MARKET DEMAND FOR SOLAR PV:

Designing incentives towards adoption of sustainable agriculture practices in South African fruit and wine sectors

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ABSTRACT

South Africa's globally recognised export focused Wine and Fruit industry relies heavily on electricity in farming and processing activities. An improved understanding of the determinants of demand is critical to developing incentives to enable wider scale adoption of renewable energy to reduce production cost, enable farmers to lower their carbon footprint which has increasingly become a market access requirement for export markets and support development of shift to diversified energy mix and green economy (GE). Part of the GE focus is on innovative approaches to business, job creation and skills development for industries that protect and enhance natural systems and resources, and capitalise on the value generated by natural systems (Western Cape Government, 2014). With these strategies in mind, solar photovoltaic (PV) is seen as an attractive option to reduce electricity demand for fruit and wine sector. Industries would benefit from introducing information exchange protocol within different banking divisions to improve due diligence, staff competencies and exposure to increase successful deal flow. Non-financial service offerings to agriculture clients such as such as free energy audits, portal to access key information and exchange with other clients. Furthermore, mainstreaming best practices for energy efficiency via agricultural extension services can contribute to more resilient and sustainable agriculture, and contribute towards a finance product offering (debt tenor and interest rate) appropriate for fruit and wine farmers. The utilisation of extension services to can improve survey response rates thereby providing an improved understanding of the determinants of demand is critical to developing incentives to enable wider scale adoption of renewable energy to reduce production cost, enable farmers to lower their carbon footprint which has increasingly become a market access requirement for export markets and support development of shift to diversified energy mix and green economy.

Keywords:

Solar Photovoltaics (PV)| Green Economy| Energy| Agriculture| Incentives| Fruit | Wine| Sustainability| South Africa

INTRODUCTION

Energy is a key driver of South Africa's (SA) economy. In agriculture, the primary energy source used is diesel fuel (54.7%) followed by electricity (19.7%), vegetable waste (10.1%), coal (8.6%) and other fuel sources less than 5% (Department of Mineral and Energy Affairs, 2002[i]). The alarming trend however is exorbitant year on year increase in average electricity cost in agriculture of 27.75 % from 2008 to 2009, 31.03 % from 2009 to 2010 and 41.81% from 2010 to 2011.

The overview of solar photovoltaics (PV) in SA identifies and describes the market in comparison to the installed capacity and development prospects of global market leaders. Key technology characteristics such as size, stand alone or grid tied, drivers and constraints are defined and described for the utility, commercial and industrial as well as residential market segments. Industry trends in particular forecasted growth prospects helps to frame the demand for and role of finance in wider scale adoption of solar PV and design of instruments in particular. The installed solar PV capacity of 30 GW in SA in 2012 compared to Europe (81.5 GW), Asia-Pacific (40.6 GW) and American (13.7 GW) illustrated a market in the early development stages despite its introduction in the 1980's. SA contributes less than 1% to global installed solar PV capacity which is significantly lower than emerging markets of India (2%) and China (13%).

There is significant potential employment opportunity from goods and services related to manufacturing, installation of solar PV, as well as research and development. The realisation of these employment opportunities is dependent on a country's industry and market structure with technology cost being the key barrier hampering for wider scale adoption[ii]. Despite being a small player in terms of global installed capacity, SA is ranked by renewable energy investors as one of top ten developing countries for renewable energy investment. A country's solar PV market development prospects are generally driven by attractiveness to investors and specifically for solar PV measured by size of electricity market and cost competitiveness in relation to irradiation amongst other criteria. SA ranks higher than the Mediterranean and North Africa, Central Africa, Middle East and Other Asia in terms of country attractiveness measured economic growth, political and financial stability. SA's favourable market prospects are largely boosted by the country attractiveness given the lower position for solar PV attractiveness compared to other countries.

A key trend in the global market is the emergence of the Asia-Pacific in 2013 as dominant market (56%) player followed in second place (29% by Europe, the number one player for many years prior to that. The Asia-Pacific region includes China, Japan, Korea, Australia, Taiwan and Thailand with China leading as country with the highest number of installations[iii]. This growth trajectory is closely aligned with macro-economic growth prospects shifting

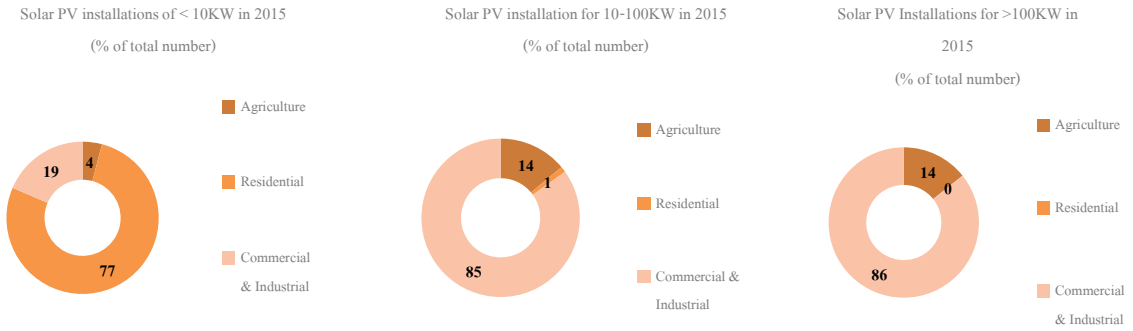
to emerging markets particular Brazil, Russian, India, China and Africa. Despite being a smaller player in global terms in relation to installed capacity SA together with Chile and Mexico show tremendous growth prospects from 2014 to 2016.

Market Segments

Solar PV systems may be distinguished in terms of sizes, end-user markets, grid connections and mounting structures. Small systems are less than 10kW, medium systems between 10kW to 1MW and large are more than 1MW. A grid tie system implies the local solar PV system is connected to electricity distribution network with any excess electricity fed back in to the grid. An off grid system is not tied to the grid and supplies electricity directly to the end user and in some cases has batteries as a back-up. Solar PV systems can be ground or rooftop mounted. In terms of end-user the three distinct market segments are residential, utility, commercial and industrial segments[ii]. Pay back periods vary significantly with average of 16 years for residential and 3-5 years for commercial and industrial.

The agriculture sector falls within the commercial and industrial solar PV market segment. Estimates of solar PV installations for three technology sizes as at end March 2015 shows agriculture installations make up 4% for systems less than 10 kW, 14% for 10-100 kW systems and 7% for systems larger than 100 kW (Figure 1).

Figure 1: Solar PV Applications in the South African Agriculture in 2015 by technology size[iv]



The commercial-industrial combined with residential market segments has a greater potential than the utility-scale market segment to deliver on development of local solar PV sector (manufacturing, installation and associated services)[ii]. Key activities identified to create enabling environment for market growth. These are raising awareness

of benefits, address regulatory constraints, improve access to finance and cost thereof, establish certification and monitoring mechanisms, set up training manuals and facilities for installers and provide training and education.

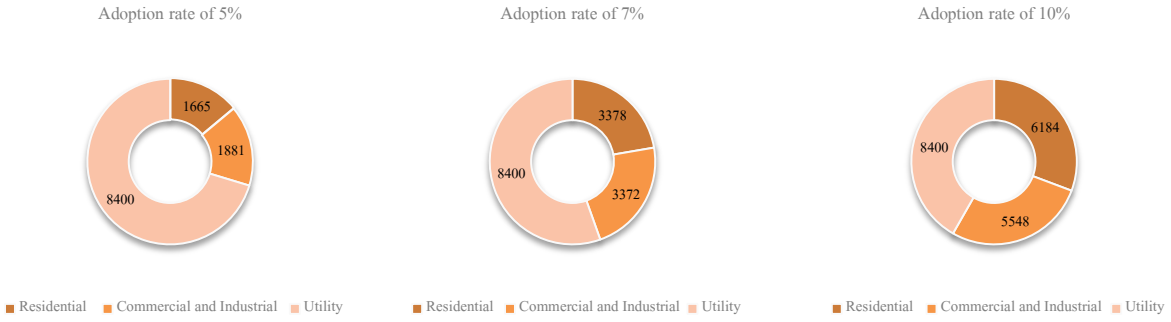
Table 1 Characteristics of Solar PV market segments in South Africa

Characteristics	Residential	Commercial and Industrial	Utility
System size	Varies depending on urban or rural & income group	Varies depending on end user	Varies for different bidding windows
Technology	Mostly rooftop structures	Preference for rooftop structures	n.a.
Grid	Off grid with back up or storage	Stand-alone with power supplemented from grid.	Grid connected
Pay-back period	Pay-back period of 16 years	Pay-back period of 3-5 years	Significant variation
Drivers	Improved affordability Desire to reduce footprint Increased availability of financing options	Rising electricity tariffs Increased reliability and security of supply Trend to reduce carbon footprint Market tool for business Rising consumer awareness	Good solar resources No space restrictions Increasing power demand Good investment opportunity
Challenges	Absence of rules net metering or connection standards Lack of public awareness and education Lack of financial incentives	High upfront capital cost Access to finance Lack of government incentives	Market certainty and government commitments Bankability of deals Cost of finance
Emerging trends	Potential size of this market is significant	Third party ownership	

Growth Prospects

Growth projections for solar PV installations for SA will reach 2 GW in 2016[v]. Longer term future growth scenarios show residential, commercial and industrial market segments surpasses utility market segment assuming an adoption rate of 10% (Figure 2). This enables improved sustainability of development of a local PV industry driven by increased manufacturing capacity and added economic opportunities. With adoption rate of 5%, 12 600 job opportunities will be created; 22 589 for adoption rate of 7% and 37 174 for adoption rate of 10% in the commercial and industrial market segments.

Figure 2 Solar PV growth projections (MW) from 2013-2035



Purpose

An innovative sustainable agriculture partnership[1] between public and private sector; the World Wide Fund for Nature (WWF) SA, Western Cape Department of Agriculture and a SA commercial bank, is aimed at designing incentives to enable behaviour change towards wider scale adoption of sustainable agriculture practices including renewable energy in SA's fruit and wine sectors. This Partnership will provide the entry point for sources of data collection for the proposed study.

The study aims to provide overview of solar PV market in SA focusing on agriculture, determine future market demand for solar PV in agriculture and identify key factors that inform decision to install solar PV in fruit and wine sector with a particular focus on role of finance.

[1] http://www.nedbank.co.za/website/content/corporate/busbanking_agri.asp

METHODS

The mixed method approach adopted was three-fold. Firstly a comprehensive desk top literature was conducted of peer reviewed scientific journals, reports and articles easily accessible and publically available preferably online. Semi-structured interviews with key individuals and institutions identified from literature review with key questions posed as informed by the review. Industry Associations were approached for survey dissemination.

Thirdly an online survey administered to email list server of Confronting Climate Change Fruit and Wine programme to 1000 individuals. To date, no similar surveys have been conducted for these industries and the success of the surveys may depend on the reach of distribution for both the private and public sectors. Additionally, a workshop is scheduled for with 30 fruit and wine farmers in July 2015 to improve response rate.

FINDINGS

No studies were found in the literature review on solar PV application in the South African agriculture sector. Hence limited data is available publically apart from what is provided in engineering and farming magazines as well as related media. To date, no similar surveys have been conducted for these industries and the success of the survey may depend on the reach of distribution for both the private and public sectors. The online survey proved to have limited reach with farmers (under-reporting). The opportunity for utilising agricultural extension services and mainstreaming energy efficiency is being explored.

Incentives

Government support and policies have played a key role in enabling the significant growth in global solar PV industry in recent years. Incentives fall into categories of tax incentives, cash grants, preferential debt tenors and interest rates offered by commercial banks and development finance institutions as well as free technical advisory service. Though fairly limited in SA, the incentive structures available for solar PV installations available from the private and public sectors, are considered below.

Tax incentives

The SA Revenue Service (SARS) promulgated a series of tax incentives from 2009 to stimulate renewable energy investment ranging from exemptions, deductions, allowances and accelerated depreciation (Table 2). Most agribusinesses that have installed solar PV choose to utilise the 12I incentive for large capital outlays and not for solar PV given this incentive applies to any manufacturing outlay[vi]. Data on number of percentage of successful

applications for 12I in general and agriculture in particular housed at National Treasury are not available for the public.

Table 2 Tax Incentives for Renewable Energy Investment in South Africa

Legislation Income Tax Act 1962 (Act No. 58 of 1962)	**Incentive**	**Qualifying criteria**
Section 12I	Industrial Policy Tax deduction	Manufacturing Demonstrate minimum of 10% energy cost reduction
Section 12L	Energy efficiency tax exemption	Professional verification by SA National Energy Development Institution. Asset allowance to owner. Solar PV excluded
Section 12B (1) and (2)	Accelerated depreciation	Renewable energy machinery and implement costs First three years of 50:30:20 depreciation per year Asset allowance
Section 12K	Income and capital gains tax exemption	Income received from sale of Certified Emission Reduction Units
Section 11D	Research and development allowance	Tax saving on eligible research and development spending of 14% with extra 50% over normal 100% tax reduction at 28% deduction rate Subject to approval of Department of Science and Technology

Source[vii]:

Utility energy efficiency incentives

The Integrated Demand Management (IDM) programme of utility, Eskom, offers incentives under three sub-programmes of an Energy Service Company (ESCo), Standard Offer and a Standard Product programme. ESCo's are Eskom approved energy savings companies that have experts in defined markets that assist in identifying opportunities to reduce electricity consumption. The ESCo funds projects through energy performance contracts linked to energy savings where a third party designs, installs and finances a new technology with the contractor are paid according to achieved savings[vii]. The Standard Offer Programme is mainly geared towards demand side savings

in the commercial sector with a project size range from 50 kW to a maximum of 1MW[viii]. Under this Programme, Eskom pays a pre-determined and pre-published rate in c/kWh for the total energy savings after the applicant has implemented an approved energy saving programme and the rate is relative to technology used, for a contract period of three years. A payment rate of 42c/kWh is offered to energy efficient lighting systems, building management systems, electrical hot water systems and process optimisation. The payment rate for solar water geysers is offered at a rate of 70c/kWh. Applicants require the upfront costs of the intervention before receiving any payment from Eskom and Eskom only pays for savings during peak periods[ix]. The Standard Product programme was designed to improve energy efficiency by replacing inefficient technologies. To qualify for the rebate, the project must achieve demand reduction greater than 1kW and the energy savings must be greater than 2MWh/a. Further eligibility criteria include property ownership, fully paid electricity bills and valid tax clearance certificate[x]. These programmes however are currently on hold until further notice.

Manufacturing Competitiveness Enhancement Programme (MCEP)

The government Department of Trade and Industry (DTI) introduced the MCEP grant in 2012 with the aim to protect jobs and support the development of local manufacturing industry. Grants are available for capital investments, green technology expenditure and resource efficiency improvements for medium to large projects. The value of grant awarded is between 30 to 40% of expenditure with maximum value of R50 million and calculated based on the manufacturing value ad (MVA) at a maximum of 7-10% of MVA[xi]. In May 2015, the DTI published changes to the MCEP incentive threshold whereby new applicants with an investment of R50 million and above will no longer be considered for the incentive and are encouraged to apply for the 12L tax allowance for capital costs.

Green Fund (grants, loan and equity)

In 2012 the government's Department of Environmental Affairs initiated the Green Fund managed by the Development Bank of South Africa to offer grants, loans or equity in support of SA's transition to a green economy. The Green Fund aims to support innovative projects and responds to market weaknesses hampering the progress of the green economy by promoting innovative and high impact green programmes and projects. The fund seeks to reinforce sustainable development objectives through green interventions, building an evidence base for the expansion of the green economy and attracting additional resources to support South Africa's green economy development. The Fund has an allocation of R800 million with three funding areas and focus on high potential sectors i.e. Green Cities and Towns, Low Carbon Economy and Environmental and Natural Resource Management.

The eligibility criteria include an initial screening process to assess suitability. All applicants should meet criteria in terms of relevance, innovation, ability to upscale and/or replicate and the funding gap should be demonstrated.

Loans under Industrial Development Corporation's Green Energy Efficiency

The Green Efficiency programme is funded by the German Bank, administered by the Industrial Development Corporation (IDC) and provides loan between R1 million and R500 million at an interest rate of prime less 2% for renewable energy. The Fund supports energy efficiency and renewable energy projects that are coupled with a certain amount of local content. The conditions of the loan include a payback period of 15 years or less. To date, the IDC has not financed solar PV projects in the agricultural sector.

Energy Audits

The United Kingdom Department for International Development has provided funds in the order of R150 million to support reduction of energy demand in SA which is administered by the National Business Initiative under the Private Sector Energy Efficiency programme. It aims to improve energy efficiency, support reduced dependence on grid electricity and identify energy efficiency opportunities as well as reducing carbon footprints for small to large businesses.

COMMERCIAL BANKS

Foreign development finance institutions including the European Investment Bank, the German Bank and the French Development Agency provide SA commercial banks with credit lines, credit guarantees and funding for technical advisory service for clients to reduce carbon emissions and electricity costs. In 2009 the European Investment Bank committed to a € 40 million loan to First Rand Bank to promote renewable energy and energy efficiency projects in SA. The European Investment Bank partnered with Anglo-African Investec in 2011 to establish a €100 million renewable energy funding facility to promote energy efficiency and clean energy generation in SA. Project eligibility would be subject to Investec's criteria[xii]. In 2014, the European Investment Bank allocated €1.2 billion to investment in Africa, Caribbean, Pacific and South Africa with €46 million to be spent in Agriculture, fisheries and forestry. South Africa is still to get a share of this investment spending. To access these funds, the investment cost of the project should not exceed €25 million and the loan should not exceed €12.5 million. Investment costs must comply with at least one of the following criteria: building sector projects need an energy savings ratio of at least 30%, otherwise energy savings of at least 20% and greenhouse gas emission reduction of at least 20% (European Investment bank, 2015). The German Bank partnered with the IDC to establish a R500m facility for energy efficiency and small-scale renewable energy projects[xiii]. In 2004, The French Development Agency increased commitment to environmental protection with SA being a priority area for intervention. The Agency provides a fund in the region of €120m for discounted credit facilities at Nedbank, ABSA and the IDC to fund renewable energy and energy efficiency projects with eligibility being subject to respective institutions'

criteria[xiv]. The World Bank private sector arm, International Finance Corporation funds the Climate Change Investments in Africa Project to provide an advisory service to strengthen the capacity of financial institutions to finance clean energy projects[xviii]. The opportunities for funding incentives through commercial banks (as well as foreign agency funding where relevant) are discussed in the section that follows.

Nedbank

The French Development Agency has partnered with Nedbank and ABSA to provide concessional funding for energy efficiency projects. With no limit on project size, the incentive is a 7% rebate paid directly towards the loan amount in order to reduce the principal loan amount and encourage investment in energy efficiency and sustainability. The rebate may be used to improve the return of the project and or finance feasibility studies or lower the interest rate. Nedbank offers a Green Savings Bond for renewable energy investments which is essentially a fixed term investment with flexible terms, competitive rate (up to 7.5% per annum) and guaranteed returns. The bond requires a minimum of R1000 with no fees and no cap on maximum investment. The total Green Savings Bond balance was close to R1bn in 2012. A $100 million guarantee facility is being negotiated with USAID.

ABSA

In 2012, Barclays Africa group company ABSA entered into an agreement with the French Development Agency to offer loans to commercially viable clean energy or energy efficient projects. The incentive takes the form of a rebate for up to 7% of the loan amount, to clients qualifying for a loan, from R10 million up to R100 million, for energy efficiency or renewable energy projects with a loan tenor between 3 and 7 years[xv]. The rebate can also be used to reduce the lending rate i.e. subsidised rate between 220 and 250 basis points. The incentive intends to support projects that aim to reduce carbon footprints and electricity costs. ABSA cited benefit for Western Cape fruit client with 1MW rooftop solar PV installation, on a particular farm used to power refrigerator compressor rooms, has the potential to offset grid electricity consumption by 89%[xvi].

ABSA support clients can apply for free energy audit service provided by the National Business Initiative's Private Sector Energy Efficiency programme. Businesses with monthly electricity cost between R62 500 and R750 000 qualify for a free energy audit whilst businesses with annual electricity cost of R45 million or more qualify for a 60% subsidy of their total energy audit costs[xiv]. The Bank also offers a "Green Guru" service where a solar PV specialist (appointed by the French Development Agency) offers technical assistance free of charge.

Standard Bank

Standard Bank has responded to the REIPPP by supporting renewable energy projects by underwriting R9.4 billion worth of debt, providing currency and interest hedges, trading carbon credits and guarantee facilities. Standard Bank funds renewable energy projects using asset finance, structured deals and unsecured lending and to further support renewable energy projects. The Bank has entered into a R20 billion agreement with the Industrial and Commercial Bank of China[xvii] and has extended loans amounting to more than R15 billion[xvi]. In addition, via the insurance division, the institution assists projects that require switching to solar water heaters[xviii]. Standard Bank also provides upfront lending to project developers that meet the Clean Development Mechanism criteria and has arranged for the first green bond in the South African Debt Capital Markets. The bond will be used for social sustainability and environmental projects[xvi]. The Bank currently deals with energy efficiency solutions on a case by case basis, subject to credit assessments and the financial strength of clients. Capital funding is considered via a term loan which is repayable according to customer requirements.

First National Bank

First National Bank offers loans for energy efficiency for businesses with an annual turnover of less than R40 million and for solar repayable over 7 years to 10 years depending on whether the business premises is owned or leased. Clients can approach the Bank for funding once they have met with specialists in the field, no further technical support services are provided by the Bank. The offer is further incentivised with a 3-month capital payment holiday at the start of the loan. Accurate figures to the level of funding provided to the agricultural sector are not available.

Landbank

The Bank considers financing solar PV in agriculture on a mortgage bond only and over a 10 year term. A solar PV system would be deemed a permanent fixture on the farm and the interest rate would be determined upon application, subject to the applicant's financial position.

Investec

The European Investment Bank provided 100 million Euros to Investec to promote clean energy with projects are funded over a three year period.

Mercantile Bank

In partnership with the World Bank's International Finance Corporation, Mercantile Bank offers a credit facility for energy efficient projects[xvi].

SASFIN

The World Bank private sector arm, International Finance Corporation provided SASFIN with a 10 million dollar credit line to be used for asset finance for energy efficiency and renewable energy projects at preferential rates.

African Development Bank/Africa Renewable Energy Fund

The equity investment funding mechanism for, independent power producers supports project development and implementation of energy efficiency and renewable energy projects between U$10 million and U$30 million, including solar, wind, biomass, hydro, geothermal and stranded gas technologies.

Evolution One Fund

The Fund focuses on clean energy projects in the subsectors listed below:

- Cleaner energy generation and energy efficiency
- Cleaner energy production technologies and processes
- Air quality emissions control
- Water quality and management
- Waste Management
- Agribusiness and forestry (e.g. food production, biomass, agricultural residues, aquaculture)
- Natural products, organics and natural health
- Sustainable buildings and environmental real estate.

Under this finance mechanism, the minimum equity investment size is R10 million with a maximum limited to no more than 15% of the fund's total capital commitments[xviii].

As banks become more familiar with due diligence and technology performance risks in utility scale market one would assume this would positively impact other market segments. These assumptions are based on cross-pollination between different teams within banks that service different market segments generally Capital division for utility scale, Business banking division for commercial and industrial and Retail division for residential segments.

The internal segmentation in commercial banks is characterised by target market client and associated product and service offering. Hence agriculture clients' solar PV financing applications will be serviced by different divisions. By way of example, the utility scale solar PV market segment is "serviced" by Capital division of bank whilst the commercial and industrial solar PV market segment by business banking division and the residential solar PV

market segment by retail finance division. From an agriculture clients' perspective this means that a farmer making an application in his personal for farm home will be serviced by retail and a wine cellar applying for solar PV to cool wine grapes by business banking or large wine wholesaler applying for solar PV application to generate energy to reduce peak electricity demand for capital.

Trends

An emerging trend is entry of utility scale market segment project developers and Engineering Procurement Construction (EPC) contractors into commercial and industrial market segment as it provides "greater sustainability, certainty and ability to offset running costs incurred in utility scale before project commissioning". The entry into this commercial and industrial market which includes the agriculture sector presents opportunity for commercial banks dominating in utility scale market to expand their service offering. Most market players in solar PV commercial and industrial market segments are situated in Western Cape and Gauteng with high levels of integration in downstream and upstream activities. Many service providers working in medium commercial market segment also operate in the residential market segment characterised by less than 1MW solar PV.

It is paramount that banks provides clarity and communicate clearly what the solar PV financing solutions are in terms of loan due diligence requirements, debt tenors and interest rate amongst others to prospective agriculture clients irrespective of banking division that services the client's business operations.

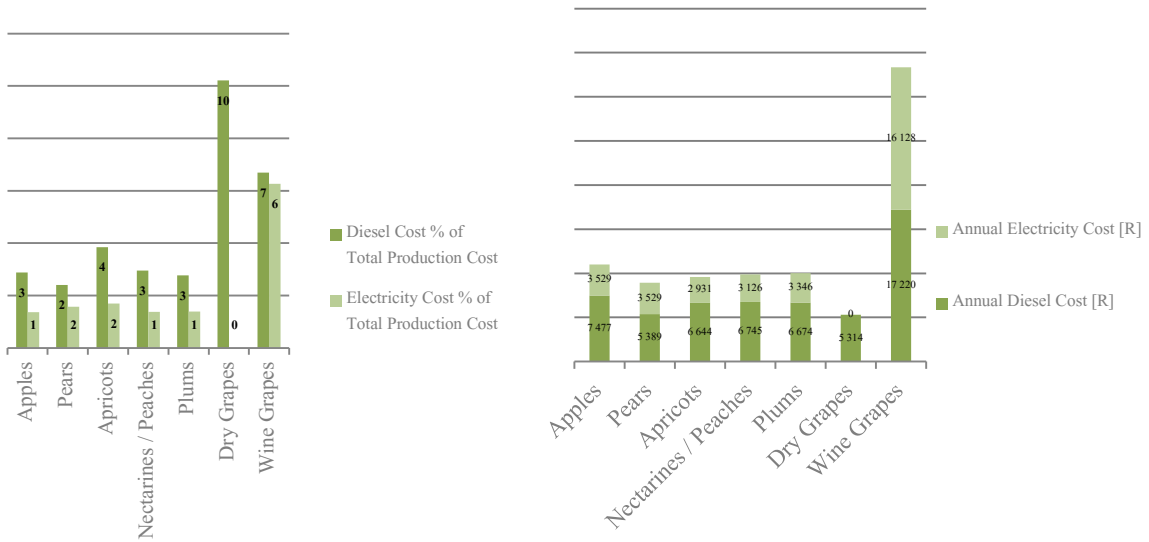


Figure 3 Energy Cost in relation to Total Production Cost in Wine and Fruit Sector in 2012[4]

The year on year electricity cost increases of 7% to 31% from 2008 to 2013 has had a significant impact on 3 233 wine grape producers, 564 wine cellars and 103 wholesalers in SA's 9 wine regions[4]. Average electricity cost varies

from between 9 wine production regions of Stellenbosch, Paarl, Robertson, Swartland, Breedekloof, Olifants River, Worcester, Northern Cape and Klein Karoo.

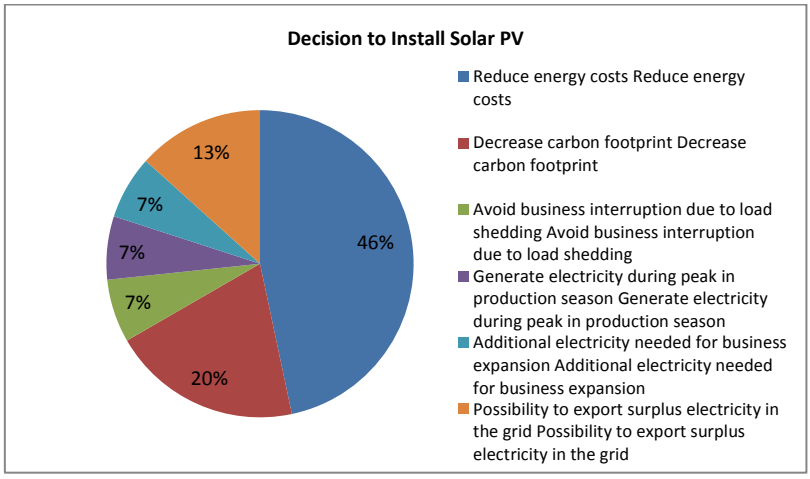
The technology size ranges from 10kW to 1MW with off- grid systems are generally installed with power supplemented by grid synonymous and to a lesser extent autonomous stand-alone systems in the industrial sector. "Fly by night" service providers offering poor quality products and service has created negative perceptions. Cost is determined by technology size and mounting system with ground mounted systems generally more expensive than roof top systems.

The decline in pay-back period from 12-15 years to 5-7 years in the last few years has resulted in increase in this market segment. EPC companies are responsible for site identification and evaluation; client needs analysis, energy modelling, design, installation, commission and permitting. Operations and maintenance activities include daily monitoring of plant performance and annual servicing. EPC companies generally provide training in basic operations, emergency operations, safety procedures and cleaning of solar arrays. Solar PV systems comprise a PV module, inverter, mounting structure and tracker, cabling and batteries. Crystalline PV modules dominate the commercial and industrial PV market segment. Installations in agriculture sector have mostly been rooftop mounted systems with few isolated cases of ground mounted systems. In rooftop systems using crystalline technology in commercial and industrial market segment such as agriculture the PV module is the largest cost component (45-60%) followed by inverters (12-13%), mounting hardware (7-12%) and rest of plant (5-15%) with rest spent on preliminary and general (2-9%) design and installation fees (8-13%)[3]. In the fruit and wine sector solar PV has been installed to reduce electricity consumption during peak demand periods mostly for cooling and irrigation pumping.

Survey Results

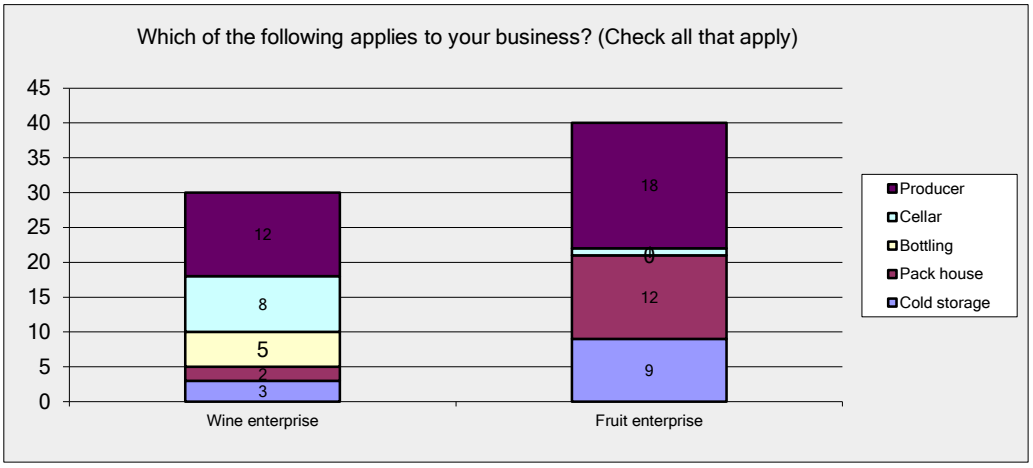
An online survey was administered to Confronting Climate Change email list server of more than 1000 individuals to determine energy consumption, perceptions about solar PV, information sources accessed for solar PV, awareness of current incentives, factors that determine decision to install solar PV and preference for finance instrument for solar PV (tenor and interest rate). Commodity and export organisations were also approached to assist with dissemination.

Figure 4 Factors determining decision to install solar PV



Source: Survey

Figure 5 Application of Solar PV



Source: Survey

Finance

Successful finance applications to commercial banks for agriculture solar have been for term loan over average tenure of 3-5 years with varying interest rates. Reason cited for not providing solar PV on hire purchase is that there is no current second hand market for solar PV modules in SA and with rapid advances in technology new models are preferred. Financing for leasing solar PV is in its infancy in SA with a few players offering solutions. Powerway PV SA partnered with Inno-vent Rental and Asset Management Solutions in 2014 together with insurers, TÜV Rheinland and Marsh, to offer a lease finance for roof mounted solar PV in the commercial, industrial and

residential market in SA. SASFIN offers lease finance as part of their current specialised equipment solutions' offering.

Table 3 Sources of Finance for Solar PV

Source of Finance	**Response Rate**
Debt finance from current bank	5
Debt finance from other financial institution	1
Own equity	5
Other (please specify)	0

Source: Survey

Table 4 Willingness to Pay for Financing Solar PV

WTP	**Response Rate**
Prime +1%	2
Prime +2%	1
Prime +3%	1
Prime +4%	1
Non responses	30

Pay back periods

Financing terms and electricity tariffs largely determine pay back periods that range from 8 to 15 years. The low rate of survey responses (81%) related to question of pay back periods may indicate lack of knowledge or information.

Figure 5 Pay back periods for Solar PV in Agriculture

Pay-back period	**Response rate**
	Number of responses
1-3 years	1
3-5 years	2
5-7 years	1
More than 7 years	2
Non responses	29

Source: Survey

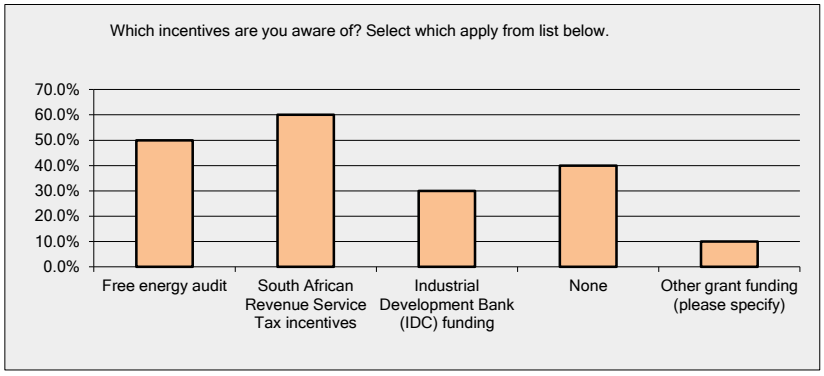
From responses to question on awareness of incentives for solar PV, it appears that there is little awareness of free energy audits, tax incentives and grant funding available with one respondent making reference to DTI MCEP grant.

Table 6 Source of Information on Solar PV

Source of Information	**Response rate**
Consultant	7
Solar PV technology service provider	6
Web search on the internet	7
Friend, family or business associate	6
Financier or Investor	7
Non responses	2

Source: Survey

Figure 6**Awareness of Incentives for Solar PV**



Source: Survey

Conclusions

The study concludes with key findings and recommendations to enable wider scale adoption of solar PV in agriculture.

- Government support and policies have played a key role in enabling the significant growth in global solar PV industry in recent years.
- Incentives fall into categories of *tax incentives, cash grants, preferential debt tenors and interest rates* offered by commercial banks and development finance institutions as well as free technical advisory service.
- Solar PV is seen as an attractive option to reduce electricity demand for fruit and wine sector.
- No formalised standards or criteria exist to vet current solar PV service or technology providers.
- Service offering is packaged as financial product with non-financial service such as energy audit and or technical advisory service.
- Online survey limited reach with farmers (under-reporting). Project extended to include face-to-face interviews in the Western Cape

Recommendations

- Introduce information exchange protocol within different banking divisions servicing utility, residential as well as commercial and industrial market segments to improve due diligence, staff competencies and exposure to increase successful deal flow. Provides clarity and communicate clearly on solar PV financing solutions in terms of loan due diligence requirements, debt tenors and interest rate to prospective agriculture clients

- Offer agriculture clients a non-financial service solution such as free energy audit, portal to access key information and exchange with other clients for e.g. chat room or email list serve, information or exhibition days with technology providers
- Finance product offering to be in range in debt tenor and interest rate of to be inserted when survey responses improve
- Mainstreaming best practices for energy efficiency via extension services can contribute to more resilient and sustainable agriculture, and contribute towards a finance product offering (debt tenor and interest rate) appropriate for fruit and wine farmers. The utilisation of extension services to can improve survey response rates thereby providing an improved understanding of the determinants of demand is critical to developing incentives to enable wider scale adoption of renewable energy to reduce production cost, enable farmers to lower their carbon footprint which has increasingly become a market access requirement for export markets and support development of shift to diversified energy mix and green economy.

[i] Department of Mineral and Energy Affairs. (2002). *Energy Outlook for 2002.* Retrieved from http://www.gov.za/sites/www.gov.za/files/DME_energy_outlook_23012004_0.pdf

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