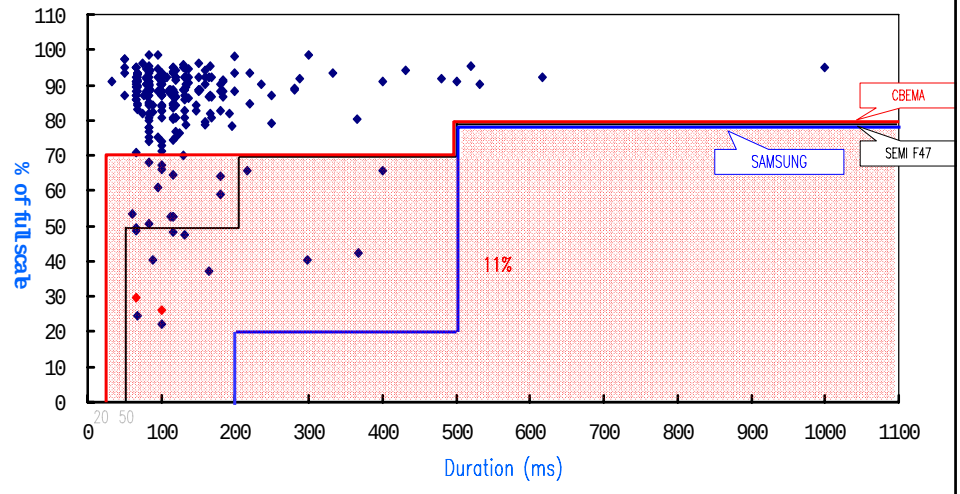
Application of Custom Power to Mitigate Power Quality Disturbances

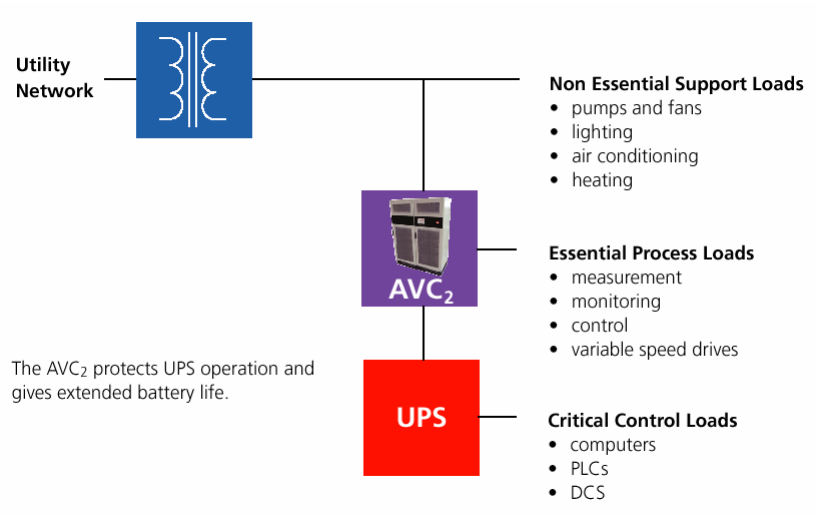
By:- Vernon Pryde

continuous clean power

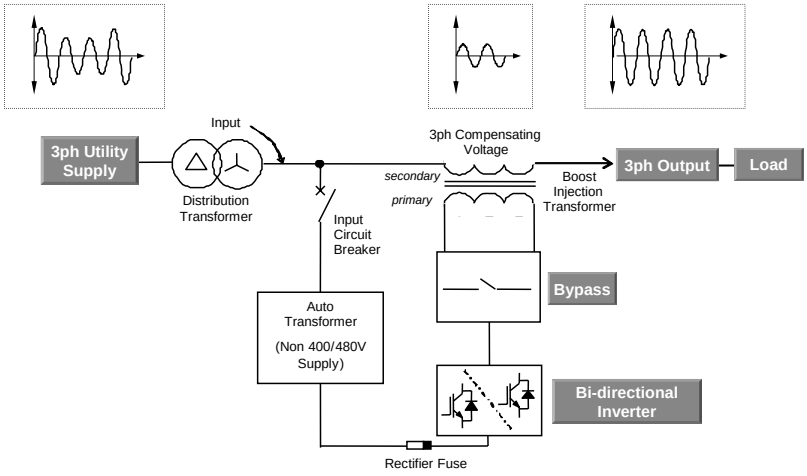
Voltage Sag Semiconductor FAB 1995-2005



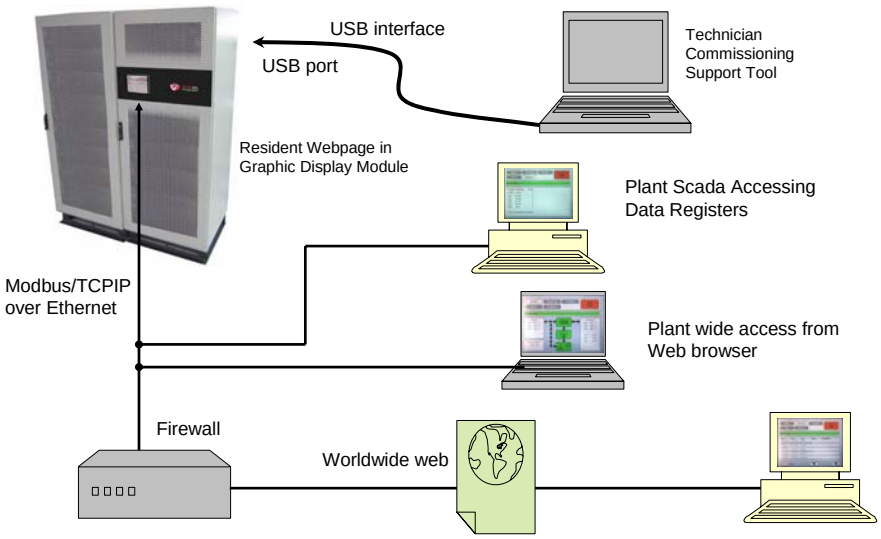
Typical Factory Configuration



Single Line Diagram



Full Web and Plant System



Vectek Case Studies

1.	Bottling Plant	Florida USA
2.	Plastic Extruder	Auckland New Zealand
3.	Solar Panel Manufacturer	Maryland USA
4.	Semiconductor FAB	China
5.	Printing Press	USA
6.	Container Crane	Hong Kong
7.	Church Vapour Lights	Samoa

Case Study One:

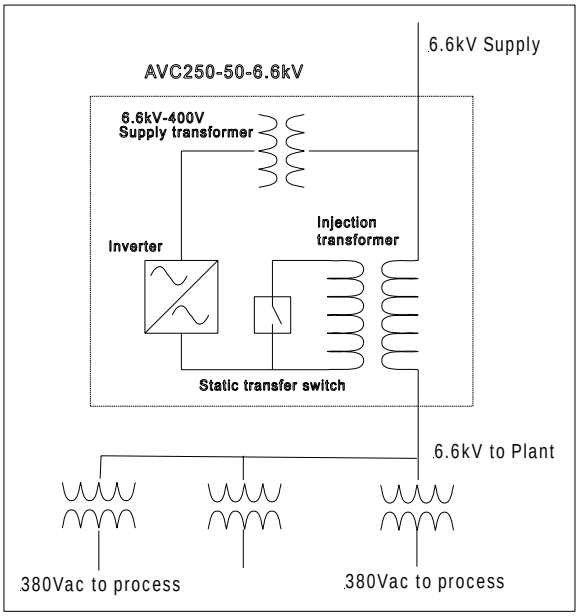
Rum Bottling Plant,
Jacksonville,
Florida.

2MVA, AVC, Rum bottling, Jacksonville, Florida.

AVC Installed Over Christmas 2003

26KV MV Installation

Medium Voltage AVC



The “Product” High Speed Bottling Line

Rum Bottling Site Data

- Working 2 x 10 hour shifts = 3,750 cases/hr
- 9 Bottling Lines
- Facility produces 75,000 cases per day
- Largest size bottles run at 400/min
- Miniatures run at 1000/min
- When an unexpected stoppage occurs it can take over one hour to restore production to normal line speeds
- Factory stated maintenance costs $350k p.a. for replacement parts damaged by unplanned stoppages

Factory Assumptions

- If lines are down for 40 minutes then 2500 cases are lost
- If a value of U$10 per case were assumed, this would equate to U$25,000 per event
- The actual figure may be higher, say 40k-50k per event
- No details are available for scrap costs, lost taxes, rework, overtime to recover lost production etc

Assumed Factory Savings

- Historically 20 unplanned stoppages p.a. - $500k cost
- Factory volunteered - maintenance costs cut by $250k p.a.
- Jan-Dec 05 490 events occurred below 87% (IEEE Level)
- If only 10% of events would have stopped production

  this would be 47 events @ $25k each = $1,175,000
- Total Assumed Savings = $1.425 million
- The Assumed payback period is less than 1 year

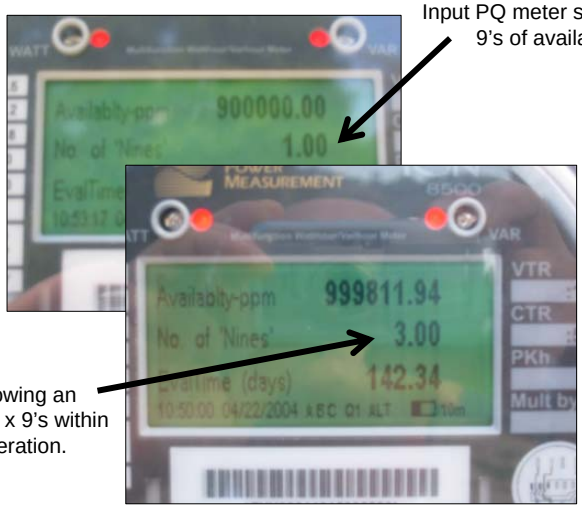
History Of Events

	>87%	>80%	>70%	>60%	Lost
Jan	3	2	3	1	1
Feb	2	3	1	2	0
Mar	3	2	1	4	1
Apr	1	4	0	0	1
May	10	2	1	4	0
Jun	13	16	15	10	1
Jul	112	15	1	5	3
Aug	16	9	2	5	0
Sep	57	35	12	24	7
Oct	4	4	0	2	0
Nov	14	26	10	2	0
Dec	13	5	0	0	0
Total	248	123	46	59	14

Lost events include 7 hurricane induced complete outages

Hurricane Frances Sweeps Into Florida

Installed On Time, On Budget



Input PQ meter showing 1 x 9's of availability

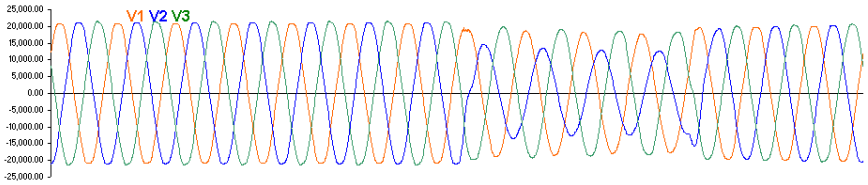
Output PQ meter showing an improvement to nearly 4 x 9's within only 142 days of operation.

2MVA, 26KV installation

Transmission Sag Correction

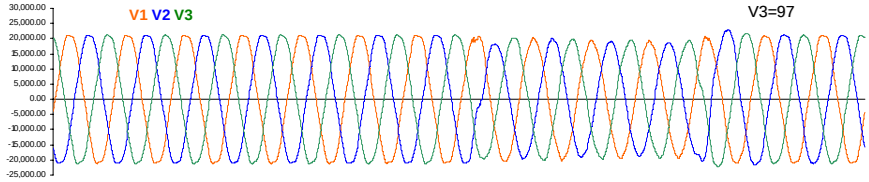
Input

V1=82
V2=58
V3=87



Output of AVC

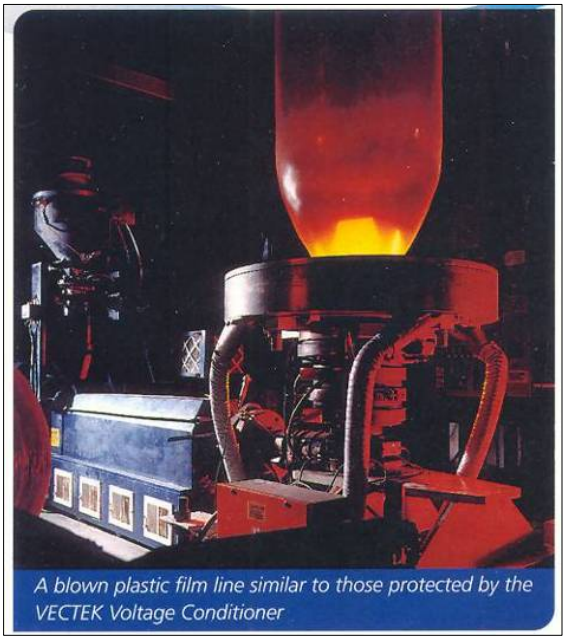
V1=97
V2=98
V3=97



Case Study Two:
Amcor Flexibles New Zealand

- Plastic Extrusion Company
- Auckland New Zealand
- Installed AVC December 1998
- 1MVA 400V 50Hz

Amcor Flexibles



A blown plastic film line similar to those protected by the VECTEK Voltage Conditioner

Problem

- Extruded barrier film. Up to 9 layers
- Nylon particularly problematic
- Long set-up times
- 30 minutes to recover a fault
- Multilayer scrap is non-recoverable
- Less than 100% rolls are not accepted

Cost

- Scrap material $2000 / event minimum
- Depending on roll build. 4 hrs/roll
- 24/7 operation. Electrician callout per event
- Unless restored within 30 mins, pull-down of extruder

The Solution

- Trailed 300kVA on one of 6 extruder lines
- Operations staff demanded unit for “their” line
- 1000KVA Installed Dec 1998 (10 years in operation)
- Amcor MD “before the AVC, the slightest flicker of the lights and we had trouble, but now we never worry”

Show of Faith

- May 2005, Amcor installed another 1000kVA unit at their expanded plant. This was 7 years after buying the first unit!

VECTEK NEWS

Vectek Voltage Conditioner (AVC) Protects Entire Plastic Extrusion Plant

September 2005

Vectek recently installed a second large scale Active Voltage Conditioner (AVC) into Amcor Flexibles plant in Albany Auckland. This unit was installed as an upgrade to the existing Vectek unit that was commissioned way back in 1998 and has been protecting this busy plastic extrusion process for the last 7 years.

Further Expansion: The plant is expanding rapidly and further equipment is being installed which requires protection against the most common problem of voltage sags. The new Vectek Voltage Conditioner is rated at 1MVA with a 30% boost capability where as the original unit was rated for 1MVA and 18% boost. After seven years of operation the plant has decided that they require increased protection for their 9 layer plastic extruders and their expanding plant.

Repeat Orders: The procurement of a second unit after having the first unit for 7 years shows a very pleasing trend amongst Vectek AVC clients. Amcor joins a growing list of Vectek clients purchasing additional units. There is no greater endorsement of a product than someone who purchases another unit after owning the first for 7 years.

100% Reliability: Paul Butler reports that after 6 years operation the unit was taken out of service for the first time and all the fans were replaced under routine maintenance. Other than this, the unit has been continuously on line without fault.

On time and on budget: Amcor's project manager Scott Leaning reports that the procurement and installation went exactly to budget and on time, and that the Vectek Voltage Conditioner is performing to expectation.

Vectek 1MVA 400V AVC installed at Amcor Flexibles

Paul Butler and Scott Leaning in front of the new AVC

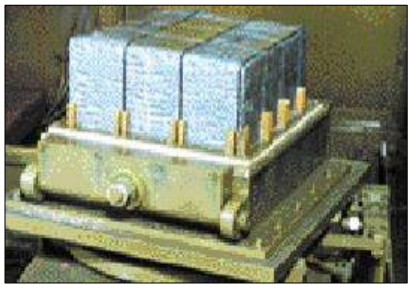
Email: info@vectek.com www.vectek.com

Case Study Three:
Solar Panel Manufacturer
Maryland

Frederick, Maryland

AVC Installation site 2002

Production Of A Solar Cell

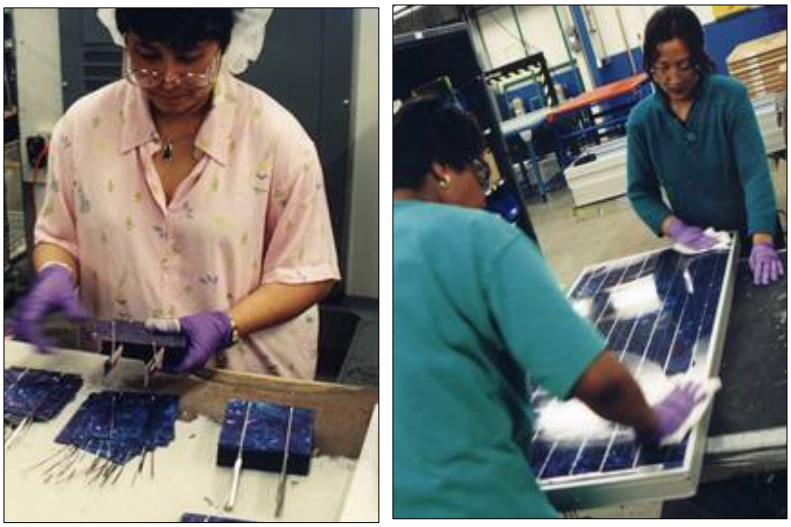


Silicon ingots are cast in an electric furnace, then mounted on the saw carriage
As presented to the saw they are valued at $2000/brick

Abrasive Wire Saw

Endless loop abrasive wire saw, simultaneously slices 2 bricks over a 4 hour period.

Assembly Process



6” wafer processed and ready for assembly into matrices for mounting and interconnection.

The Problem

- 15 wafer saws susceptible to sags
- Wire breaks damaged 2 bricks
- Replacing the wire took 6 hours

The Cost

- Broken saw wire, 2 bricks @ $2000
- Up to 15 saws on site
- plus lost production down stream
- plus downtime
- Maintenance costs
- $4000 to $40,000 per event

The Solution

1600kVA AVC installed Aug 2002

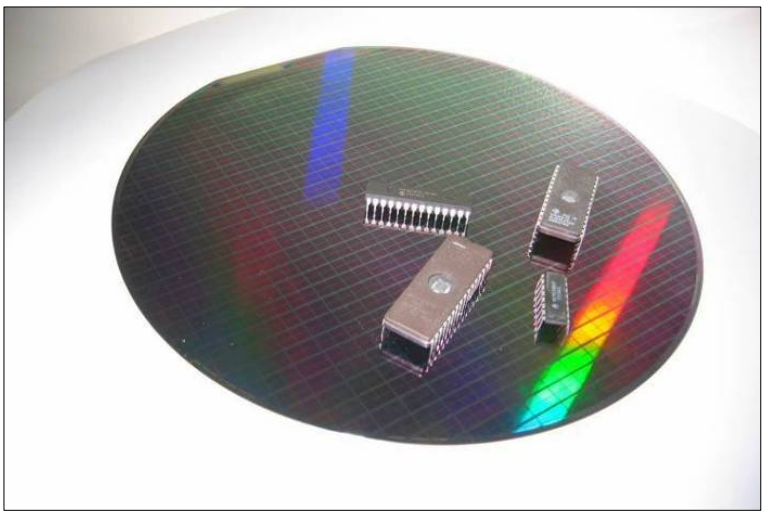
The Results

- Solar Manufacturer says “the results were dramatic. Productivity losses on protected saws were eliminated”
- “Pay back was under one year”
- “Production managers asked why only half the plant was protected”
- During thunderstorms, unprotected plant was shutdown.

Show of Faith

- Finally, after 3 years the plant purchased a second unit to protect the remaining facility.

Case Study Four: Semiconductor FAB Plants



The most sensitive industry to voltage sags

FAB environment. The most PQ sensitive industry

The Problem

- The “series” nature of the process
- Any disturbance results in a total loss
- Major events, in excess $1million
- No rework, days to recover
- Hugely competitive business

One of the worlds leading semiconductor FABs had a MV switch fail during 2007. The plant went down for 8 hours. They announced a $50 Million loss to the stock market for this 1 event.

The Traditional Solution

UPS's

- large floor space
- low efficiency
- high capital cost
- significant operational costs
- growing resistance to "battery" based solutions.

The New Modern Solution

AVC's

- 98-99% efficiency
- Small foot print
- Extremely high integrity
- Low maintenance

>400MW Installed Units

#3 Memory Manufacturer

#1 LCD Manufacturer

1.5MVA 208V AVC

Protecting multiple FAB production tools

Process Protection

75KVA Protecting Vacuum Pumps

650KVA Protecting semiconductor FAB line

50 x 650kVA AVC In FAB Plant

Sag Depth	175kVA	75kVA	50kVA	25kVA	Avg
10-20%	1	4	2	4	2.8
20-30%	7	6	9	4	6.5
30-40%	19	16	20	21	19.0
40-50%	5	6	1	3	3.8
>50%	0	0	0	0	0.0

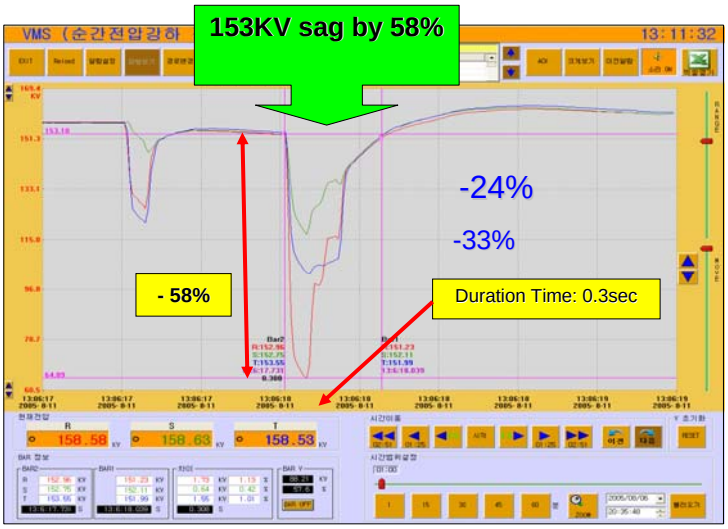
Logging for one month
including a snow storm

>100MW of AVC's inside a 200MW FAB Facility

>75MW In Two Plant Rooms Wuxi China

52 x AVC1250kVA Units in Memory FAB, Korea

Voltage Sag 13:00hr Aug. 11. 2005



Over 300 pieces production machinery protected.

Case Study Five:
High Speed Printing Press Florida

- A high speed printing press in Florida
- Multiple sags during the “Storm Season”
- The cost / event was not large, however,
  the number of events was
- Significant “clean-up” and “re-start” time after each sag.

High Speed Printing Press

Hi-speed, multi-colour printing presses

3MVA AVC Controller Section

3000KVA, 480Vac, 60Hz Vectek AVC

Out Door 3MVA Installation

Case Study Six:
Container Crane Hong Kong

- Air Cargo Handling
- Automatic Stacker Reclaimer Crane
- Hong Kong
- Installed AVC March 2007
- 300kVA 400V 50Hz

Hong Kong Airport

1000’s of containers per day

Automatically stacked and reclaimed, by robotic container crane system

Weather Created Voltage Disturbances

- Crane malfunctions:-
  - Jambs a container mid cycle
  - Crane has to be manually reset
  - Staff have to physically enter the crane
  - Risk of personal injury. Safety Issue
  - Damaged Container and Crane
- Airliner penalty charges for delayed flights

AVC Solution

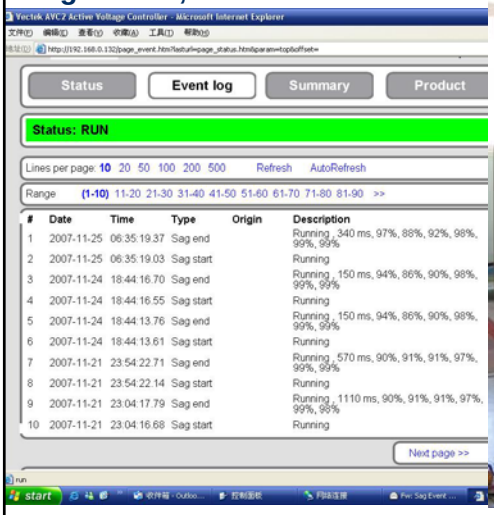
- Eliminates Voltage Sags from Crane
- Corrects sags when crane lifting (motoring)
- Corrects sags when crane is lowering (regenerating)

Case Study Seven:
Protecting Church Vapour Lighting

Protecting Church Vapor Lighting in Samoa

Island power was causing premature light bulb failure
(some lights actually falling from the ceiling onto the congregation!)

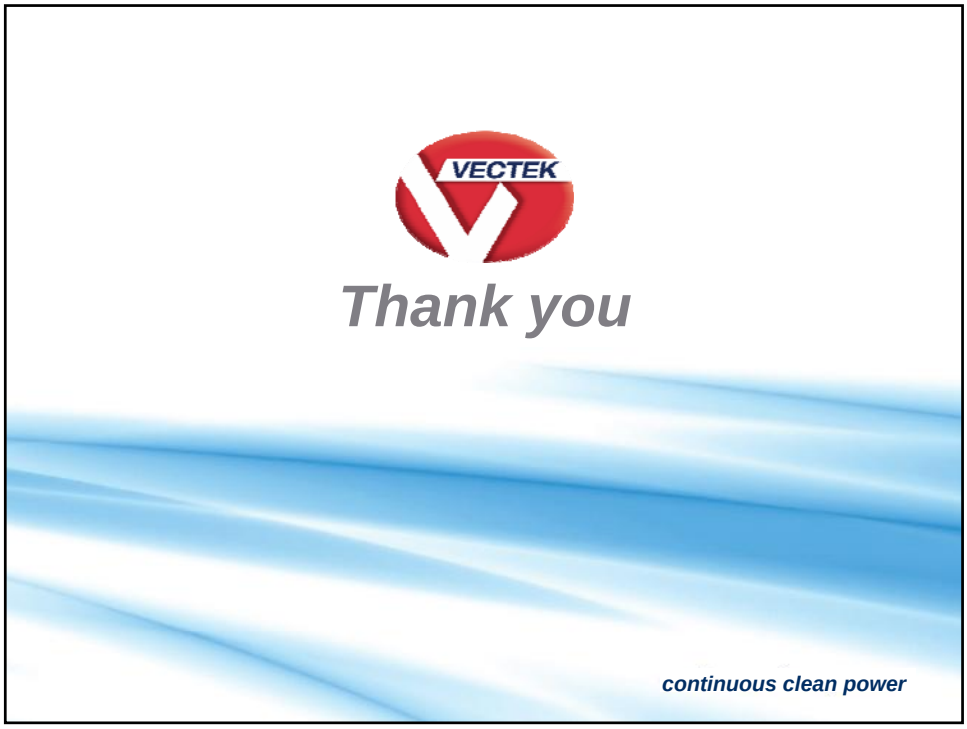
Within hours of installation, the unit was recording significant sag events, which it eliminated



AVC as opposed to UPS

Download at:-

www.vectek.com


VECTEK
Thank you
continuous clean power