodies, contractors and suppliers of ABT, especially in the state-subsidised housing sector, should be taken in to account when planning projects using ABT.
Current gaps to fill
There is a lack of data and indicators against which to measure the environmental, financial and economic implications for state-subsidised housing decisions. Furthermore, a key challenge to this analysis has been the lack of standardised project costing information.
There is a lack of certification measures for contractor installation and quality control needed in order to ensure compliance with national standards, if they exist.
Both project managers and those working with the various municipalities identified that there is a need to educate and raise the awareness of beneficiaries and communities at the handover of projects.
All four case studies have focused on interventions for individual units. There is however an opportunity to benefit from economies of scale in providing a single, larger services intervention for the whole project at a lower per unit cost, with possibly higher performance.
There is a gap in the knowledge and capacity of municipal and provincial decision-makers in using a life cycle approach to understand the environmental impacts and costs of any design choices.

This is the first research project of its kind and it is hoped that this report has provided a framework for improved monitoring and evaluation of projects in the future. Key to innovation and embedding sustainability in state-subsidised housing projects and processes is to continue to learn from projects that aim to push the boundaries of current practice and then to capture and build on the knowledge gained through them.

THE EFFECTIVENESS AND IMPLICATIONS OF GREEN PROCUREMENT
CASE STUDY 1 of 4: WITSAND iEEECO HOUSING

Location	Atlantis, City of Cape Town Municipality	Project Partners
Date of Inception	Phase 1: 2005 and Phase 2: 2009	PEER Africa, Witsand IEEECO Housing Beneficiary Support Organisation (WEHBSO), Khaya M5, Mellon Housing Initiative, The City of Cape Town, Western Cape Department of Human Settlements, Masiphumelele PHP Group, Masakhe PHP Group, VHP Construction
Date of Completion	Phase 1: 2008 and Phase 2 still in progress	
Size of Project Site (ha)	67	
Size of single erf (m2)	120	
Size of Unit (m2)	35 - 40	**Motivation for Project**
No. of units	2235	High energy and health costs to individuals, high costs of infrastructure and service delivery, and high environmental degradation due to the dependence on combustible fuels whether in the home or as a source for electricity production. iEEECO methodology defined as integrated, empowerment, environment, energy, cost-optimisation
No. of units built using iEEECO	1252	
Average Density du/hectare)	33	
Housing Project Typology	semi-detached and detached single storey dwellings (two double storey show houses)	
Housing Subsidy Type	BNG / PHP	

Intervention	No. of units	Desired Impact	Effectiveness	Cost	Provided within subsidy	Required in NBR and SANS 10400-XA
North-facing orientation	1252	Thermal Efficiency Passive Solar Design	High	No cost	Yes	Yes
Larger windows on North facade	1252	Thermal Efficiency Daylighting	High	Low	Yes	No
North orientated space layout	400	Thermal Efficiency Passive Solar Design	High	No cost	Yes	No
Ceiling with Insulation	2235	Thermal Efficiency	High	Moderate	Yes, SCCCA top-up	Yes
CFL bulbs	1252	Energy Efficiency	Moderate	Low	No, extra Eskom DSM funding	No
Wall insulation	0	Thermal Efficiency	N/A	N/A	N/A	No
Off-grid feature: Domestic solar water heater	500	Energy Efficiency	Moderate	Moderate to High	No, MHI funded	Only if providing hot water
Off-grid feature: Solar home systems (photovoltaics)	3	Energy Generation	High, when working	Very high	No, PEER Africa funded	No
Off-grid feature: Wind turbine	3	Energy Efficiency	High, when working	Very High	No, PEER Africa funded	No
Off-grid feature: Rainwater Harvesting Tank	1	Water Conservation	Moderate	Moderate	No, PEER Africa funded	No
Business Case achieved? Yes, where the iEEECO methodology was strictly adhered to. Lack of funding limited the implementation of the off-grid features.						

THE EFFECTIVENESS AND IMPLICATIONS OF GREEN PROCUREMENT
CASE STUDY 2 of 4: KLEINMOND ECO-HOUSING

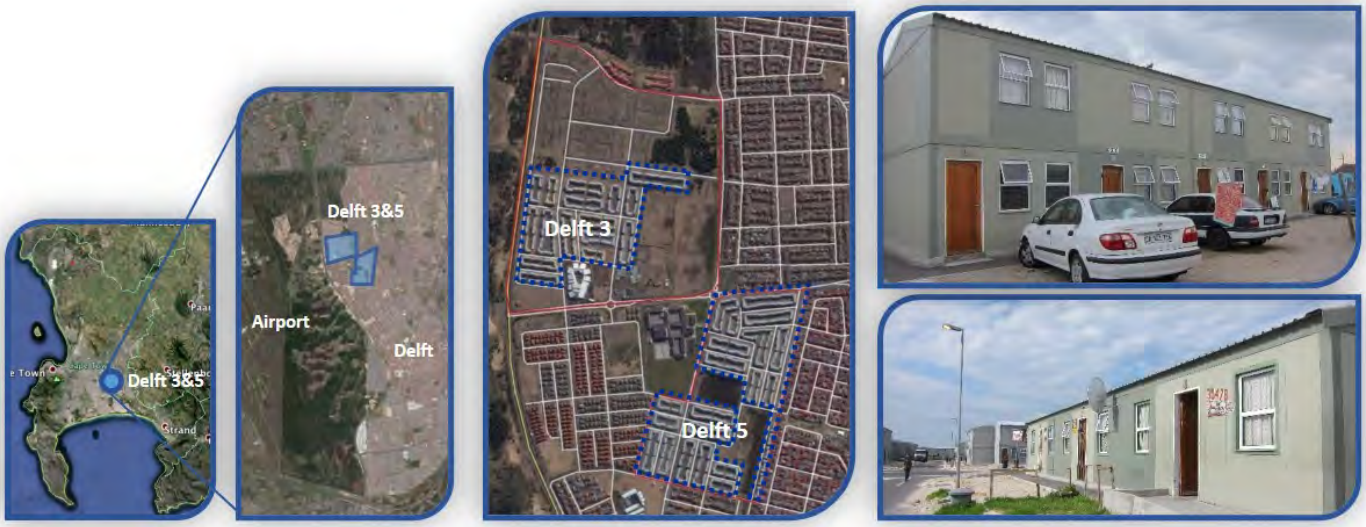
Location	Kleinmond, Overstrand Municipality	Project Partners
Project Programme	February 2010 to December 2011	CSIR, Dept. Science and Technology, Motlekar Cape, Overstrand Municipality, Western Cape Department of Human Settlements, Eskom, Department of Energy, Solek Renewable Energy Engineers, and Eskom
Size of Project Site (ha)	7.95	
Size of erf (m2)	120 - 163	
Size of Unit (m2)	40	**Motivation for Project**
No. of units	410	This innovative state-subsidised housing project aimed to improve the quality of construction and reduce utility costs and bulk infrastructure costs, through the application of science and technology to improve livelihoods of the poor in South Africa
Density (du/hectare)	51	
Housing Project Typology	Detached and semi-detached, single storey	
Housing Subsidy Type	BNG	

Intervention	Desired Impact	Effectiveness	Cost	Provided within subsidy	Required in NBR and SANS 10400-XA
Insulated ceiling board	Thermal Efficiency Dematerialisation	Moderate	Moderate	Yes, SCCCA top-up	Yes
Solar water heaters	Energy demand reduction	Moderate to High	High	No	Only if providing hot water
Photovoltaic panel and battery	Energy demand reduction	Moderate	Very High	No	No
Front doors with glass inlay	Daylighting Energy Efficiency	Low	Low	No	No
Rainwater Tanks	Water Demand Management	High	Low to Moderate	No	No
Shower/sit bath	Water Demand Management	Low	Low	Yes	No
Splashbacks	Health and Hygiene	Moderate	Low	No	No
Designed for expansion	Structural integrity	High	No cost	Yes	No
UTRCP Continuous foundation slab	Dematerialisation	Moderate	Cost saving	Yes	No
Modular masonry design	Waste Reduction	Very High	Cost saving	Yes	No
Pre-fabricated plumbing unit	Dematerialisation Waste Reduction	Very High	Cost saving	Yes	No
Structural ring beam	Structural integrity	High	Low cost	Yes	No

Business Case realised? Overall, this has been a successful project with the business case being realised. Certain objectives outperformed others, such as reducing construction waste, improving structural integrity, and the water demand management. It is interesting to note that simple design changes were made that allowed for a significant reduction of the negative impacts on the environment due to this project.

THE EFFECTIVENESS AND IMPLICATIONS OF GREEN PROCUREMENT
CASE STUDY 3 of 4: DELFT SYMPHONY PRECINCT 3 & 5

Location	Delft, City of Cape Town Municipality	Project Partners
Project Programme	21 February 2013 - 14 August 2015	Housing Development Agency, Western Cape Department of Human Settlements, Motlekar Cape/Group 5 JV
Size of Project Site (ha)	7	
Size of erf (m2)	145 - 175	
Size of Unit (m2)	40 (single storey) and 42 (double storey)	
Alternative Building Technology	Vela Building System : Structural Insulated Panel (SIP) with a structural steel frame	Motivation for Project
No. of ABT units	1426 of the 1911 units	The business case made for the use of ABT in this project was to test the durability, cost effectiveness, environmental impact, appeal and acceptance of such technologies.
Density (du/hectare)	203	
Housing Project Typology	Single and double storey, row housing	
Housing Subsidy Type	UISP utilising the BNG subsidy	



Intervention	Cost	Provided within subsidy	Desired Impact of Alternative Building Technology	Effectiveness in comparison to other non-ABT projects	Lessons learnt
Alternative Building Technology	Moderate increase, with funding provided by Western Cape Provincial Government, until new subsidy quantum came in to existence.	No	Increased speed of delivery	Low	A life cycle approach must be taken towards understanding the environmental impacts of any ABT pilot to look at embodied energy and maintenance costs too. Pilot projects that test new technologies should be smaller to start with (to build 150 houses rather than 2000) to test and showcase the product in the market and then grow on the knowledge from that experience. The hidden costs and extended time lines of pilot projects need to be accommodated for sufficient learning to take place; this is both during the process and once the houses have been handed over (monitoring and evaluation). More care must be taken to ensure that the tender specifications for future ABT projects are sufficiently descriptive to match the desire of the Western Cape DHS to test innovative and new materials, technologies and construction systems.
			Thermal Efficiency	Moderate	
			Energy Efficiency	Low	
			Less construction waste	High	
			Durability	Moderate	
			Ability to maintain	Low	
			Job creation	Moderate	
			Appeal and acceptance	Moderate	
Site Layout: Perimeter block	No cost	Yes	Semi-private communal courtyard	Moderate	
			Increased road safety	Moderate	
Business Case realised? No, the complexities of this as a pilot project limited the benefits possible from the use of Alternative Building Technology.					

THE EFFECTIVENESS AND IMPLICATIONS OF GREEN PROCUREMENT
CASE STUDY 4 of 4: STEEN VILLA SOCIAL HOUSING

Location	Steenberg, City of Cape Town Municipality	**Project Partners**
Project Programme	February 2009 – August 2014	Social Housing Company (SOHCO), the City of Cape Town, and Western Cape Department of Human Settlements.
Size of Project Site (ha)	7	
No. of units	700, constructed in three phases	
Size of Unit (m2)	30 (bachelor) – 42 (2 bedroom)	
Density (du/hectare)	100	**Motivation for Project**
Housing Project Typology	Simplex and Duplex, 2-3 storey walk-ups	To develop quality, safe and well-maintained social housing units that offer cost-effective rental accommodation to couples and families. Going green made sense from a long-term cost perspective for SOHCO.
Housing Subsidy Type	Restructuring Capital Grant and Institutional Subsidy (60%) with private funding (40%)	
Ownership model	Rental units only	

Intervention	Desired Impact	Effectiveness	Capital cost	Operational cost	Provided within subsidy/private split budget (60/40)	Required in NBR and SANS 10400-XA
Well-located site	Reduced environmental footprint	High	No cost to SOHCO, cost of land provision (opportunity cost) to CoCT	None	Yes	N/A
Density	Reduced environmental footprint	Moderate to High	Low to Moderate	Cost-saving	Yes	N/A
Permeable paving	Water demand management Stormwater management	Moderate	Moderate	Moderate	Yes	No
Solar water heaters (SWH)	Energy Demand Management	High	High	Moderate	Yes	Only if providing hot water
Manual by-pass switch for SWH	Energy Demand Management	Very high	Low to Moderate	Low	Yes	No
Water-wise gardening	Water Demand Management	Moderate	Low	Low	Yes	No
Water meters	Water Demand Management	High	Moderate	Low	Yes	No
Low flow bathroom fittings (showerhead, sit-bath, toilet)	Water Demand Management	Moderate	Moderate	Low	Yes	No
Business Case realised? Overall, this has been a successful project with the business case being realised. SWHs were the most valued feature by residents.						