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The Role of Smart Metering in Revenue Protection

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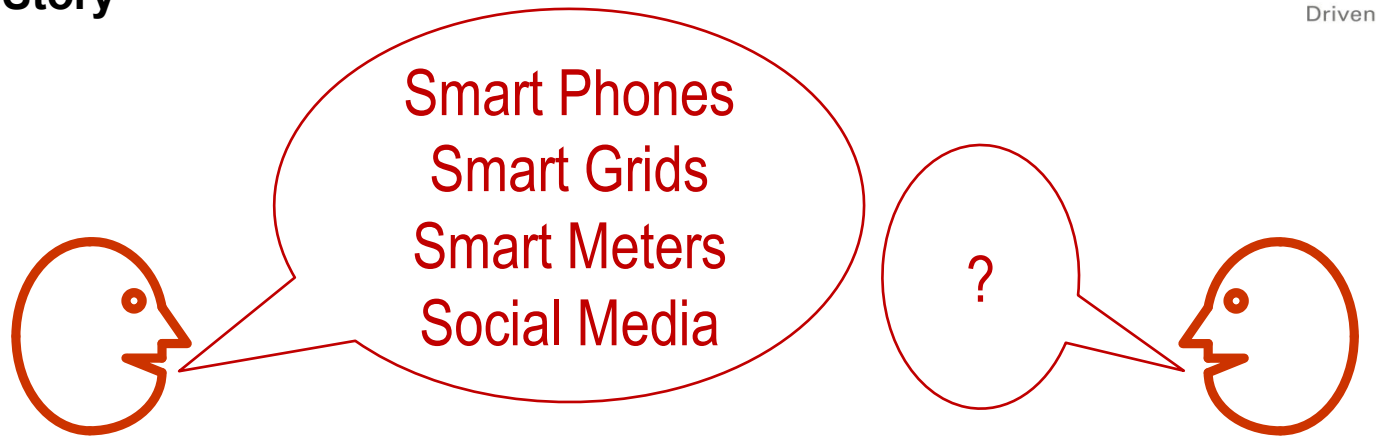
Smart Technologies

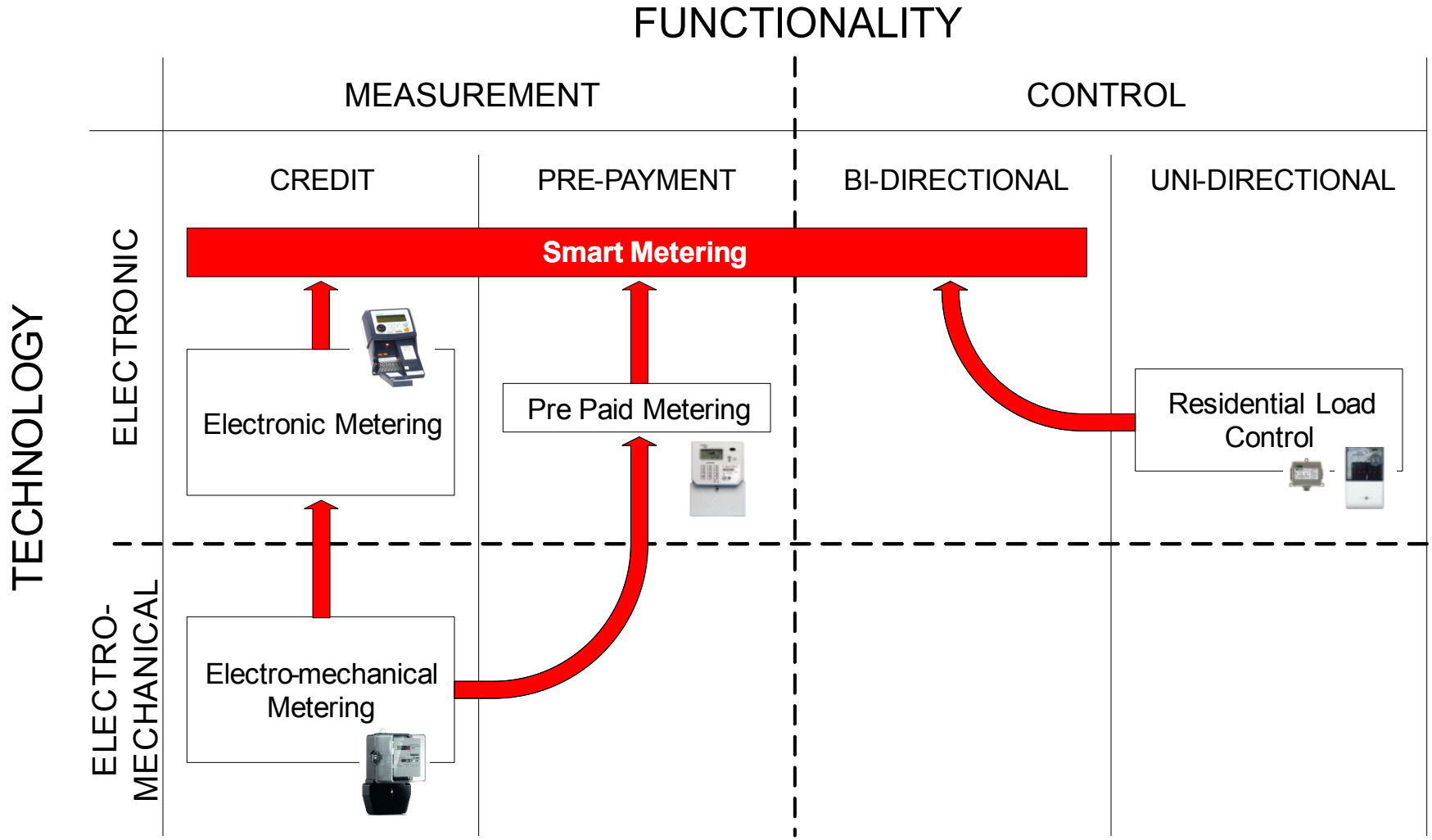
What is the Story



- Everyone is an expert! (or "…blah, blah, smart metering, blah, blah…")
- How has metering technology grown and what are the options?
- Is smart technology a smart solution?
  - Getting bang for your buck
  - Consider all of the costs
- Comparing Apples with Apples (or "little birds build small nests")
- But why go smart? (or "maybe we are onto something good here")

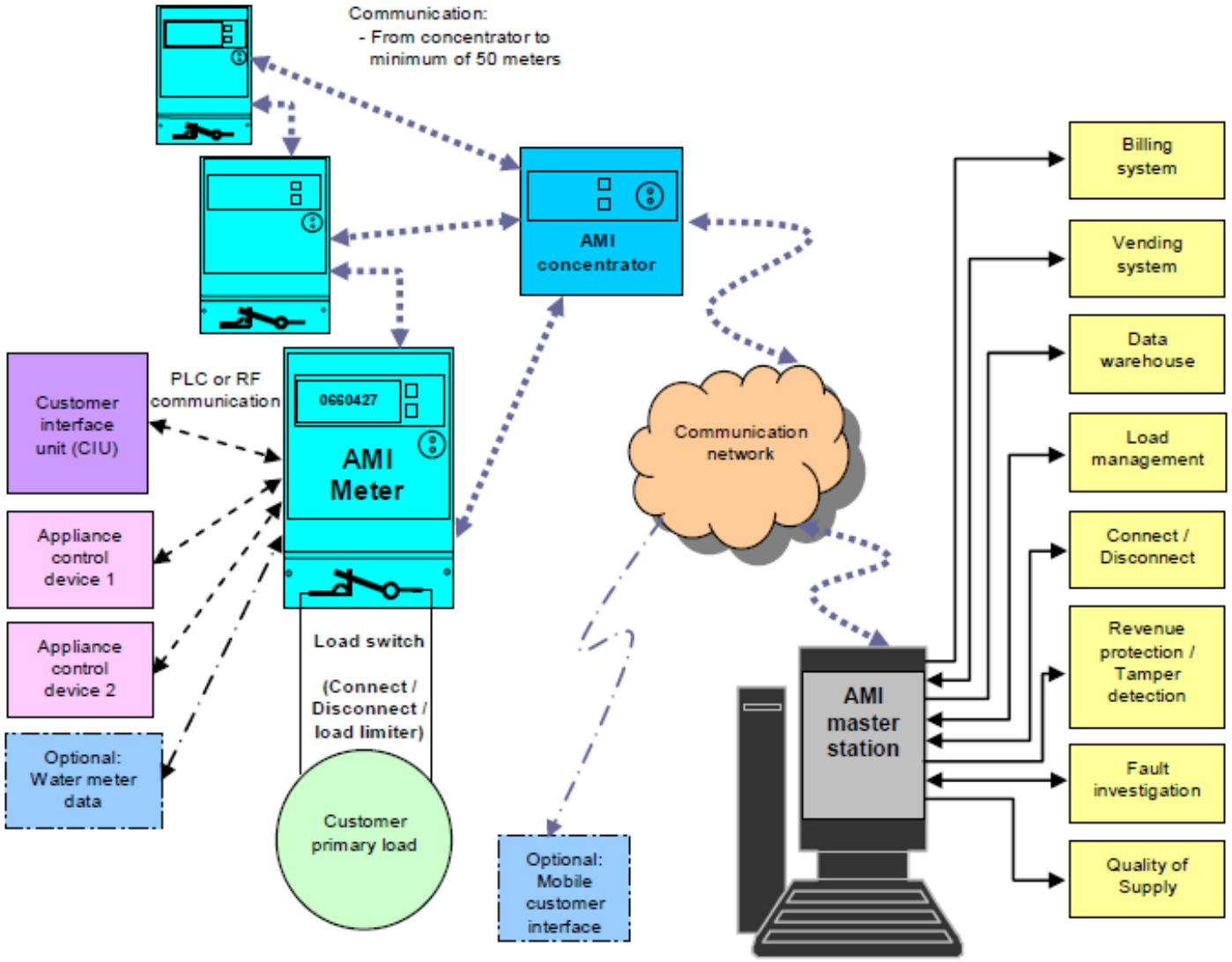
Technology Growth

The expansion of metering capabilities



Advanced Metering Infrastructure (AMI)

South African Context: NRS049-1:2010



Advanced Metering Infrastructure (AMI)

Primary Features

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MUST HAVE

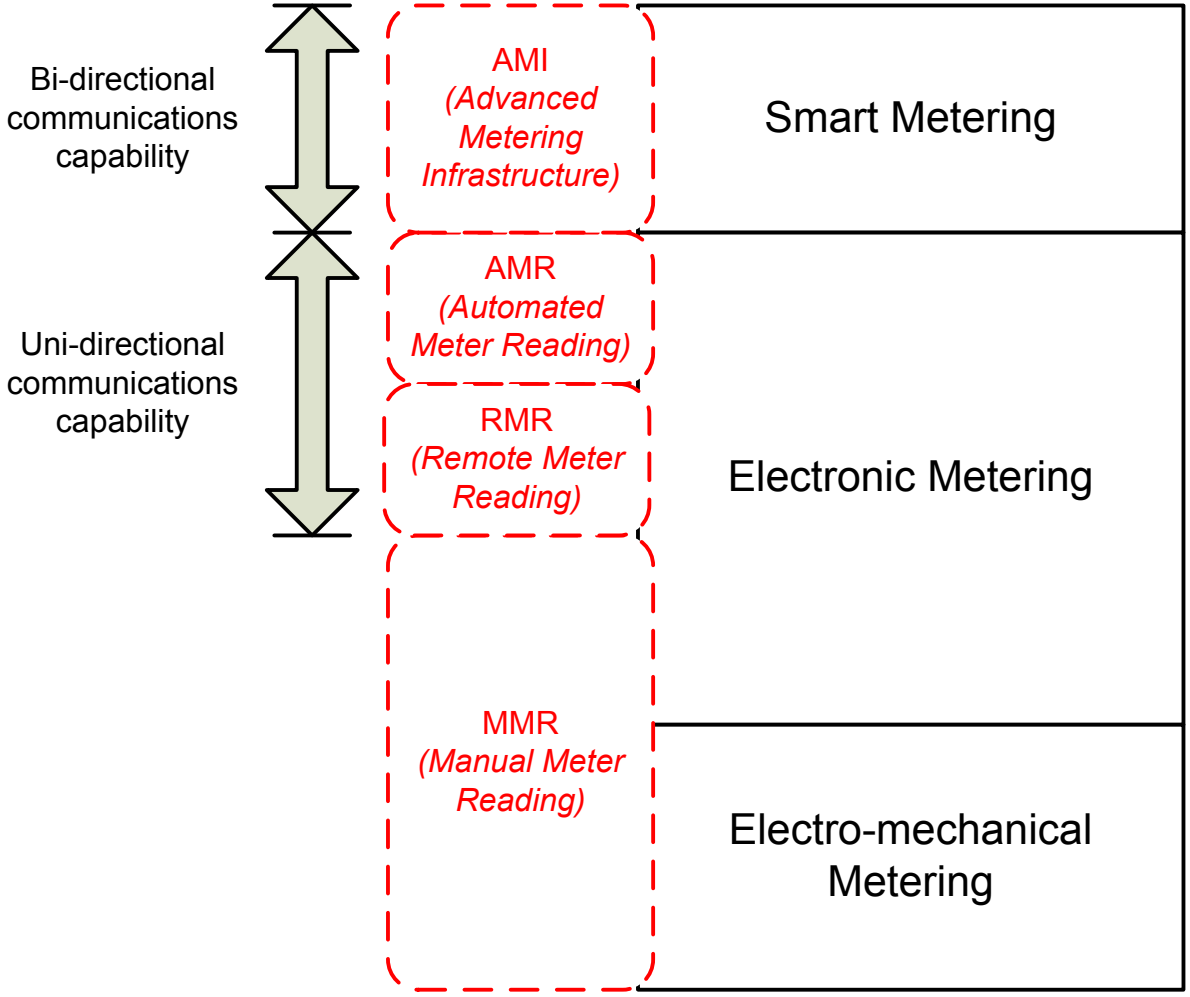
- Bi-directional communications between server and meters based on Power Line Carrier (PLC) or Wireless RF (ZigBee)
- Portable customer interface to meters
- Incorporation of communication to at least two load control devices
- Metering able to do load disconnects

SHOULD ALSO

- Be capable of being deployed as credit or pre-payment metering with easy switching between the two modes
- Be capable of operating in a token-less pre-payment configuration
- Give customers on-line access to their billing information
- Support e-Commerce (online energy sales from anywhere in the world)
- Be capable of handling any complexity or variety of tariffs (TOU and IBT)
- Be future proofed with Over The Air (OTA) firmware and configuration updates

Technology Platforms

Credit Revenue Platforms



Investing in Technology

Return on Net Assets of AMI Technology

$$RONA = \frac{Net\ Income}{Fixed\ Assets + Net\ Working\ Capital}$$

$$NWC = Stock + Debtors + (Creditors)$$

- Expected moves (as a result of investing in new AMI technology) should be:
  - Fixed assets 
  - Debtors (overdue receivables) 
  - Net Income 
- Business case is where increase in the fixed assets is matched by a decrease in debtors and increase in the net working capital over the useful lifetime and depreciation of the asset

RONA

Simple Example

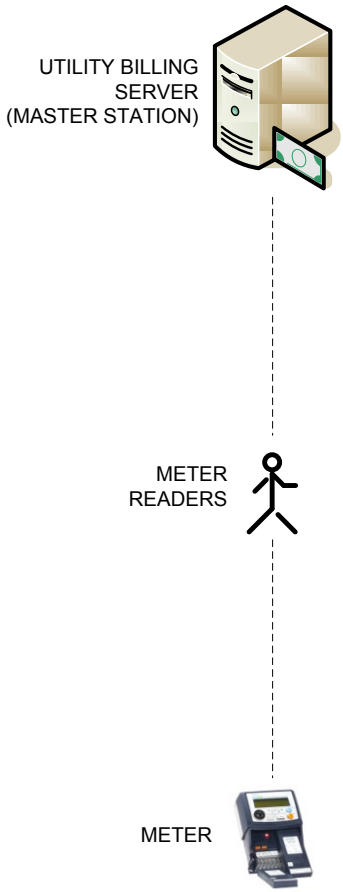
	Year 0	Year 1	Year 2	Year 3	Year 4
Increase in Fixed Assets (Asset Value)	10	8	6	4	2
Reduction in Debtors	2	1.6	1.2	0.8	0.4
Increase in Net Income	1	0.8	0.6	0.4	0.2
RONA %	**12.5%**	**12.5%**	**12.5%**	**12.5%**	**12.5%**

- It is assumed that input (electricity purchases) and output tariffs (electricity sales) remain in balance
- A phased-approach may prove more prudent focusing on more profitable customers first (according to the 80/20 principle)
- CAPEX surges can be overcome by leveraging OPEX by means of leased or rental-to-own options

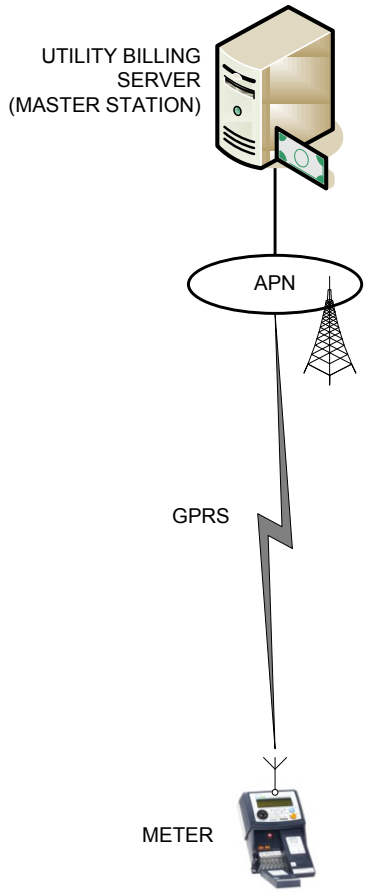
Metering System Platforms

Basic platform types

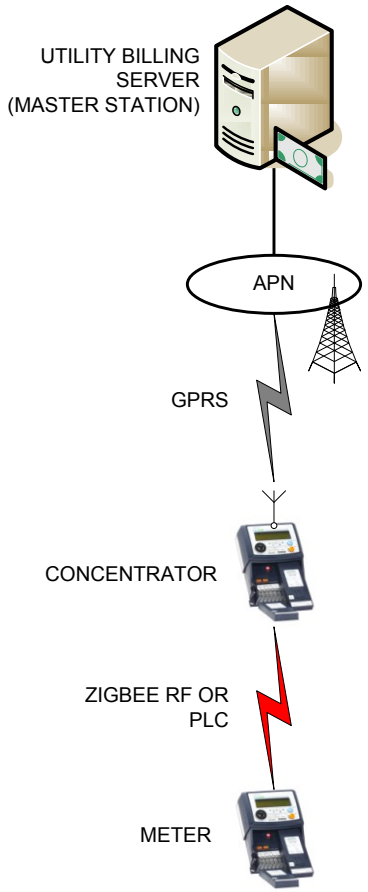
MMR
Manual Meter Reading



AMR
Automated Meter Reading



AMI
Advanced Metering Infrastructure



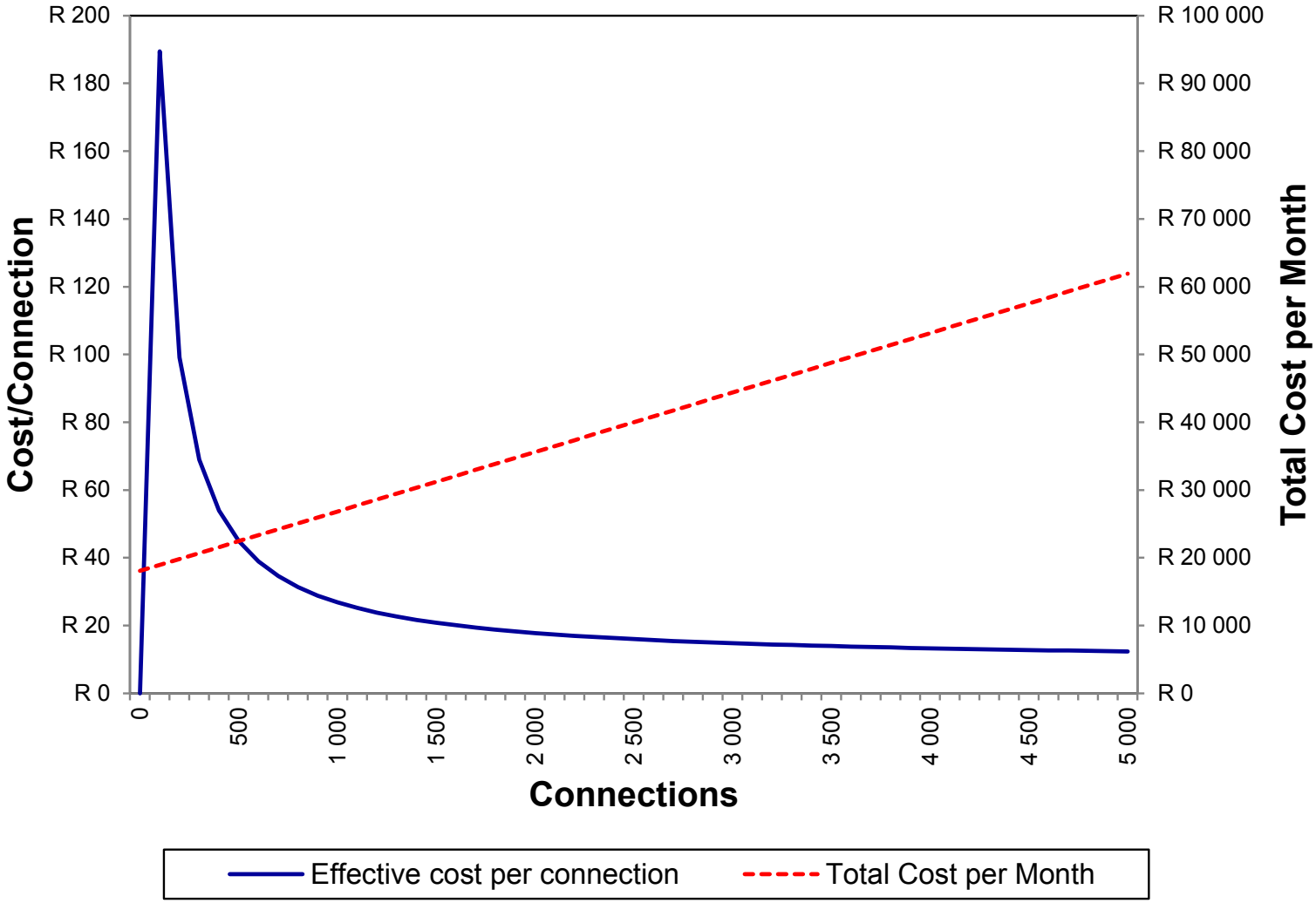
Cellular Communications Costs

Last Mile Communication Costs per Month

- Significant advances in cellular communications technology and costing (M2M technologies over cellular networks)
- Costs to Consider include:
  - Once-off initial setup costs
  - Fixed costs per month (per connection)
  - Communication or data transfer costs per month (per connection)
- Significant difference between AMR and AMI type systems involves the last-mile communications
  - AMR communicates to each meter
  - AMI communicates to data concentrators (who in turn communicate to between 20 to 500 meters each using PLC or RF Technology)
- AMI last-mile costs typically included in the hardware costs (or is licence transparent)

Cellular Communications Costs

Last Mile Communication Costs per Month

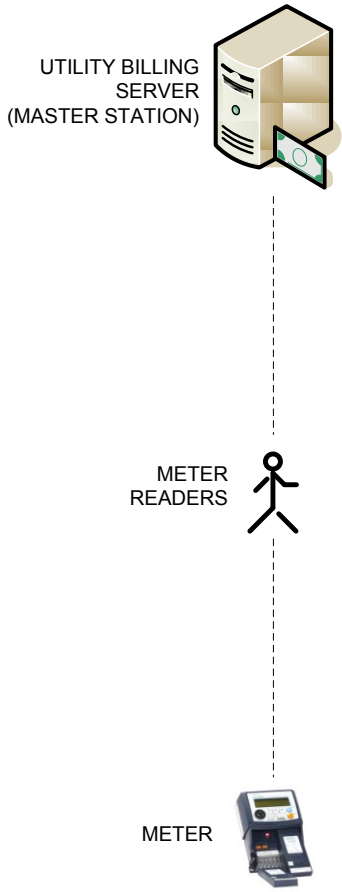


MMR Costs

Cost Consideration Formula

$$C_{MMR} = (M_T + M_R \cdot p) \cdot n$$

C_{MMR}	=	Total MMR platform cost
M_T	=	Hardware cost of the meter
M_R	=	Meter reading service cost per meter per month
p	=	Project period (months)
n	=	Number of metering points or end-users



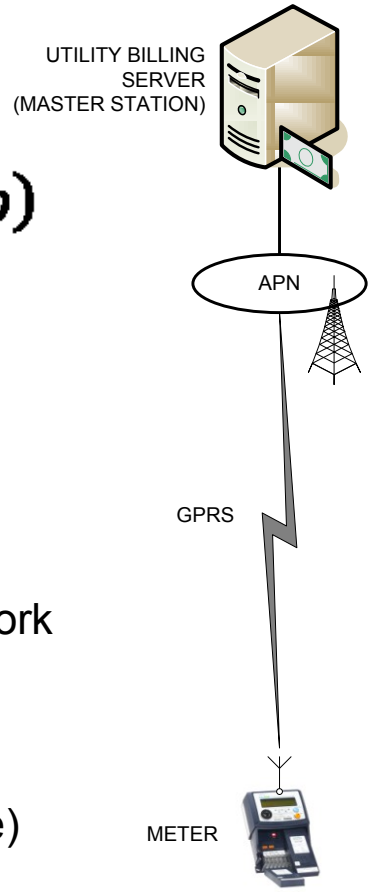
A similar project period (in months) should be used as a base for comparison. This should be equal to the shortest product lifetime or warranty of any system component.

AMR Costs

Cost Consideration Formula

$$C_{AMR} = (M_T + M_D + p \cdot C_{GSM}) \cdot n + (S_{APN} + C_{APN} \cdot p)$$

C_{AMR}	=	Total AMR platform cost
M_T	=	Hardware cost of the meter
M_D	=	Hardware cost of the modem
p	=	Project period (months)
C_{GSM}	=	Cost per meter or connection per month for GSM network traffic (including SIM card)
n	=	Number of metering points or end-users
S_{APN}	=	Initial setup costs for an APN system
C_{APN}	=	Fixed cost per month for an APN (irrespective of usage)



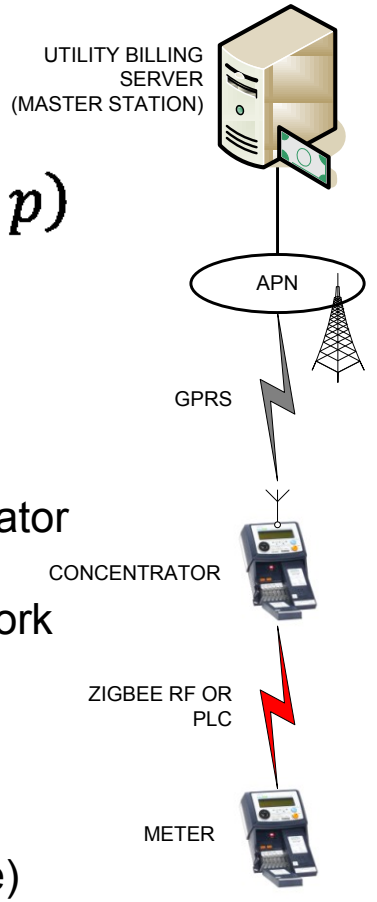
A similar project period (in months) should be used as a base for comparison. This should be equal to the shortest product lifetime or warranty of any system component.

AMI Costs

Cost Consideration Formula

$$C_{AMI} = \left(M_{TA} + \frac{M_C + C_{GSM} \cdot p}{R} \right) \cdot n + (S_{APN} + C_{APN} \cdot p)$$

C_{AMI}	=	Total AMI platform cost
M_{TA}	=	Hardware cost of the AMI ready meter
M_C	=	Hardware cost of the GSM/GPRS ready data concentrator
p	=	Project period (months)
C_{GSM}	=	Cost per meter or connection per month for GSM network traffic (including SIM card)
R	=	Concentration ratio of meters per data concentrator
n	=	Number of metering points or end-users
S_{APN}	=	Initial setup costs for an APN system
C_{APN}	=	Fixed cost per month for an APN (irrespective of usage)



A similar project period (in months) should be used as a base for comparison. This should be equal to the shortest product lifetime or warranty of any system component.

Platform Comparison

Case Study Using the Models

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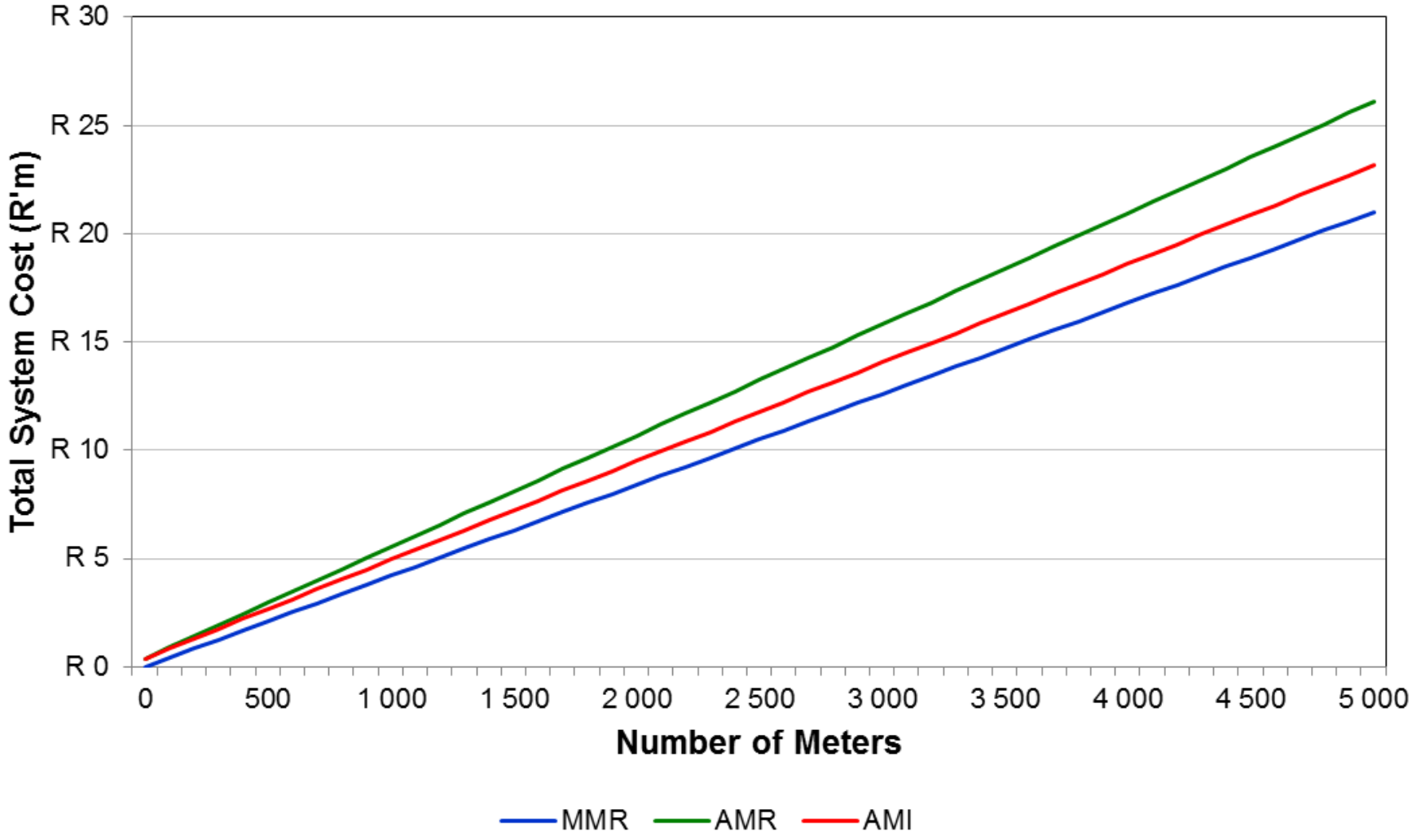
- Consider two cases namely, a three-phase system (C&I type customers) and a single-phase system (residential type customers)
- Ignore installation costs (a meter is a meter)
- Typical costs of the hardware currently available to market are used
- Basic electro-mechanical metering is used for residential customers
- For a three-phase system:
  - Project duration is 60 months (5 years)
  - Concentration ratio is low (30 meters per data concentrator)
- For a single-phase system:
  - Project duration is 60 months (5 years)
  - Concentration ratio is high (200 meters per data concentrator)

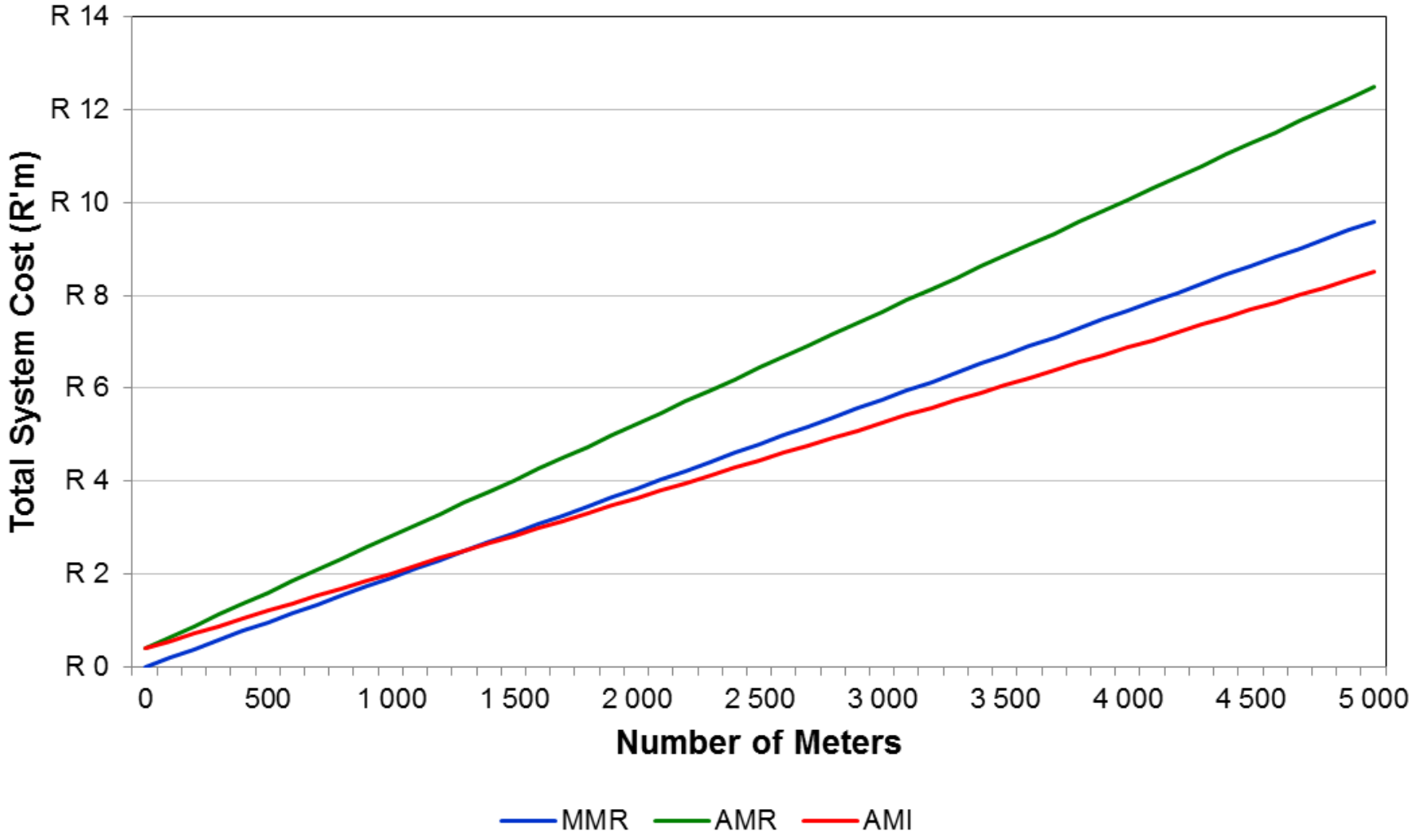
Platform Comparison: Three-Phase System

Case Study Using the Models (C&I Application)



Platform Comparison: Single-Phase System

Case Study Using the Models (Residential Application)



The Results

Case Study Using the Models

- For both scenarios, AMI is cheaper than AMR
- This is particularly true for single-phase customers due to the volumes of metering points involved and the cheaper last-mile communications to those customers
- In reality, AMI systems will have a mixture of three and single phase customers but a summation of costs in the models can be used
- MMR systems remain viable in the short term. However electro-mechanical meters deployed at cannot handle complex tariffs (TOU, IBT etc) and other benefits (thus fall far short of the proposals in the Electricity Regulations Act)
- The current understanding and deployment of pre-payment metering (i.e. a token-based solution) is near-sighted due to technical and communication limitations
- Smart Metering is not as expensive as it sounds (but it is also not free or on the same level as limited existing systems)
- Reality Check: someday all metering systems will work this way…

Why Smart Metering

Substance to the Legislation

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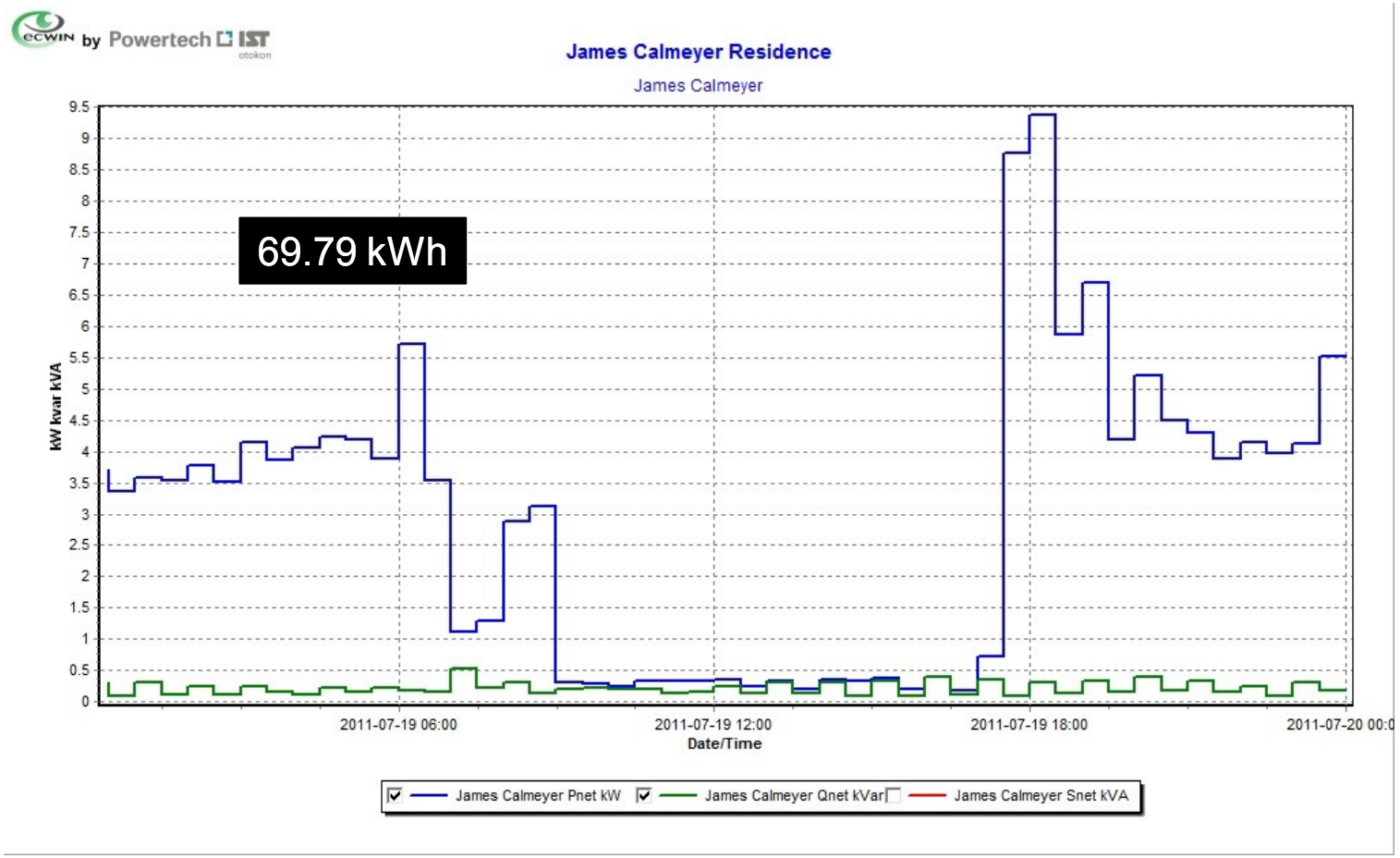
A Customer's Perspective



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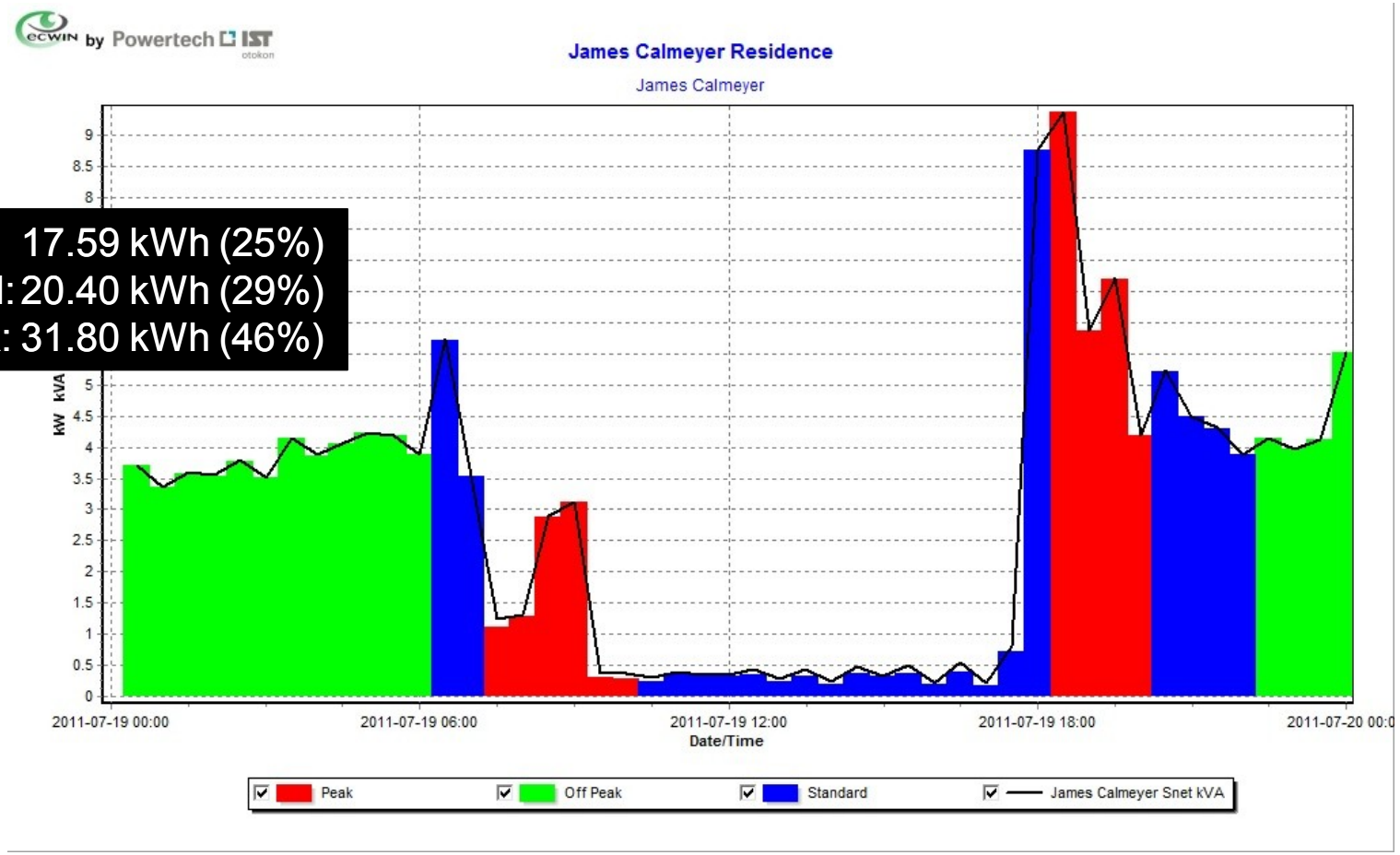
A Customer's Perspective



Peak: 17.59 kWh (25%)
Standard: 20.40 kWh (29%)
Off-Peak: 31.80 kWh (46%)

Why Smart Metering

Substance to the Legislation

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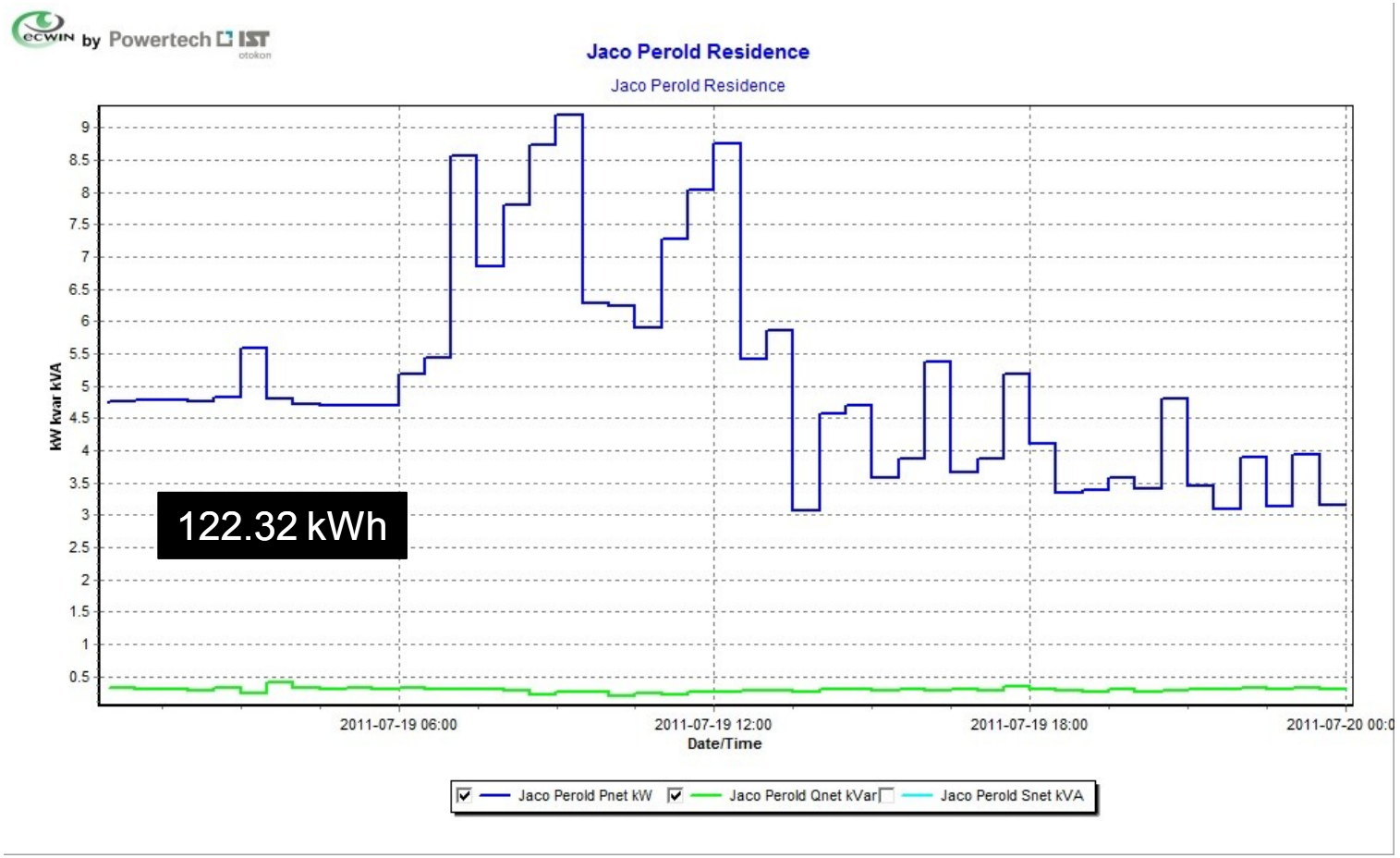
A Utility's Perspective



Why Smart Metering

Substance to the Legislation

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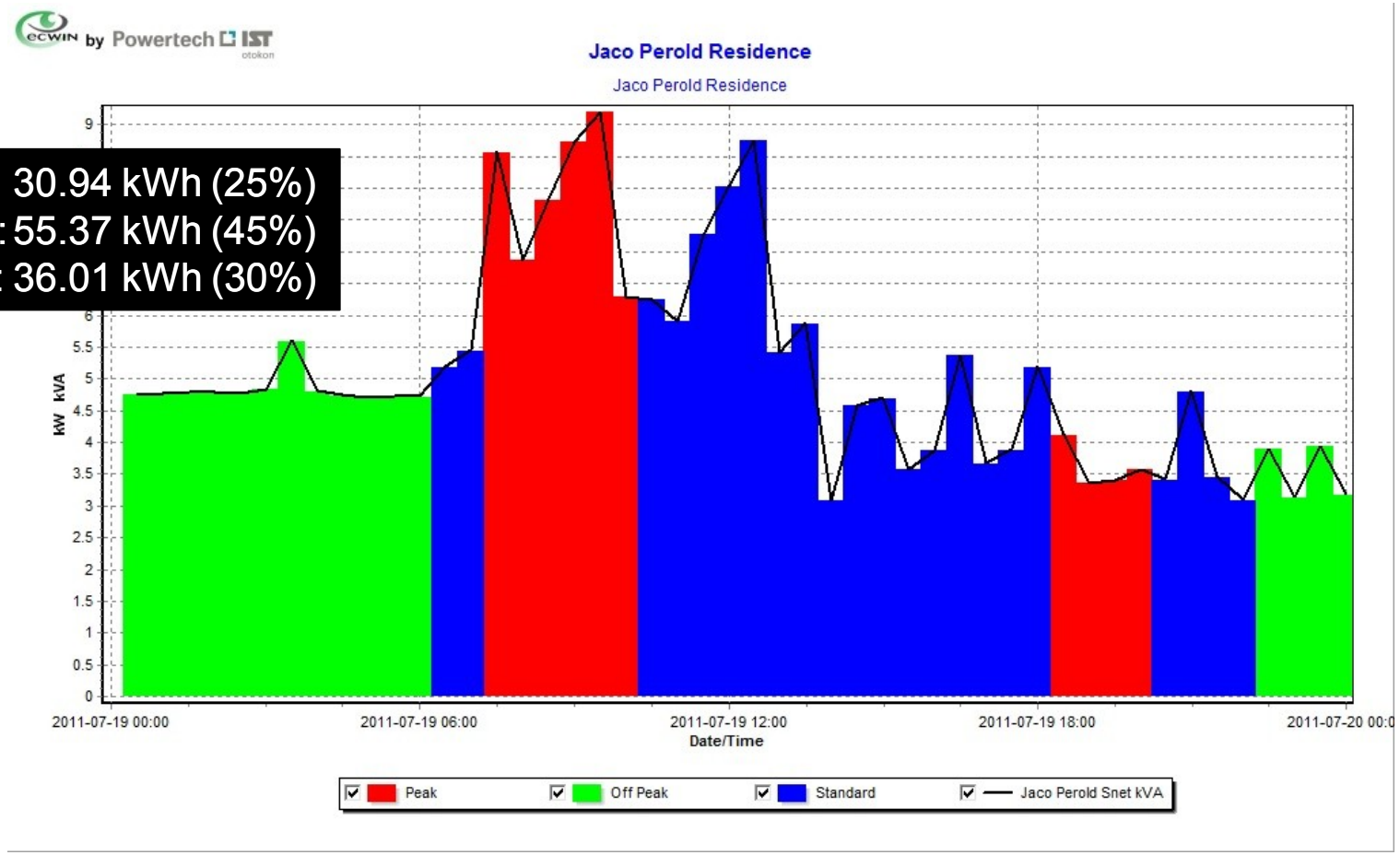
A Utility's Perspective

Peak: 30.94 kWh (25%)
Standard: 55.37 kWh (45%)
Off-Peak: 36.01 kWh (30%)



Conclusions

When all is said and done…

- Financial tools can be used to determine the best fit solution (between MMR, AMR and AMI) based on the variables of each application taking life-cycle costs into account
- For AMI applications
  - Consider the system reach – more customers means greater costs but not necessarily greater returns
  - The lifetime of the assets is also important – the longer the lifetime the more feasible AMI becomes
  - The concentration of meters per concentrator is a major cost component – higher geographical penetrations of metering reduce the overall costs and concentrators that can handle greater number of meters also reduce the overall costs
- One the surface of it, MMR seems the best solution but the assets are old and the technology outdated – you can do more with AMI systems

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