

# Opportunities for value addition to selected Western Cape organic waste streams

Lignocellulosic biomass

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# Opportunities for value addition to lignocellulosic biomass

## 1. Goal statement

This document sets out the business opportunity for value addition to lignocellulosic biomass. This document forms the foundation for discussion with the intended final outcome of **business-matching, shared expertise and ideally (foreign) investment in value add opportunities in South Africa.**

## 2. Scope

The analysis is limited to the **Western Cape of South Africa**, but where there may be other regions with equal or greater potential, links to source of information and potential business partners are also provided. This document focusses primarily on biomass available in the **private sector**. Some government controlled streams are also considered, but generally, these are difficult to access due to the complexity of the regulations pertaining to municipal responsibilities, procurement of services and public-private partnerships.

## 3. Current status of utilisation of resource

### 3.1. Invasive alien vegetation (IAV)

In the Western Cape, a great deal of attention has been directed to value addition to woody biomass, specifically invasive alien vegetation (IAV). This is primarily due to the fact that organisations responsible for clearing IAV are entirely grant funded, which is inherently an unsustainable business model. In order to increase the sustainability of these clearing operations, clearers are investigating ways to beneficiate cleared biomass.

According to the Cape Agency for Sustainable Integrated Development in Rural Areas (CASIDRA), approximately 700 000 tonnes of IAV biomass is available in the Breede and Berg River catchment areas in the Western Cape. (These are the two largest river systems in the Western Cape.) Although this is a significant amount capable of contributing to a sustainable business, it is important to note that most of this IAV is not easily accessible. The requirement for increased labour to contribute to the easing of logistics, creates increased expense and thus often leads to decreased opportunity for beneficiation due to low/negative margins. This opportunity could be unlocked by considering higher value products and foreign markets. For example, the European charcoal market could be explored in order to justify the increased cost of clearing, as charcoal has higher value in these markets than it has locally.

The GreenHouse (TGH), a Cape Town based sustainability consulting firm, was commissioned by CASIDRA to provide a better understanding of the uses of woody biomass in the Western Cape. Their most recent report (Cohen, 2015) presents the following seven uses for invasive alien biomass beneficiation in the Western Cape context:

- **Energy recovery / biofuels** – increasing interest in this space, for both energy use and by-product (charcoal, biochar) utilisation as land owners are better understanding the value of healthy arable land enabled by addition of biochar and further beneficiation to activated carbon (for water treatment and pharmaceuticals).
- **Landscaping** – small equipment investment, but mulch has been indicated by Cohen (2015) to have relatively low market value. (GC comment: This is unexpected, as at the retailer end mulch fetches high prices at nurseries. It remains to be seen how the current drought in the Western Cape and associated changes in land management practice in agriculture and gardening change these market dynamics).
- **Sawmill planks and industrial uses** – drying is the key issue, as well as the fact that IAV will compete with other, more desirable hardwoods. Finally, plank-recovery from a single tree is only in the order of 10-15% (i.e. not efficient biomass utilisation) and does not align well with the aim of

IAV clearing (i.e. removing individual trees to prevent excessive water use and biodiversity security, rather than production of biomass at scale for beneficiation).

- **Furniture** – Uses include: decking, outdoor furniture, school desks though faces similar constraints as sawmill planks.
- **Poles** – Easy solution, very low treatment requirements because of ‘hardness’ of some IAV cores.
- **Paper and pulp** – Not identified as an existing solution, but highlighted as a potential opportunity.
- **Wood composites** – Not identified as an existing solution because there are only a few wood composite manufacturers in the entire country. (GC comment: composite woods may not be an ideal value add option in the current SA context as there is a lack of solutions for post use of such composite wood material – see details later in this document).

### 3.2. Industrial woody waste, primarily composite wood materials

The Western Cape Industrial Symbiosis Programme (WISP) team has identified manufacturers generating waste woody biomass materials. Thus far, it has been determined that most of these companies occur in a defined area, making the utilisation of this waste material more likely to be financially viable. A large proportion of these waste generators are located in the Northern Suburbs of the City of Cape Town (CoCT).

The waste generated by these manufacturers comprises four types of material, namely:

- medium density fibre-board (MDF)
- chipboard (chip)
- plywood (ply), and
- solid woods.

The first three types are treated with chemicals harmful to the environment. Not only are these three types of waste treated with harmful chemicals, but chip and MDF are sometimes laminated with a material (plastic and/or paper composite) which contains a highly toxic, yet inert compound polyvinyl chloride (PVC). Various challenges exist around treating this waste material, as combustion releases chlorine into the atmosphere, while formaldehyde has long been thought of as a carcinogen. These woody waste materials are often not sorted and get disposed of to landfills at an expense to the waste generator. WISP has identified that between 3000 and 5 000 tonnes of this type of material is being generated annually by companies in the Western Cape. This difference is accounted for by the varying demand by the consumers of solid vs composite wood materials. Another important point to note is that this waste material is comprised of dust, shavings and off-cuts, but, as indicated, is largely localised to the Northern Suburbs of CoCT.

### 3.3. Pallets

Another lignocellulosic waste material found in industry is packaging pallets. Packaging pallets are treated in multiple ways, namely, prolonged heat exposure, treatment with copper-chrome-arsenic (CCA) and painted. Painted and CCA treated pallets are often sent to landfill sites or utilised in the manufacture of furniture. Painted pallets are also generally leased to industry, rather than sold. This business model demands that industry returns pallets for re-use, rather than disposing of them.

### 3.4. Paper sludge

Another form of lignocellulose derived waste material has again been identified by WISP and occurs at paper and cardboard manufacturers or recyclers. This is fibrous material with a high water content, generally known as paper sludge.

### 3.5. Green waste (landscape-derived waste)

Tree off-cuts, leaves and grass clippings are typically managed separately on municipal landfill sites. (Households are required to deliver waste to local materials recovery facilities). Depending on the particular municipality, the material is either processed by the municipality or by a service provider. Composting is the most common waste treatment method.

## 4. What is required to unlock this opportunity for utilisation / transformation

### 4.1. Invasive alien vegetation (IAV)

Because IAVs are solid wood and comprise no harmful chemicals, utilisation of these waste materials is considered to be easy (waste-to-energy, furniture, pallets, garden mulch, composting etc.). Logistical challenges exist around the collection of these materials, as clearers operate in difficult-to-reach places and often stockpile the material for later burning. Transporting this material has proven to be not financially viable, unless its proximity is close to major roads and the material is chipped on site. Multiple technologies exist for utilisation of this type of material, but they often come at great capital expense, while requiring consistent high volume input into the technology. According to CASIDRA, IAV is an unsustainable resource and any investment into technology needs to consider a ten year lifespan, as current supply of IAV is estimated to only last for the next ten years. Most IAV clearing projects are funded by the national government's Department of Environmental Affairs' Working for Water programme which has the explicit aim of creating employment. Increased mechanisation may decrease employment, although if coupled with additional manufacturing jobs may still be a favourable outcome.

There has been some success in utilising IAVs. The Toronto Group, a Wellington based IAV beneficiation business, has successfully raised funds for their business. Key requirements in securing funding are typically: security of supply of raw material (IAV) and security of demand, in this case, export of charcoal to Europe. Toronto Group have procured land in close proximity to most clearing operations within the Western Cape, which aids in strengthening their business case (by reducing logistics costs). Along with the benefits of proximity to clearing operations, the procured land has significant amounts of established IAV, increasing the lifespan needed to obtain good returns on the initial investment and making the business case for IAV to charcoal stronger in this particular case. Another example is the Nollen Group. The company has experienced challenges with supply to local boilers (e.g. cost of) logistics; suitability of local boilers for biomass feedstock; competition from cheap coal) and difficulties to access international markets (e.g. few ports having correct loading infrastructure, relatively expensive loading costs compared to loading cost internationally and biomass not meeting the sustainability requirements of several international markets). Despite this, the group has had some success locally where it has been able to supply (converted/new boilers) with biomass. This success has been primarily in the Eastern Cape.

### 4.2. Composite wood materials (chip, MDF, ply and pallets):

Composites require great stringency from legal authorities in the Western Cape context as they are mostly treated with environmentally unfriendly chemical compounds. Currently, however, there seems to be little regulation in place from a disposal point of view. However, any process emitting a noxious gas is stringently regulated by the local municipal authorities. The onus lies with the producer of the waste wood to dispose of it in an environmentally responsible manner at their own cost. The CoCT will not collect wood off-cuts as part of the municipal solid waste (MSW) fraction, but will do so upon request and additional payment for services. This is definitely viewed as a key opportunity for the alternative treatment and use of composite wood waste. Most companies generating this composite wood waste are unaware of alternative uses or disposal methods. A very small furniture manufacturing concern makes use of off-cut composites as structural support inside of couches and sofas. This is a very small volume use and makes very little difference to the total available composite wood waste.

Meganika is a local company currently enrolled in the South African Renewable Energy Business Incubator (SAREBI) enterprise development programme. Meganika is exploring the use of this type of woody waste in a gasification process capable of generating energy for industrial use. This company is currently the only entity GreenCape is aware of exploring this space and the company has a good relationship with the WISP team within GreenCape, as WISP has identified all of their current feedstocks. An identified challenge is that chip which is laminated may not be suitable for the process of gasification, nor may CCA treated pallets and certain MDF materials due to the chemical make-up thereof. Meganika is exploring these technical challenges.

With large increases in use by international companies like IKEA that need to comply with EU manufacturing standards, a shift to an increased local production of E0.5 boards (i.e. emitting no more than 0.005 ppm formaldehyde) is envisioned. There is already some E1 board being produced by PG Bison, but the shift from E1 to E0.5 is coupled with an increased cost. If this cost can be recovered in

a secondary market (also the responsibility of the manufacturer), this could facilitate a structural change in the market.

A key opportunity area that may need technical development or knowledge transfer is the affordable manufacturing of low emission composite wood materials and technologies to enable value add to composite wood materials (of varying specifications with regard to composition and emission performance).

#### 4.3. Pallets

Industrial packaging pallets are currently all taken up by furniture manufacturers and waste-to-energy technologies. Furniture manufacturers are able to use CCA treated pallets, while waste-to-energy initiatives take up chemically untreated pallet materials. (Pallets are also recycled by a number of recyclers in the City of Cape Town before going to alternative uses. Pallet manufacturing is also an end-use for industrial wood wastes).

#### 4.4. Paper sludge

Currently, all paper sludge is being utilised by clay brick manufacturers and demand exceeds supply. Little to no opportunity exists for paper sludge, unless it is possible to valorise paper sludge more than it currently is. The University of Stellenbosch (Process Engineering) is currently doing research on value add to paper sludge. It is of note however that paper sludge is evaluated on a case by case basis and is sometimes classified as hazardous and thus requires specialised treatment and licensing for handling of this type of waste.

#### 4.5. Green waste and landscaping-derived waste

Reliance Compost has secured the largest share of municipal green waste being delivered to municipal drop-off sites. Obtaining green waste from municipalities has its challenges. Tenders are sent out by local municipalities, after which companies bid for green waste processing contracts. Often the City of Cape Town releases tenders to deal with two specific concerns around green waste; namely, on-site processing of green waste (chipping, sorting, etc.) and transport of processed green waste to a facility which further processes the waste into a valuable compost. Reliance is currently best placed to deal with both these concerns, as they have a large logistics fleet available to them for the collection of large volumes of chipped material. They also have their own processing technologies in the form of chippers and shredders, as well as a large-scale composting facility on the outskirts of the City of Cape Town.

Residents of a municipality are not charged for disposal of their green/garden waste, which allows for greater opportunity by the municipality to consolidate this waste stream. Consolidation leads to reduced logistics costs for Reliance compost, making the business case more profitable.

### 5. Possible South African business partners

Waste providers
<p><u>Company name:</u> Twinsaver  <u>Core business:</u> Manufacture of tissues and low quality paper  <u>Website:</u> <a href="http://www.twinsavergroup.co.za/">http://www.twinsavergroup.co.za/</a></p>
<p><u>Company name:</u> Gayatri Paper  <u>Core business:</u> Traditional paper recycler  <u>Website:</u> <a href="http://www.golden-era.co.za/?page_id=97">http://www.golden-era.co.za/?page_id=97</a></p>
<p><u>Company name:</u> Working for Water  <u>Core business:</u> Invasive Alien Species clearance and land rehabilitation  <u>Website:</u> <a href="https://sites.google.com/site/wfwplanning/">https://sites.google.com/site/wfwplanning/</a></p>
<p><u>Company name:</u> Cape Nature Conservation  <u>Core business:</u> Invasive Alien Species clearance and land rehabilitation  <u>Website:</u> <a href="http://www.capenature.co.za">http://www.capenature.co.za</a></p>
<p><u>Company name:</u> Geelhout Vlei Timbers  <u>Core business:</u> Manufacture of timber raw materials</p>

Website: <http://www.geelhoutvlei.co.za/>

Company name: Cape Boards

Core business: Cutting and milling of boards for cupboard manufacture

Website: <http://www.capeboards.co.za/>

Company name: bam d'afrique

Core business: Bamboo growers with idea of bamboo to energy initiative

Website: <http://www.bda.hk/southafrica/>

### Solution / technology providers

Company name: Adsorb technologies

Core business: Activated carbon producer utilising IAV and other carbonaceous biomass

Website: <http://www.adsorb.co.za>

Company name: Sustainable Heating

Core business: Waste to energy from chipped (untreated) biomass

Website: <http://www.sustainableheating.co.za/>

Company name: Toronto Group

Core business: Waste to energy from chipped (untreated) IAV with a valuable char bi-product for export – using Dutch technology

Website: <http://www.torontogroup.co.za/>

Company name: Meganika

Core business: Waste to energy gasification using chip, MDF and ply

Website: <http://www.meganika.com>

Company name: STH Energy

Core business: Waste to energy gasification using untreated biomass

Website: <http://www.sthenergysolutions.co.za>

Company name: New Carbon

Core business: Waste to energy pyrolysis using untreated IAV and sawmill residue to produce carbon to supplement chicken feed

Website: <http://www.newcarbon.co.za/>

Company name: John Thompson Boilers

Core business: Boiler manufacturers capable of utilising biomass in boilers

Website: <http://www.johnthompson.co.za>

Company name: Ywaste

Core business: Composting solution looking for carbonaceous supplement

Website: <http://www.ywaste.co.za>

Company name: Reliance Compost

Core business: Composting solution taking up the majority of garden waste

Website: <http://www.reliance.co.za>

### Product buyers/offtaker

Company name: Astral Foods

Core business: Bulk purchaser of shavings and sawdust for use as animal bedding

Website: <http://www.astralpoultry.com/Index.html>

Company name: RCL Foods

Core business: Bulk purchaser of shavings and sawdust for use as animal bedding

Website: <http://www.rcloffices.com/rainbowchicken>

Company name: Tomis group

Core business: Composting of abattoir waste requires carbonaceous supplement

Website: <http://www.tomis.co.za>

<p><u>Company name:</u> Swaco Organics &amp; Recycling  <u>Core business:</u> Composter of abattoir waste and other organics  <u>Website:</u> <b>N/A</b></p>
<p><u>Company name:</u> Visser Vervoer  <u>Core business:</u> Collection and sale of untreated shavings and saw dust to animal bedding market  <u>Website:</u> <b>N/A</b></p>
<p><u>Company name:</u> TJ's Lekka Braai  <u>Core business:</u> Manufacturer and sale of charcoal and sale of chipped untreated biomass  <u>Website:</u> <a href="https://www.tjslekkabraai.co.za/">https://www.tjslekkabraai.co.za/</a></p>
<p><u>Company name:</u> Agri Organics  <u>Core business:</u> Manufacturer of compost, mulch, lawn dressing etc.  <u>Website:</u> <a href="http://www.agriorganics.co.za/">http://www.agriorganics.co.za/</a></p>
<p><u>Company name:</u> Valleï Organies  <u>Core business:</u> Purchaser of shaved and sawdust biomass for resale to chicken farmers as bedding.  <u>Website:</u> <a href="http://www.valleiorganies.com/">http://www.valleiorganies.com/</a></p>

Note: GreenCape is able to furnish potential partners with contact details for those companies listed below, as well as wider ecosystem contacts not listed in this table.

#### 5.1. Other stakeholders to note

- Western Cape Government Department of Environmental Affairs and Development Planning (DEA&DP) – IAV Projects <https://www.westerncape.gov.za/directories/#projects>
- Mountain to Ocean Group (MTO) – Forestry management - <http://www.mto.co.za/mto-company-overview>
- Cape Agency for Sustainable Integrated Development in Rural Areas (CASIDRA) – <https://www.casidra.co.za/programmes>
- WWF – Biodiversity Conservation - [http://www.wwf.org.za/what\\_we\\_do/land/](http://www.wwf.org.za/what_we_do/land/)
- South African Furniture Initiative (SAFI) - <http://www.furnitureza.org.za/>
- The Department of Trade and Industry - Industrial Development Financial Assistance (Incentives) Agro-Processing Support Scheme (APSS) - [http://www.thedti.gov.za/financial\\_assistance/financial\\_incentive.jsp?id=69&subthemeid=25](http://www.thedti.gov.za/financial_assistance/financial_incentive.jsp?id=69&subthemeid=25)
- Industrial Development Corporation – Agro-processing and Agriculture SBU - <https://www.idc.co.za/sbu-overview.html>
- Land Bank – Land and Agricultural Development Bank of South Africa - <http://www.daff.gov.za/daffweb3/Links/State-Owned-Enterprises/Land-Bank>
- National Development Agency (NDA) - [http://www.nda.org.za/home/Funding\\_Criteria-21.html](http://www.nda.org.za/home/Funding_Criteria-21.html)

## 6. SWOT analysis

Below is a SWOT analysis for this opportunity from the point of view of the likelihood of the opportunity being realised through foreign business matchmaking, foreign investment or sharing of overseas expertise.

**Table 1: SWOT analysis for IAV, composite woods, paper sludge and garden waste**

<b>Internal</b>	<p><b>Strengths</b></p> <ul style="list-style-type: none"> <li>• IAV – material has to be cleared (fire risk; increasing water availability)</li> <li>• Composites – Concentrated volumes available.</li> <li>• Paper sludge – costly to transport as significant water content; opportunity for small scale local beneficiation</li> <li>• Garden greens – consolidated at MRFs, hence high volume</li> </ul>	<p><b>Weaknesses</b></p> <ul style="list-style-type: none"> <li>• IAV – not a long term business opportunity (10 years only)</li> <li>• IAV – decentralised nature of material</li> <li>• Composites – often contain potentially harmful chemicals.</li> <li>• Paper sludge – sometimes classified as hazardous</li> <li>• Garden greens – mostly taken up by existing local solution – ease of access to material challenging</li> </ul>
	<p><b>External</b></p> <ul style="list-style-type: none"> <li>• IAV – national government’s Working for Water could decrease cost of collecting material.</li> <li>• Composites - producers have responsibility for disposal so clear market for valorisation.</li> <li>• Paper sludge – local research expertise developing alternatives – opportunities for knowledge exchange</li> <li>• Garden greens – partnership with existing solution provider to collect small dispersed volumes – munics outside CoCT may not have solution (investigation needed)</li> </ul>	<p><b>Threats</b></p> <ul style="list-style-type: none"> <li>• IAV – drought and emphasis on water saving could speed up clearing and decrease possible project span.</li> <li>• Paper sludge – compete with existing use in bricks</li> <li>• Composites – cost of disposal cheaper than cost of treatment due to high capex of tech</li> <li>• Garden greens – municipal procurement processes onerous; existing solution providers - typically composters</li> </ul>

### 6.1. Opportunities outside of the Western Cape

KwaZulu-Natal and Mpumalanga provinces are significant areas to explore as they contain approximately 49% and 20% of South Africa’s forestry (by value), respectively. The Bioenergy Atlas (<http://bea.dirisa.org/atlas/biomass>) provides a South African overview of available biomass. KwaZulu-Natal hosts most of South Africa’s sugar cane production that could also be considered for value addition.

GreenCape has made introductions to the Sugar Milling Research Institute (KZN) and can do so as well for the Mpumalanga Bioenergy Cluster.

Various value-add studies have been done on lignocellulosic biomass, especially in the Western Cape context. The National Department of Environmental Affairs has significant resources available on their Natural Resource Management Programmes website (<https://sites.google.com/site/nrmprogrammes/ecofurniture-programme>)

## 7. Bibliography

Brett Cohen, Lewis, Y., Logan A, Pieterse R, and Swanepoel E., 2015. *Economic study on the use of cleared alien biomass for commercial exploitation*, Cape Town: The Green House. - **Compiled on behalf of CASIDRA**