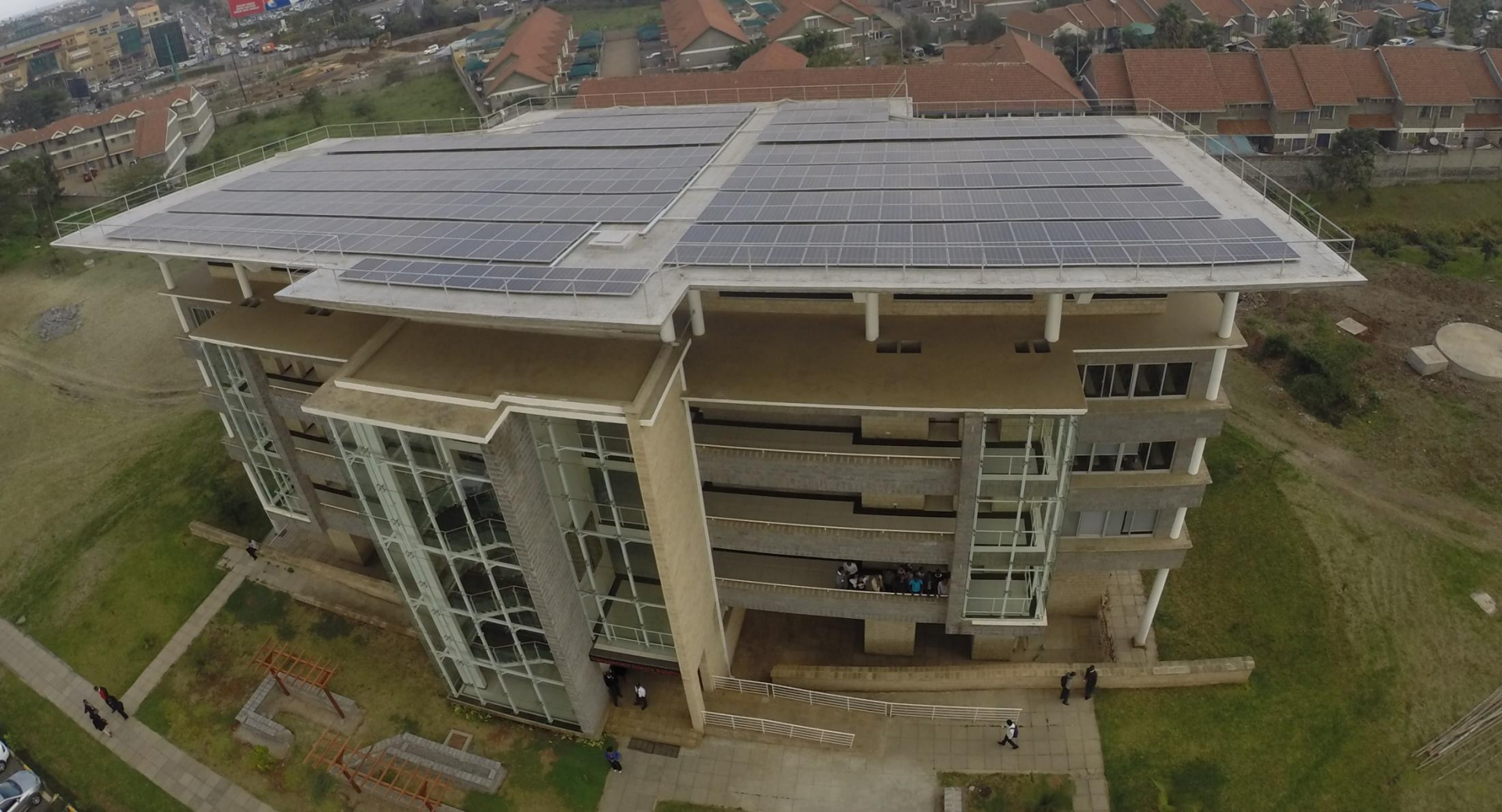




Distributed energy generation at SERC

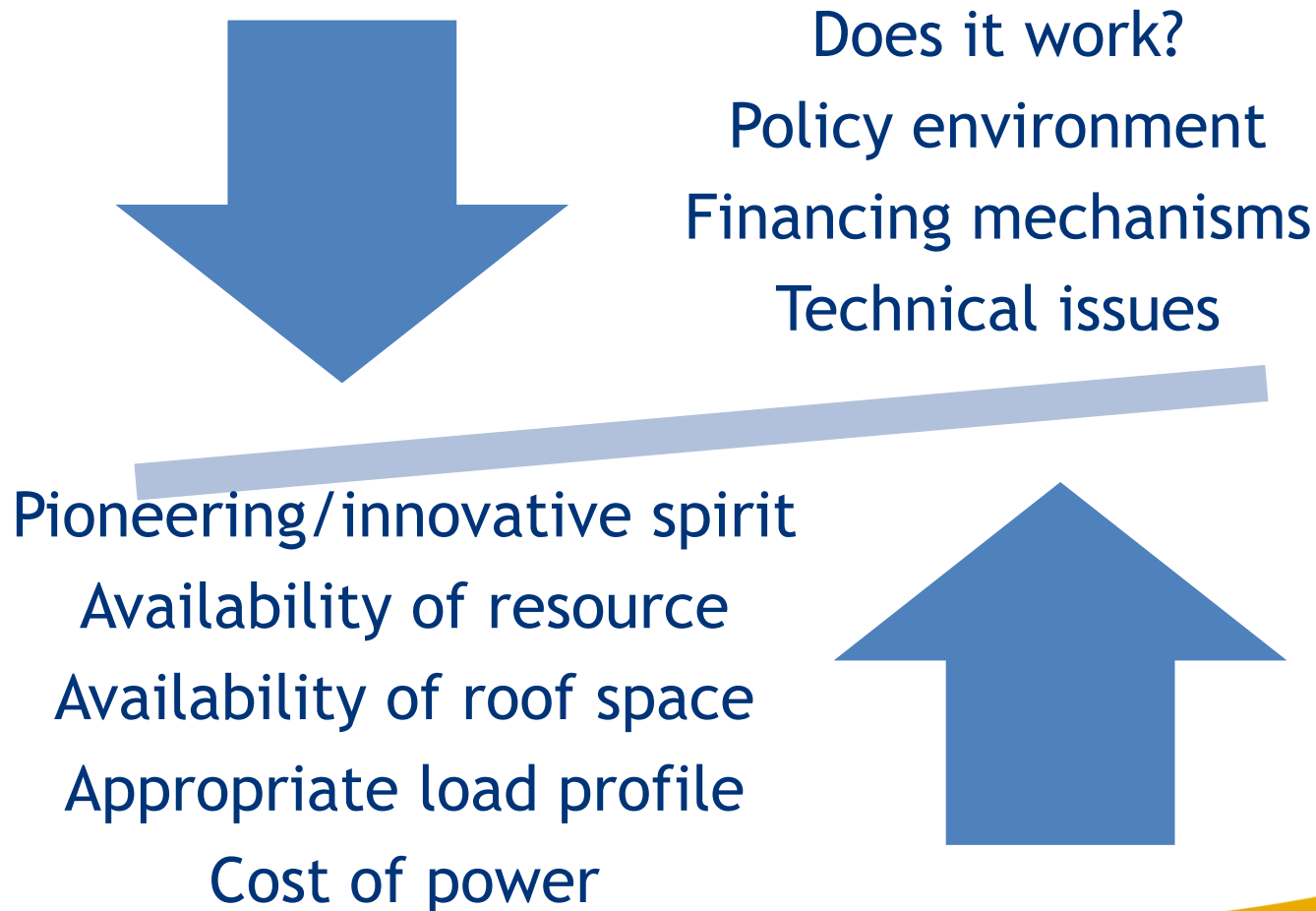
Case study of the 600kW solar PV system

October 2015



Strathmore
UNIVERSITY

The 600kW grid-connect system *what were the catalyst?*



The 600kW grid-connect system *does the technology work?*

- In 2010, installed an 10kWp system in the student centre building for captive use only
- Provided good data on PV performance in our environment (dust, heat, irradiance)
- Average annual yield measured at 1,300kWh/kWp pa.

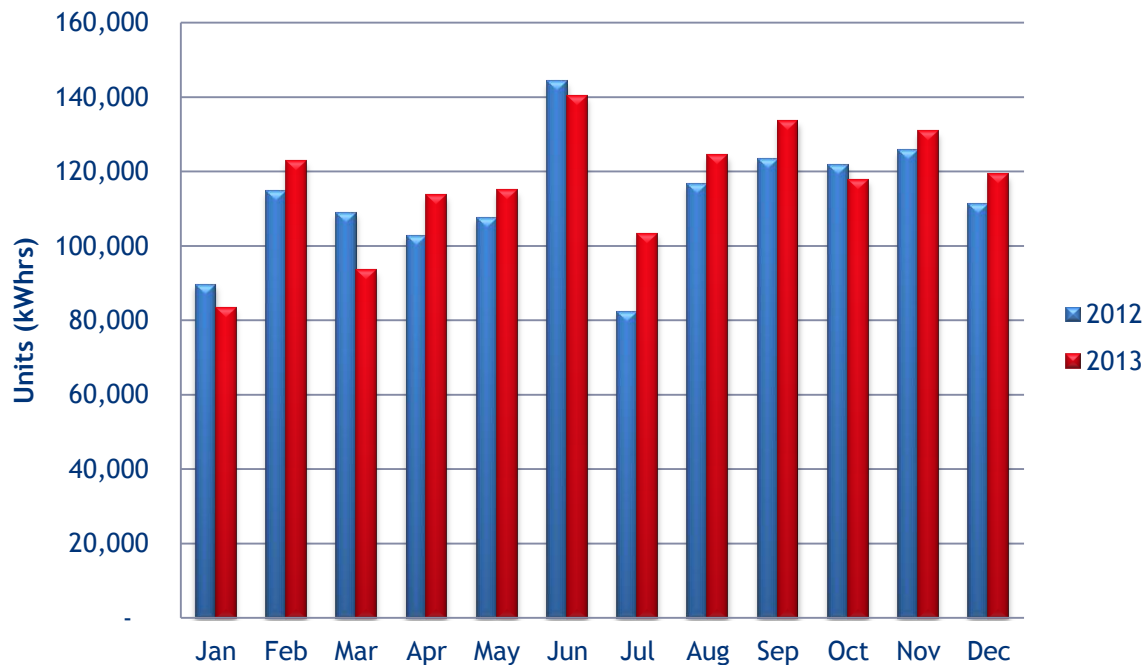


Distributed generation (DG) refers to power generation at the point of consumption. Generating power on-site, rather than centrally, eliminates the cost, complexity, interdependencies, and inefficiencies associated with transmission and distribution. Like distributed computing (i.e. the PC) and distributed telephony (i.e. the mobile phone), distributed generation shifts control to the consumer.

The 600 kW grid-tied PV system

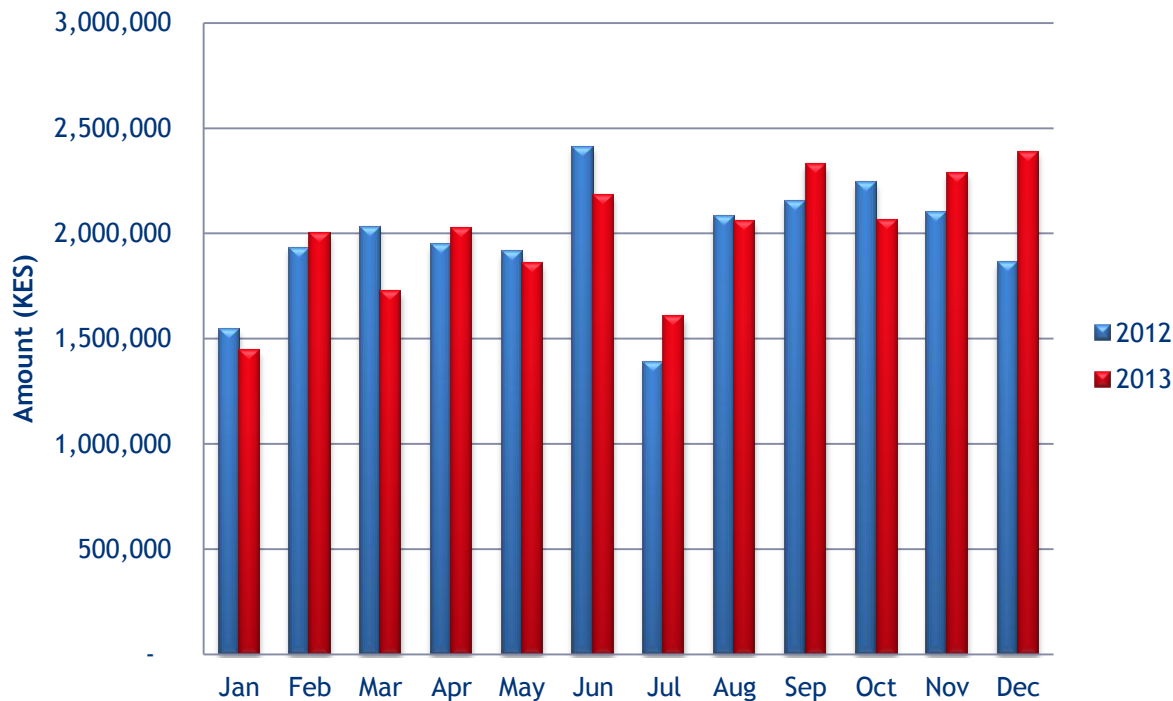
Current power costs

- 1.37 million units of electrical energy are consumed per year in Strathmore at a cost of about USD 273,000 per annum (US cents 20/unit)



The 600 kW grid-tied PV system

Current power costs



1.4 megawatt of installed power back-up capacity in the form of three diesel generators (750kW, 400kW and 250kW) - spend approx KES 1 million per annum

The 600 kW grid-tied PV system

Financial mechanism

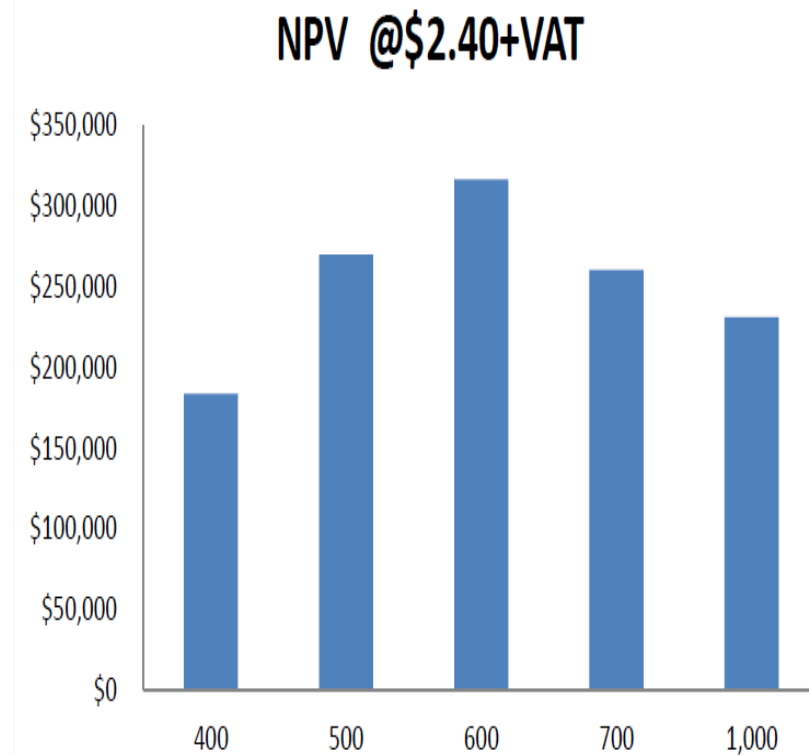
- A simple calculation with the existing financing mechanism showed clearly that investing in solar energy does not make financial sense, despite the ever decreasing cost of solar modules and inverters.
- The AFD green line of credit - 4.1% per annum, 10 years payback period and 1 year grace period made all the difference.

Mortgage VS paying Rent

The 600 kW grid-tied PV system

System sizing

- Once the finances were made right, the next issue was the technical aspect.
- Bidding process, award to QuestWorks Co.
- Size, IRR study
- 0.5 - 10 mW; 12 cents of USD per unit
- Current price 20 US cents paid to utility

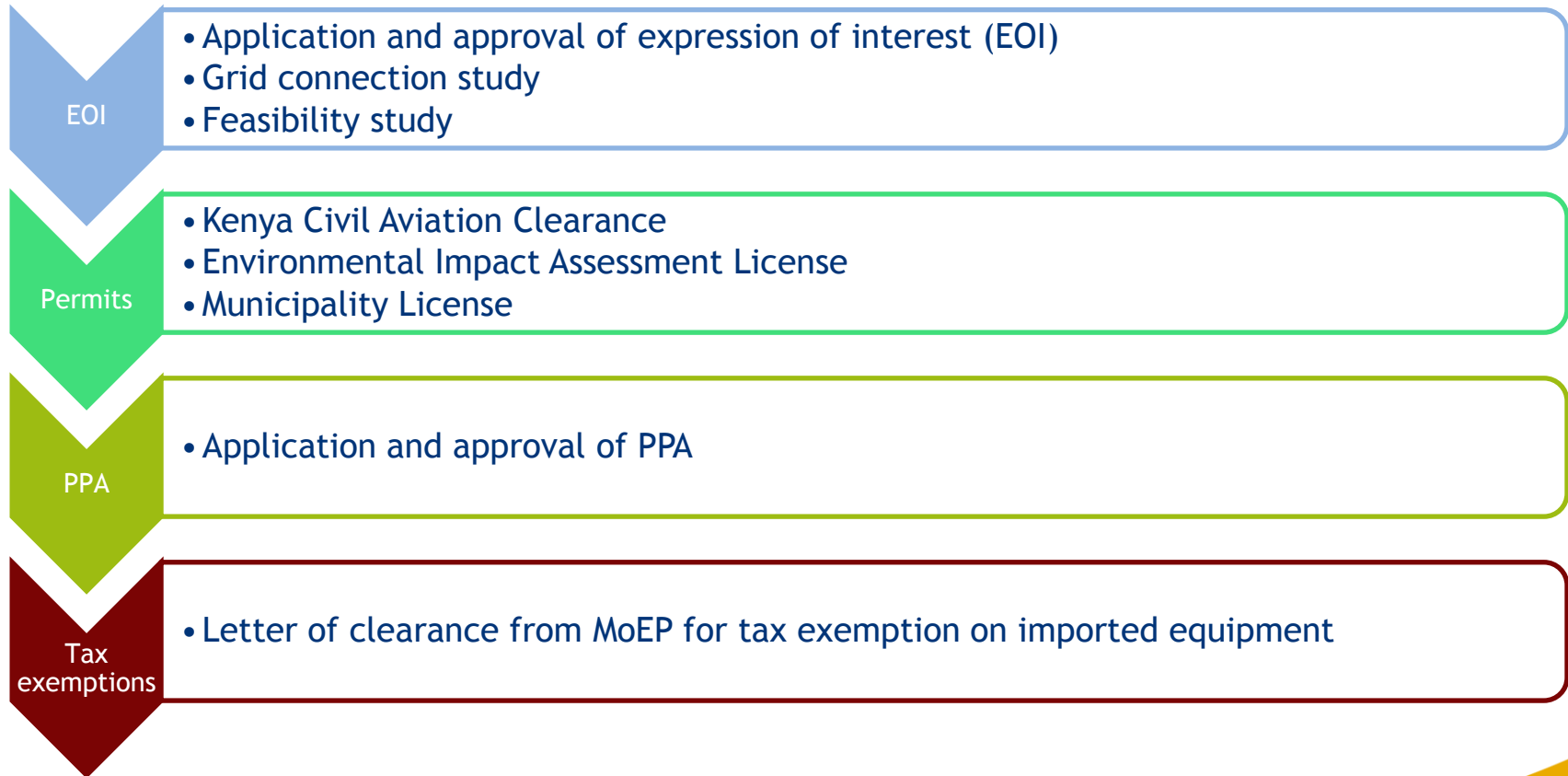


The 600 kW grid-tied PV system

Availability of roof space



Regulatory Process



The 600 kW grid-tied PV system

Timelines

INTERNAL APPROVAL RECEIVED

FINANCING SECURED

GROUND BREAKING

SYSTEM INSTAL PROJECT END

23 Nov 23 Dec 23 Jan 23 Feb 23 Mar 23 Apr 23 May 23 Jun 23 Jul 23 Aug 23 Sep 23 Oct 23 Nov 23 Dec 23 Jan 23 Feb 23 Mar 23 Apr 23 May 23 Jun 23 Jul

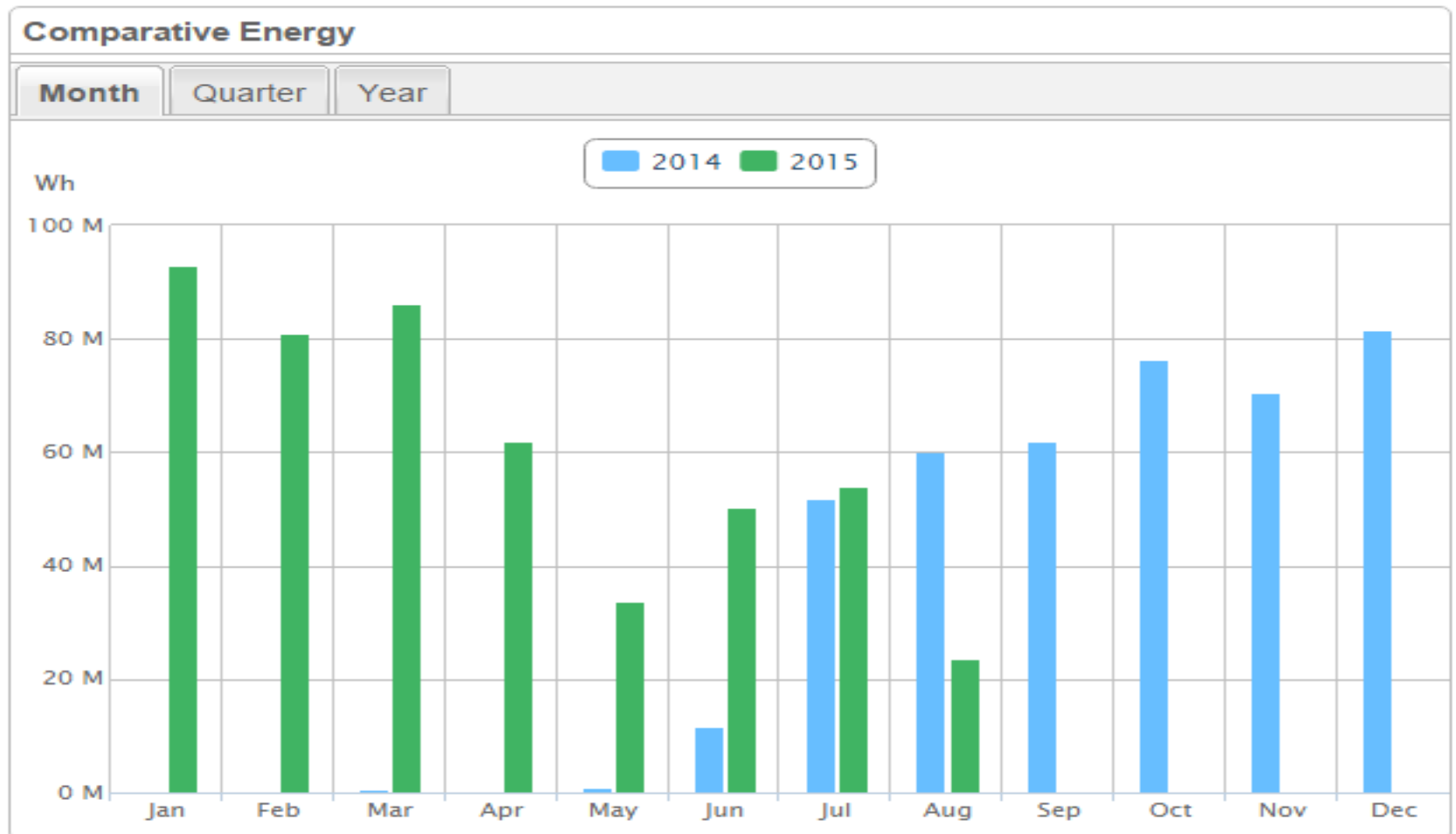
EPC CONTRACT AWARDED

TEST SYSTEM INSTALLED

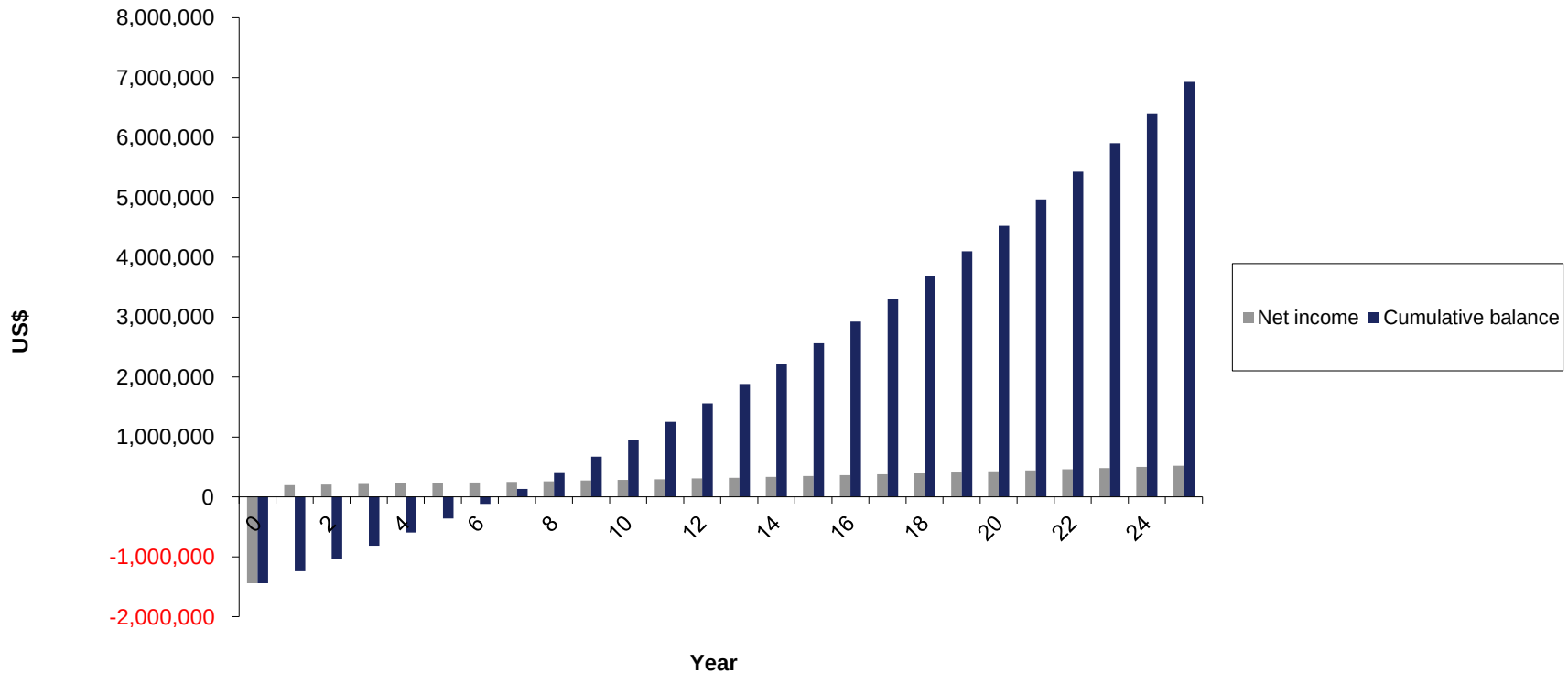
SYSTEM COMMISSIONED



One year later...



Projected cumulative project balance and net income for 25 years



Awards & Recognition

- PPA finally signed with KP in mid-October 2015
- Won the **Private Sector award** in the **KAM Renewable Energy Project Awards 2015** during the **Kenya Clean Energy**



Challenges/Conclusions

- PPA process
- Dirt & dust - major issue
- Grid instability - losses in production
- An excellent tool for applied research on solar PV performance in SSA as the monitoring system is quite comprehensive allowing for performance grading at single panel levels.
- The system serves as a training tool for engineers in Kenya
- Awareness creation amongst students



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