# BARRIERS AND OPPORTUNITIES FOR SMME PARTICIPATION IN RENEWABLE ENERGY INDUSTRY

## 1. INTRODUCTION

Renewable energy can be explained as energy that is derived from natural resources and processes, that are not depleted but replenished at a rate that is faster than the consumption thereof (International Energy Agency, 2018). This form of energy has gained a lot of interest as a result of its advantages over the conventional energy generation from fossil resources that are currently depleting and results to pollution. South Africa in-line with the energy transition to low-carbon, by introducing the renewable energy into the energy mix, established the Integrated Resource Plan 2010 for electricity, which stipulates the energy composition for the country, by the Department of Energy (DoE) (Department of Energy, 2013). This plan was promulgated in March 2011 and has been the basis for the establishment of the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP), to facilitate introduction of renewable energy into the grid.

Figure 1 illustrates some of the renewable energy technologies.

Figure 1 Renewable energy technologies

## 2. PROBLEM STATEMENT

The procurement of renewable energy through the REIPPPP, which began in 2011, has attracted R201.8 Billion investment from both local and foreign investors from bid round 1 to bid round 4. The REIPPPP economic development rules requires IPPs to commit to a certain percentage of their revenues to enterprise development.

According to the IPP Office Report (2017) enterprise development commitments are made as percentage of revenue of the operating IPPs. The target for IPPs to spend on enterprise development is 0.6% of revenues over the 20 year project operational life, which amount to an average of R320 million per annum for Round 1 to Round 4 projects. Despite these reported commitments, SMME participation in in the core value chain of renewable energy remains minimal; instead are found predominantly offering services such as security, catering, accommodation etc. which are non-core and are not giving maximum economic benefit.

The purpose of this study is to:

- Establish an industry view on participation of SMMEs in the renewable energy value chain

- Consolidate the information relating to barriers and opportunities for SMME participation in the REIPPPP and package it in the form of a guide for SMMEs
- Identify possible solutions to alleviate the challenges faced by the SMME

## 3. METHODOLOGY

In order to identify opportunities that facilitate and the challenges that prohibits the SMME from participation in the core value chain of the renewable energy, a desktop study was conducted. The desktop study focused on analysing renewable energy the policy and market in South Africa, and further analysed different value chains within the renewable energy sector, in order to identify parts of the value chains where SMMEs can play a role. The study followed a qualitative research method, using interviews as a method of primary data collection. Because of a small number of participants this method does not presume to represent the wider population, but enables the researcher to present detailed snapshots of the participants under study. Key industry role players including project developers (IPP), equipment manufacturers (OEM), construction companies (EPC) and other industry role players were interviewed. The focus of the interviews was on opportunities, challenges and possible solutions for better representation of SMMEs in the renewable energy value chain. The results were analysed by means of grouping responses according to emerging themes and building a narrative according to those themes.

## 4. RESULTS

### 4.1 Barriers of entry into RE industry for SMME

Figure 2 represents the challenges that were outlined by the industry players that were interviewed, who had an interaction with the SMME within the renewable energy industry. The number of participants that have identified the issue as a barrier for the SMME, as expressed in percentages. Thus, a 100% means all participants identified the issue as a barrier. Below are the challenges that were quite common amongst the participants, with items in bold indicating a high intensity:

- Advertising opportunities not standardized, contract work opportunities missed
- Lack of experience & track record
- Local content not enforced
- Lack of financial resources for upfront compliance
- Lack of resources for working capital

- Lack of equipment- high capital investment

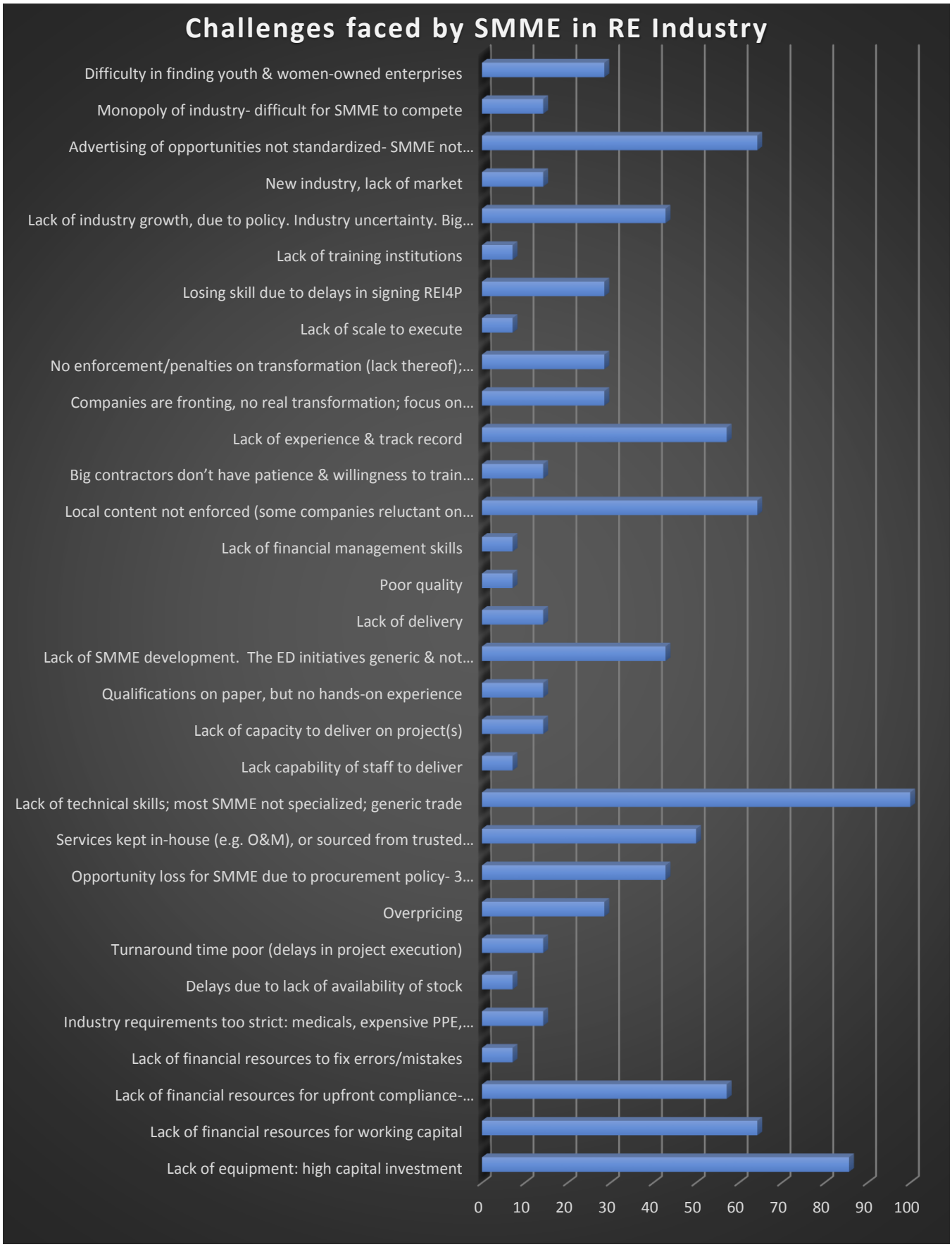

Figure 2: Barriers of entry for SMME participation

## 4.2 Opportunities available for SMME participation

### 4.2.1 Industry feedback

The research participants identified opportunities that SMMEs can tap into within the renewable energy value chain. It was noted SMMEs often benefit from providing auxiliary services such as cleaning, catering, security, etc. These are seen as "low hanging fruits" as they do not require specialised skills. However, is was also noted that there are several opportunities that SMMEs can tap into, if barriers can be sufficiently addressed. Figure 3 illustrates opportunities at different stages of the value chain that were identified by research participants.

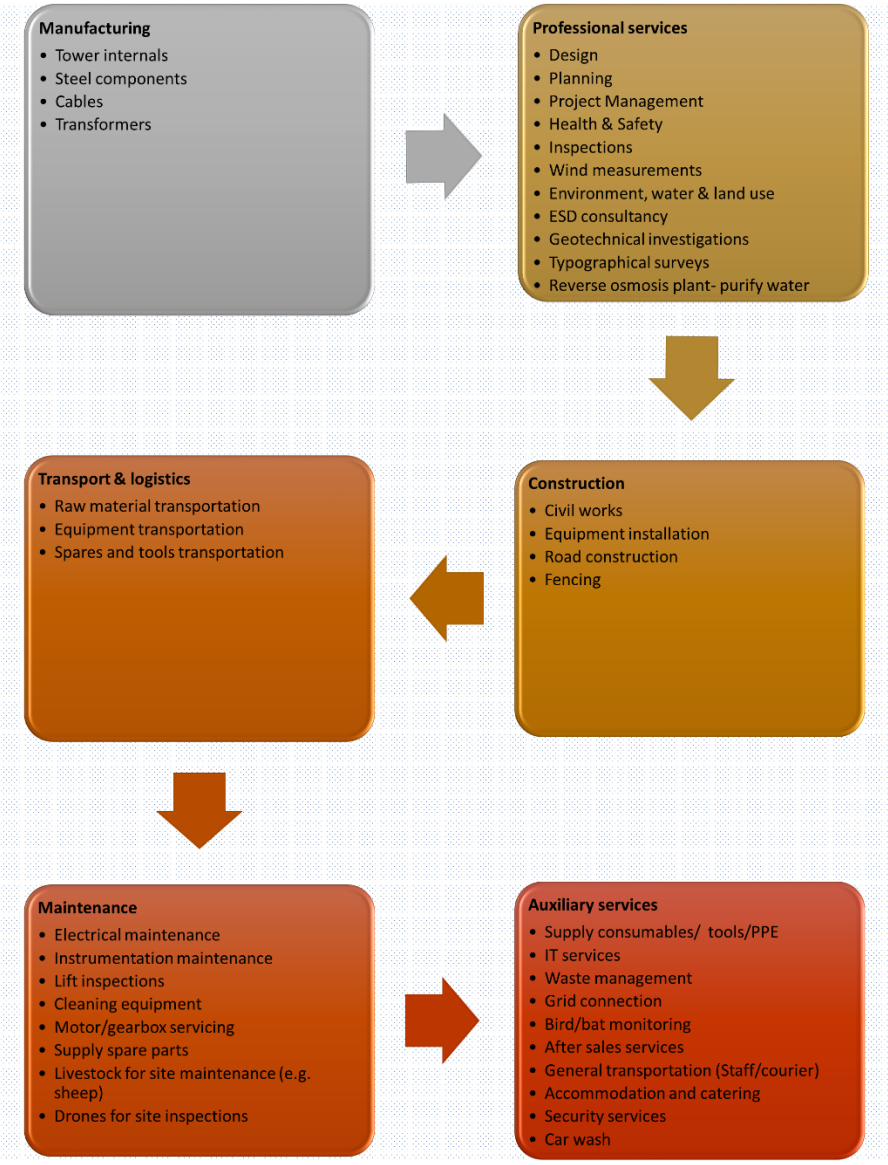


Figure 3: Renewable energy value chain opportunities

The opportunities identified by the industry role players include:

- Manufacturing

Although barriers for entry are high for SMME for the equipment manufacturing, due to high capital requirements, high resources requirements for accessing technology etc. However, there are opportunities that exists for manufacturing of components by small businesses such as wind tower internals, steel components, etc.

- Professional services

Offering the professional services in the value chain has a number of opportunities for small consulting firms to provide services at project development stage, during construction, and during operation and maintenance. This when the enterprises have the necessary skill in that particular focus area.

- Construction

The construction stage of the renewable energy projects offers many opportunities for SMME considering the approach of sub-contracting them in areas such as civil works, electrical installations, fencing, etc. These are skills that are generic to all industries and are applicable to this sector as well.

- Transport and logistics

The transport and logistics avenue is dependent on the type of technology in question. Some of the technologies offers a number of opportunities where the required resources for facilitating such are within reach and can be easily accessed; whilst other technologies requires far advanced and specialized equipment or facilities to facilitate, such as the wind tower and this resulting to high financial resource requirements.

- Maintenance

The industry identified this element as another area that presents opportunities for SMME; however, due to the requirements on equipment warranty, the OEM tend to prefer servicing their equipment in the early stages of development, with potential of appointment of a service provider at a later stage. Other opportunities exists in less critical services such as cleaning the equipment and others.

However the operation of the plant as it is linked to the performance of the equipment, is kept in house by equipment manufacturers.

- Auxiliary services

This stage of the value chain presents the most opportunities for SMME participation, and a confirmation has been given that SMME predominantly play in this stage. This stage includes a variety of services such as catering, security services, fencing of the site etc.

### 4.2.2 Opportunities in the value chain per technology

The Department of Trade and Industry embarked on a journey of investigating the localization potential per technology, in South Africa, based on the availability of resources and skill. A biogas plant site selection study conducted by Biogas East, provided insight to the potential in the development of the biogas plants. The findings were reported in various technology reports that included the following:

- Photovoltaic Electricity: the localization potential of Photovoltaic and a strategy to support the large scale roll-out in South Africa (The DTI)
- The wind energy industry localization roadmap in support of large-scale roll-out in South Africa (The DTI)
- Assessment of localisation, industrialisation and job creation potential of CSP infrastructure projects in South Africa- a 2030 vision for CSP (The DTI)
- Guidelines for selecting suitable sites for Biogas plants; compiled by Biogas East (Biogas for Eastern Europe)

2.2.1 CSP

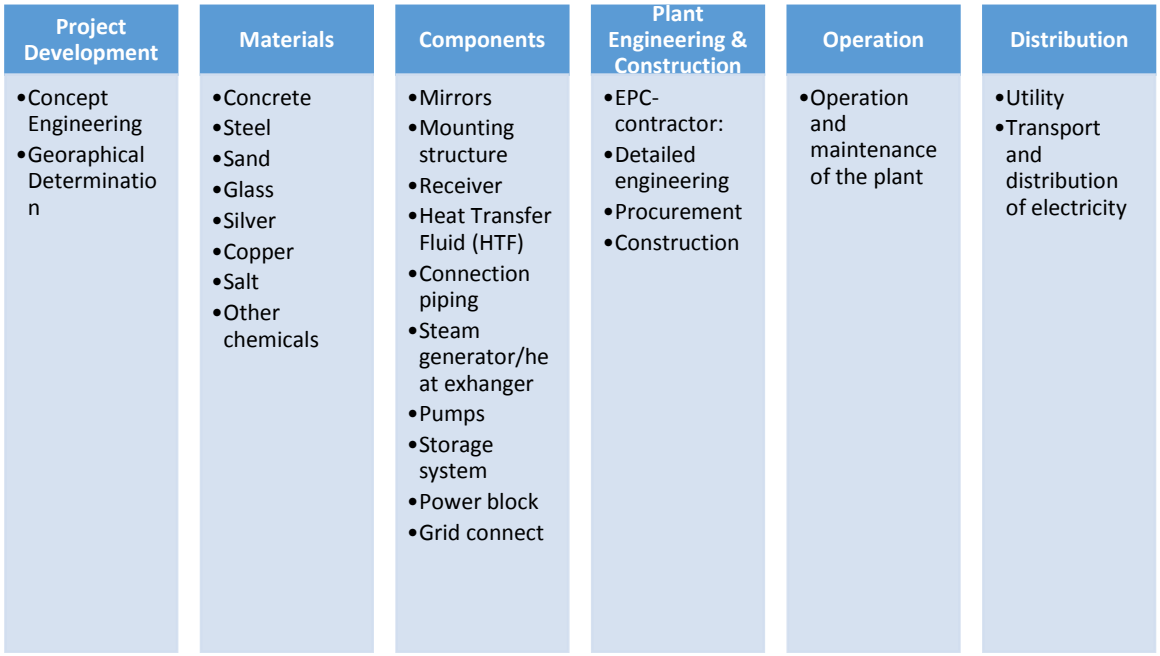


Figure 4: CSP Value Chain

The CSP technology offers a number of opportunities in the value chain, ranging from project development, production of the material, component manufacturing, plant engineering and construction, operation and distribution.

Some of the opportunities are generic and acquired from various industries, such as the provision of services such as concrete, sand, mounting structures etc. However, some needs specialized skill-set that is specific to this technology, such as the construction, maintenance etc.

In the study conducted by The DTI, an evaluation was done to determine opportunities that can be easily implemented within short-term and those that can be considered in the long-term, versus the market opportunity or attractiveness. Below is the breakdown of the opportunities identified for short-term that has less barriers of implementation, as well as opportunities that can be considered in the long term due to the barriers that exists.

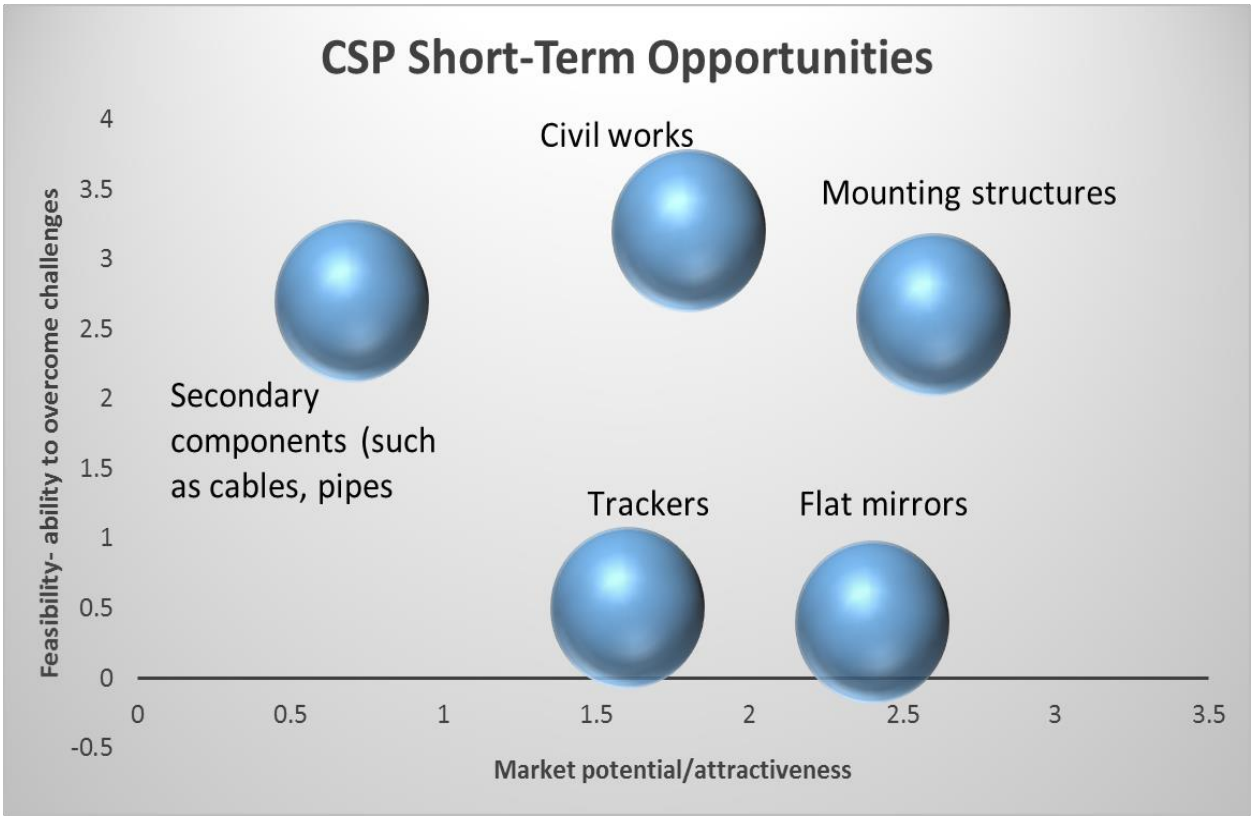


Figure 5: CSP Short Term Opportunities

Figure 5 indicates that for a South African market, the feasibility of overcoming challenges in offering services in secondary components such as the pipes, cables combined with the market potential that is attractive makes this field viable in a short-term. Components such as the trackers and flat mirrors has a higher market attractiveness with a low feasibility to overcome the challenges of the industry. This an indication that there's potential of offering the service, however, the barriers to be overcome could be tougher based on sector-specific requirements and technology requirements.

Services such as civil works and mounting structures seems to have higher potential of overcoming barriers of the industry, as it is a service that is generic and not necessarily a specialized service. In addition, these services have higher market potential.

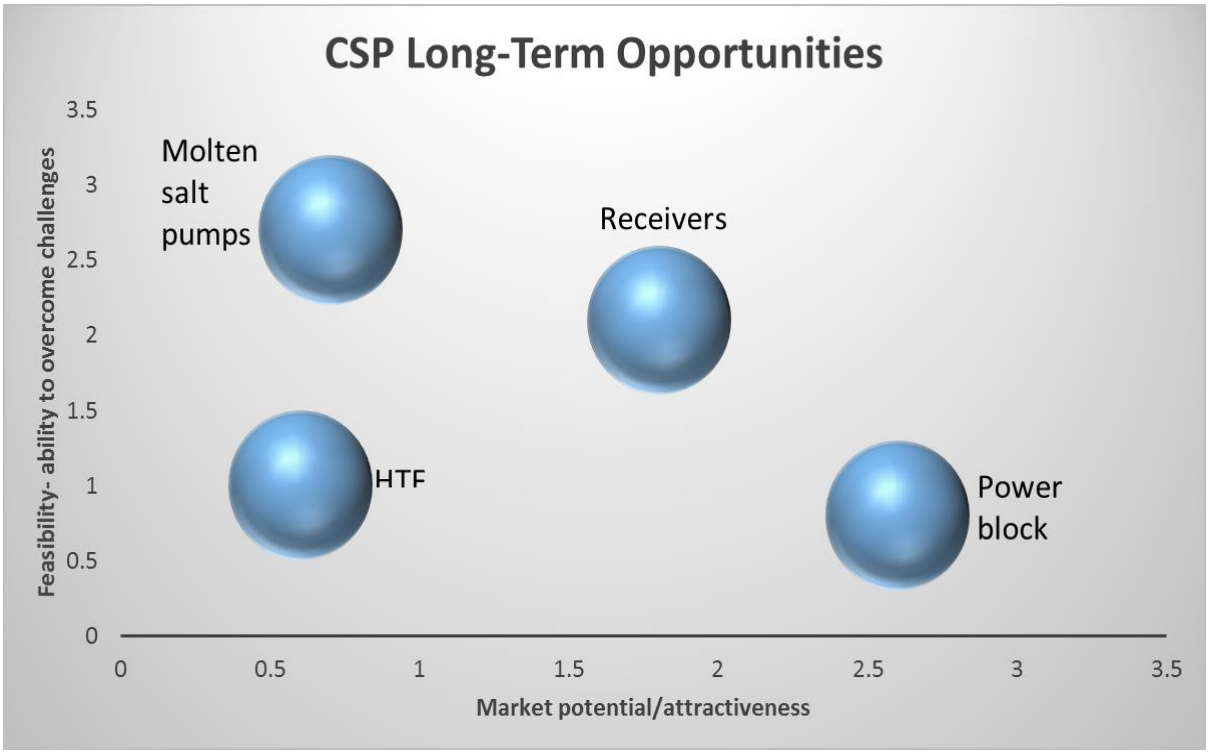

Figure 6: CSP Long Term Opportunities

Services that can be considered long-term opportunities includes molten pumps, receivers, power block and the HTF. Power block has high market attractiveness with low viability of overcoming industry barriers, meaning the market will find these attractive and hence has potential in being offered within the country, however, overcoming the industry barriers will not be easy. Whilst the service offering and manufacturing of the receivers have both high market potential as well as the high potential of overcoming the barriers, which will mean success of the business opportunity. The molten salt pumps have a high potential of overcoming the industry barriers, however, the molten pumps have a low market attractiveness. These might not be of interest to a few customers.

Lastly, the HTF have low market attractiveness and potential of acceptance in the market, and also have a low chance of overcoming the industry barriers. Thus, the manufacturing of the HTF might not be easily welcomed by the market and it might not be easy to provide the service in the industry due to the barriers of the industry.

2.2.2 Wind technology

The value chain of the wind technology includes: raw material sourcing and equipment supply, the design and development, component supply, construction and installation and maintenance. Figure 7 shows the technology value chain.

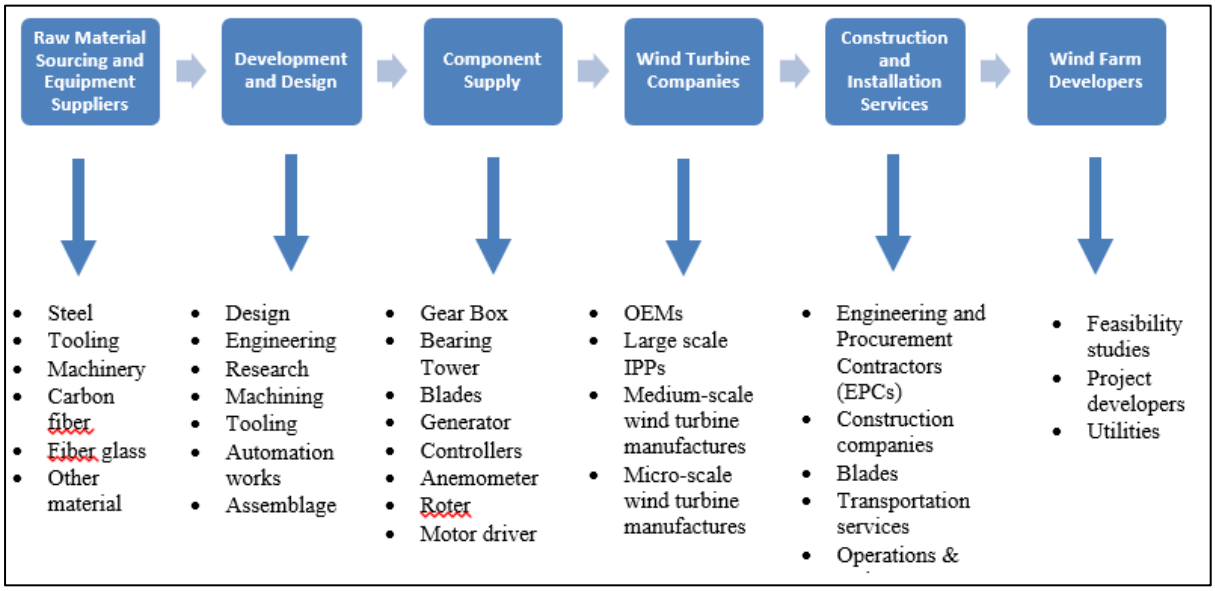


Figure 7: Wind Energy Value Chain

The raw material and equipment supply value chain requires steel, tooling, machinery, carbon fiber, fiber glass etc. South Africa already has capacity in producing some of the material in the list, such as the steel, fiber glass, carbon fiber. Whilst the component supply has generic equipment which South Africa has capability of, such as the gear boxes, generators etc. However, specialized equipment such as the rotors, blades, nacelle, controls, tower components are specialized components that South Africa doesn't have a capability in, as yet.

Services such as design and engineering, construction, operation and maintenance require specialized skill-set as they are technology based. However, opportunities exists in services such as transportation and logistics services, construction, feasibility studies, where a certain skill-set will be sufficient in providing the service.

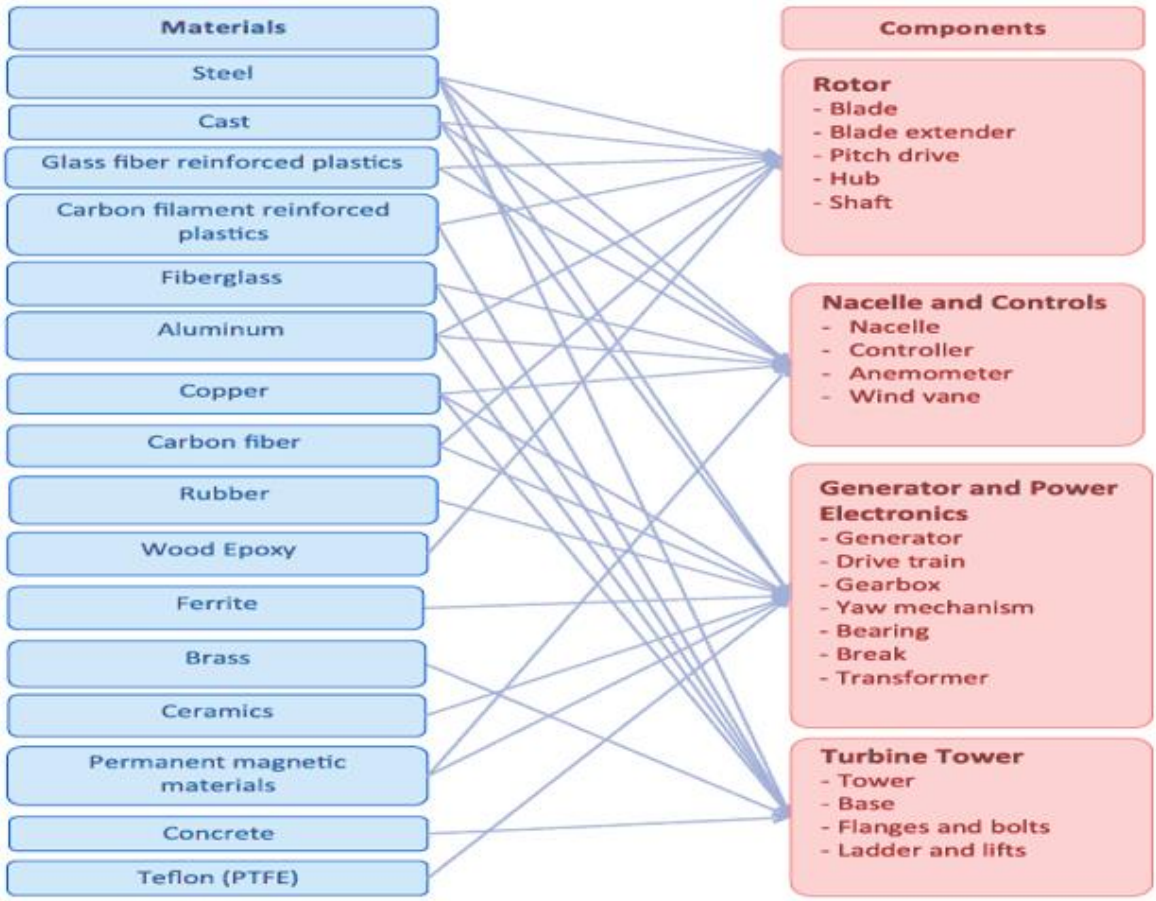


Figure 8: Components Used in Wind Energy Value Chain

The diagram in Figure 8 is an indication of the various components used in the wind technology, with a direct link to particular material used for that component. Example being the rotor of the wind turbine which has various parts such as the blade, blade extender, the pitch drive, the hub and shaft that needs material such as the steel, cast, glass fiber, carbon filament, aluminium, carbon fiber and wood epoxy.

The turbine tower that consists of the tower, the base, flanges and bolts, ladder and lifts requires material such concrete, brass, copper, aluminium, fiber glass, carbon filament and steel.

With the accessibility to the technology, some of the components could be manufactured in the country, due to the availability of the respective material that is required for the manufacturing of such (such as steel, fiber glass etc.).

### 2.2.3 Solar PV

The value chain in photovoltaics is considerably complex, and involves all the different processes required to create a utility-scale PV solar system.

Production of polycrystalline Silicon - This Polycrystalline sillicon (also called: polysilicon, poly crystal, poly-Si or also: multi-Si, mc-Si) are manufactured from cast square ingots, produced by cooling and solidifying molten silicon. The liquid silicon is poured into blocks which are cut into thin plates. There are different processes used in manufacturing of polycrystalline solar cells. According to (http://www.greenworldinvestor.com, 2011) The Czochralski process is the most commonly used process of producing polysilicon and is also known as the Siemens process. In this process High-purity silicon is melted in a quartz crucibles.

Once the high-purity silicon has been produced, the subsequent step involves converting it into thin sheets of good crystallographic quality, for use as solar cells. A thickness of about 100 microns is all that is needed to obtain the photovoltaic output from silicon18. Production of crystalline wafers can be achieved either by ribbon growth, or a two-step process starting with ingot casting or crystallization followed by wafer manufacturing (Xakalashe & Tangstad, 2011).

The third step in the solar PV value chain is the manufacture of cells from the wafers. This step involves the conversion of the wafer to a photoactive diode i.e. a piece of semiconductor that is able to generate free electrons when exposed to sunlight (Energy Alternatives India, 2011).

The final step in the value chain is the assembly of the various solar cells into modules. The process in this stage involves the interconnection and packaging of multiple cells into a single unit. The price of a PV module is mainly influenced by the price of the cells it incorporates. The solar module manufacturing segment is highly fragmented due to the ease of manufacturing of the module – which in essence is just an assembly process and the low capital cost involved in setting up of the assembly line. (Energy Alternatives India, 2011). Other components involved in the assembly process are glass, back sheet, aluminium frame, and a junction box. The assembly process is the easiest to localise as it less capital intensive.

Other components that make up the balance of system include inverters, cables and transformers and combiner boxes. Inverters are usually made in Europe with a potential to localise the assembly process

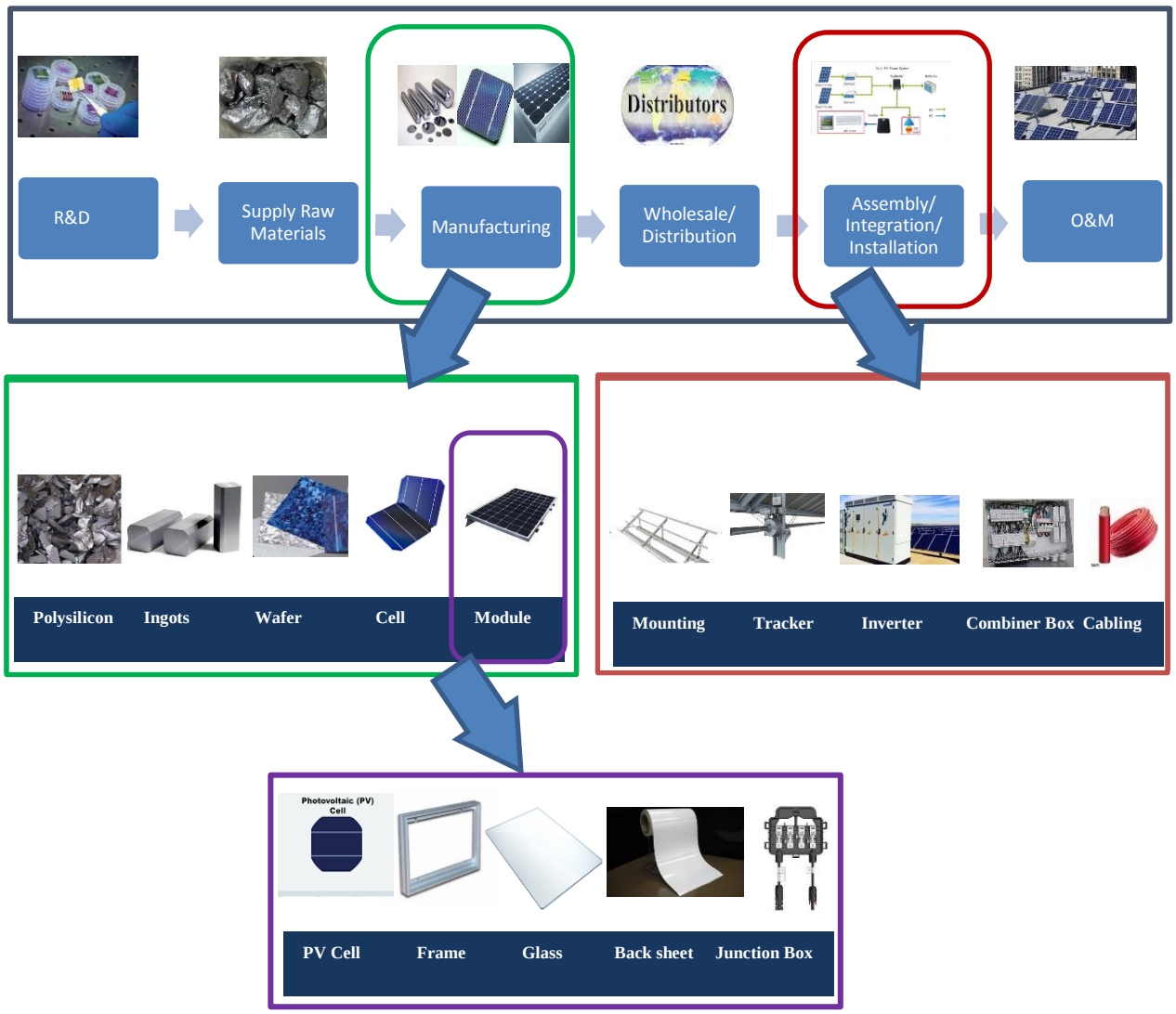


Figure 9: Solar PV Value Chain

The solar PV Industry globally had undergone massive shifts in markets. Over the years as there are new entrants in the market, companies that are involved at the time start to decline as successful companies grow in size and smaller companies are either bought out or go out of business. The main issue in the solar PV industry is the "race to the bottom". The demand side of the industry is pressured by to reduce prices and therefore exert pressure on the manufacturers. The survivors focus on improving competitiveness and reaching economies of scale in production. The Solar Industry has high number of competitors, particularly concentrated in the east, with a small share of the market in the USA and Europe.

## 2.2.4 Bioenergy

The bioenergy industry encompasses the biogas and biomass technology. Each technology has its own value chain and respective opportunities and ease of implementation within the country, based on the availability of the resources required.

**Biomass technology**

The summary of the value chain for the biomass technology is illustrated in Figure 10, with various service offerings that offers a number of role players opportunities.

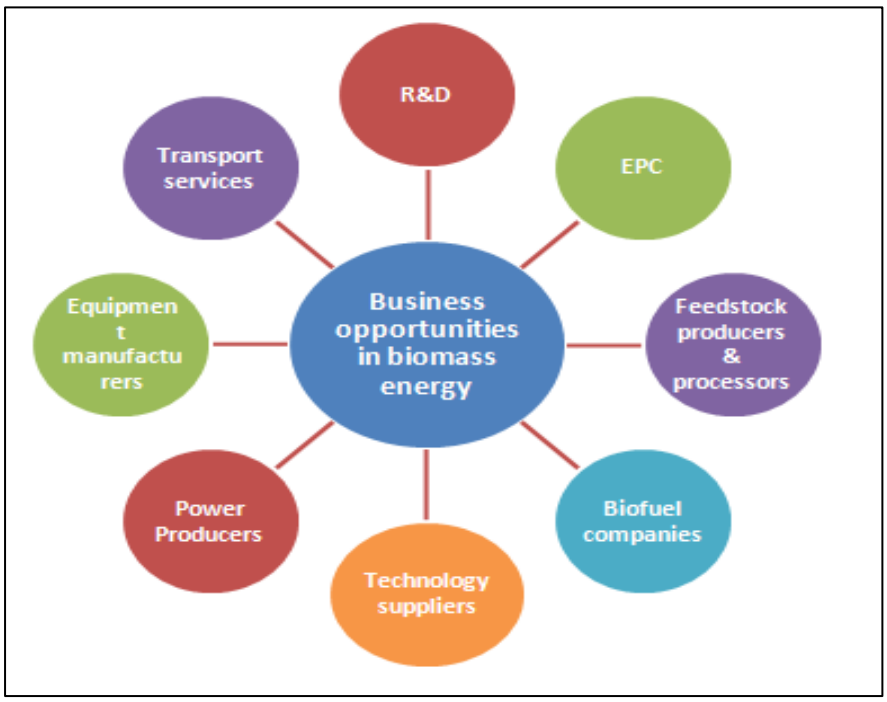


Figure 10: Biomass opportunities

The biomass value chain is broken into the following value chain and role play:

- Research and development- professional service prior the development of the renewable energy. In order to provide such service, technical skill and capability in the field will be a primary requirement for such.
- Engineering, Procurement and Construction (EPC)- services for construction of the biomass technology developments are offered by such contractors, that have the technical capability to conduct engineering designs, equipment procurement and the actual construction of the plants.
- Feedstock producers and processors- the service can be offered by the parties that have access to large feedstock material that is suitable for a particular technology offered, that includes material such as the food waste, animal waste, agricultural waste etc. The

processing of the feedstock will include treatment of the waste in ensuring compliancy to the technology requirements.

- Biofuel companies- these parties will be off-takers of the produced biogas for production of biofuel.
- Technology suppliers- the role players in this value chain are responsible for the provision of the actual technology to be used in generating the biogas from the waste material sourced from the feedstock suppliers.
- Power producers- they are operators of the biodigesters, where they are responsible for the day-to-day operation of the facility, ensuring constant feedstock supply, monitoring of the operating conditions and power output.
- Equipment manufacturers- provides components required for the construction of the biodigesters that includes: digester, gas storage, septic tank, agitators, flares etc. These could be offered by separate companies that are specialists, in that area.
- Transport services- the role players in this value chain, covers the service providers that transports either the equipment/components, the feedstock to the site and also depending on the downstream requirements and uses, this could include the biogas transportation if that is the desired product, unless if transformed to electricity.

The biogas technology

Figure 11 is a split of the biogas technology, into the value chain that offers the industry players opportunities for provision of services in the establishment, operation and maintenance of the biogas plant.

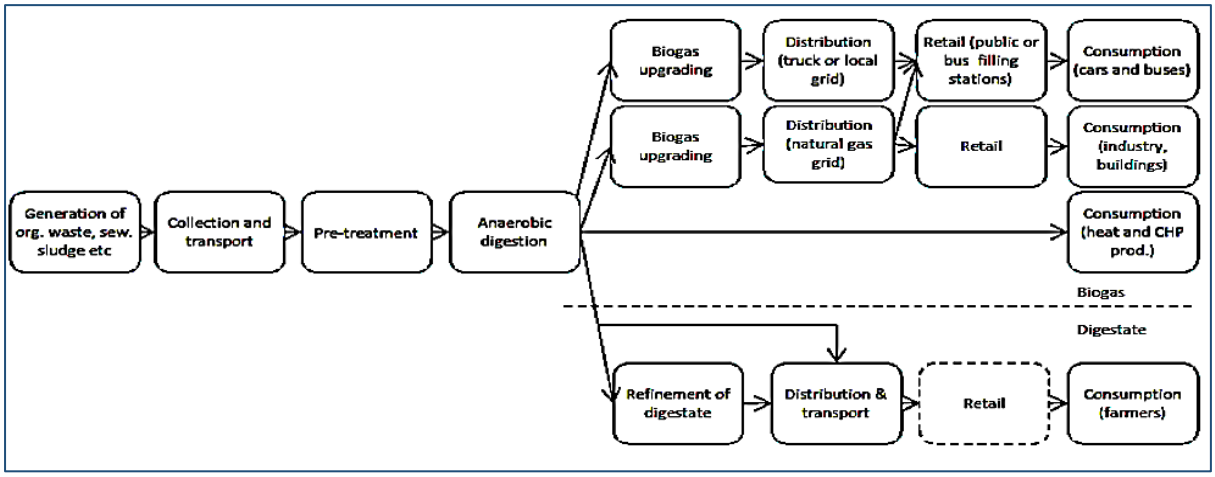


Figure 11: Biogas Value Chain

The various role play in the biogas technology includes the following:

- Waste generation- the feedstock sources for the biogas plants includes sewage systems, the agricultural waste such as corn stovers. These waste generators serve as the providers of the waste to the biogas plant.
- Transport and logistics of the waste- this could be the collection of waste from one site to another (unless the biogas plant is constructed closer to the source) and the storage thereof.
- Pre-treatment- at this stage, the activities includes sorting of the waste or treatment thereof to desired technology requirements.
- Anaerobic digestion- this includes equipment manufacturing and transportation, plant operation and maintenance. The opportunities exists when the technical skill exists and the technology is available.
- Distribution of the biogas- opportunities for distribution are dependent on the desired product, whether the end product desired is the gas or the electricity; whereby for the gas, packaging thereof and transportation to the customer offers SMME to partake in.
- Refinement of digestate- this refers to the refinement of the waste, which requires further treatment and packaging as per the desired products.

## 5. DISCUSSION

SMME participation in the renewable energy value chain remains a challenge. Construction of renewable energy plants needs to meet very strict quality standards which needs experienced companies with a strong financial muscle. While several challenges have been identified that prohibit SMMEs from obtaining business opportunities in the renewable energy industry, there is an opportunity for government to establish programmes that prepare the small companies to get to a state of readiness when these projects are built. These programmes could include technical support, incubation, financial support and certification. If enterprise development criteria of the REIPPPP could specify that a certain percentage of the funds be spend to develop renewable energy companies that could strengthen SMME participation.

A vast number of opportunities exists for SMME participation in the core value chain; that are within reach without high capital investment requirements in order to participate. A number of these opportunities were identified across the entire value chain, with very limited role for SMME in Operation and Manufacturing.

## 6. CONCLUSION

The renewable energy industry is at its infancy in South African, a certain degree of reliance on international expertise is expected; however, with time, skills transfer needs to take place to allow local participation. This can be achieved with all parties working towards achieving that goal by enabling the environment for it to be conducive for SMME to play key role in the sector.

Support needs to be given to SMME in terms of coaching, mentorship and financial resources. In addition, SMME also need to strive for excellence, get specialized skill and aim for an above-average service delivery.

## 7. RECOMMENDATIONS

The industry made suggestions for all stakeholders, to alleviate the current challenges and to enable the SMME to take advantage of opportunities available. Indicates recommendations proposed by the study participants.


Figure 12: Possible solutions to alleviate challenges

As per Figure 12, possible solutions identified by the industry role players particularly by the SMME, includes being proactive and taking initiative to seek opportunities and help, to stay informed by constantly accessing platforms that provides industry information. For SMME to aim to deliver services on time, which creates a good profile about them and many more.

The industry identified possible solutions targeted at the IPP, and these includes using the Enterprise Development (ED) spend predominantly in developing SMME in this industry, which will increase their skillset. To standardize the method of advertising contract work opportunities available, in order to give a fair chance to all interested parties. To incorporate SMME in the renewable energy, on their ED program, where there are no SMME that have the skill required etc.

The industry further identified possible solutions aimed at the Department of Energy (DOE), and these includes interventions such as increasing the local content requirements, with strict monitoring and applying penalties where some do not adhere to the rules. To intensify the skills development programs such as manufacturing (training). To introduce soft loans for SMME at inception, with no interest to encourage and support them with the steep requirements, amongst others.

Lastly, the industry role players identified possible solutions to be addressed by the contractors (such as EPC/OEM etc.) by allowing skills transfer to take place for SMME to develop. To share their global expertise and experience with the locals. To collaborate with SMME and provide mentorship that will equip and empower the SMME.

These proved that in order for the industry to progress and continue incorporating the SMME, each role player will have to put in efforts that will help alleviate the challenges faced by the SMME in entering the renewable energy industry, particularly through the formal programme such as the REIPPPP.