



# TESCO Meter Manager

Meter Inventory Management & Automating Meter  
Records - Overview

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*for the Mid-South Electric Metering Association 2015*

# TESCO Meter Manager

Meter Inventory Management & Automating Meter records - Overview

- TESCO
  - Has been involved with metering for more than 100 years
  - Focuses solely on the needs of metering, with a wide range of software, test equipment, and tools
- Meter Manager
  - Is the result of more than 20 years of experience creating software for electric and gas utilities
  - Has been designed from the ground up to meet your needs not only today, but in the future
  - Is built with state-of-art tools and modern software architecture
  - Continues to grow, with new and expanded features, all of which are made available to all of our customers



# Software Team

- Software team headed by our CTO and our Senior Software Architect
- Software development staff
  - 3 team leaders
  - 12 developers
  - 3 software testers
- TESCO has over 125 employees in total
- TESCO Software support staff includes Project Managers Business Analysts, Trainers, Process Analysts and our Regional Managers.



# Meter Life Cycle

- New Meter Purchase
  - Purchase Order
  - Vendor File
  - Meter Receiving
  - Acceptance Testing
  - Device Creation in Customer System of Record
  - Device Release to Stock
- Used Meter Processing
  - Meter Check-in
  - Meter Testing
  - Device Restocking



# Meter Life Cycle (continued)

- Asset Management
  - Track Inventory within shops / warehouses / storerooms, down to the container and/or shelf
  - Track Inventory to the person or truck
    - Meters are assigned to the person / truck
    - As meters are set, they are removed from inventory
    - Used meters are tracked from removal to meter shop
    - Physical inventory counts may be performed at any time
- Quality management
  - Detailed analysis of meter performance
  - In-service random sample and periodic test plans
  - Full RMA tracking



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# Creating New Device Records

- Usually records are created from vendor files
  - Standard industry format vendor files are supported
  - Any documented format will be supported without extra cost
  - Records typically include AMR/AMI module information and factory test results
- Individual records may be created interactively for a single meter
- Ranges of sequential serial numbered devices can be added
- Mass creation of meters with or without attached devices may be done by entering the attributes and then scanning the meters and modules



File Go View User: Test

Purchase Orders x

☒ PO # 
☐ Search

☐ Expected Arrival from  to

☐ Ordered  
☐ Partially Shipped  
☐ Shipped

Find Clear

Search for and display existing POs

PO #	Supplier	Status	Order Date	Expected Ship Date	Expected Arrival Date

Count: 0

PO #  Order Date   
 Supplier  Expected Ship Date   
 Status  Expected Arrival Date

Order Lines Attachments

Count: 0

Manufacturer   
 Model   
 Catalog #   
 Line #  0  
 Item #   
 Unit cost  0.00  
 Qty  0

Line #	Item	Description	Qty	Cost

Vendor File Shipment

Vendor Files

Release	Filename	Date Created	Qty	Date Loaded





Add Devices x

Model

Configuration

Type

Group

Manufacturer

Manufacturer Model  Catalog #

Description

Form  Phase  Class

Voltage  Amps  Wires  Kh

Dials  Multiplier  Register Ratio

Read Group  Program Id


Read Types

☐ KYZ ☐ Bi Directional Comm

TOU ☐ AEP Test Code  Num Elements

Next Cancel



 Add Devices x

Model

Configuration

Type

Group

Manufacturer

Manufacturer Model  Catalog #

Description

Form  Phase  Class

Voltage  Amps  Wires  Kh

Dials  Multiplier  Register Ratio

Read Group  Program Id

Read Types

☐ KYZ ☐ Bi Directional Comm

TOU ☐ AEP Test Code  Num Elements

Next

Cancel



# Avoiding Duplicate Records

- **Open ranges of serial numbers can be found**

When choosing serial numbers for an order of new meters, the system can find a range of available unique numbers, or just verify your intended range, as needed

- **Uniqueness may be enforced**

By default Meter Manager will enforce unique serial numbers within a manufacturer for both meters and attached devices, such as AMR/AMI modules. System-wide uniqueness may be enforced for any particular type of device, such as requiring unique serial numbers for all AMI modules.

- **Devices may be renumbered**

Because MM uses its own unique key, if a device is renumbered, all related data is preserved.



214 Unused Serial Number Range X

Item Type

Manufacturer

Higher than

Quantity to find

Find



Item Types x

Name	Description	Item Category Name	
AMI Module	AMI Module	Device	
BVI		Device	
CT		Device	
Electric Meter		Device	
ERT		Device	
Gas Meter		Device	
Installation		Device	
PT		Device	

Item Types Count: 18

Name: Electric Meter

Item Category: Device

Description:

Serial Number Unique in: Manufacturer

Item Search

Device


☒ Meters Only
☒ Show All Tests

Count: 0

Location

Receive Batch

Company #
Manufacturer #

Barcode #

Type

Group

Manufacturer

Manufacturer Model
Catalog #

Description

Tests

Count: 0

Test Type	Status	Source	Test Date	Due Date	Requested By	Tester
-----------	--------	--------	-----------	----------	--------------	--------




# Meter Acceptance Testing

- Sample Test
  - Any Work Order type may be assigned via configuration
  - Selection meters may be manual, random, or random by box
    - User selects meters (pseudo random)
    - System selects boxes (random boxes)
    - System selects meters (completely random, rarely used)
  - ANSI Z1.4, Z1.9, MIL-STD-105E, or fixed percentage may be used
  - Work Orders are generated, which will include whatever functional and accuracy testing you require for both the meter and any included AMR/AMI modules
  - Multiple testers can complete the required testing
  - The current status of the sample is always visible





## Sample Testing x

☒ All Status **Quarantined**☐ PO  Sample Batch   **Sample Batches** Count: 0


Sample Batch	PO	Qty	Status
--------------	----	-----	--------

For each device model received within the shipment, a batch is created. We can see what shipments have not yet been sampled when we create a new sample batch.

Line Item	Release	Date Received	Qty	Receive Batch
-----------	---------	---------------	-----	---------------

Samples Tests

Date Created	Sample Type	Sample Size	Passed	# Tested	# Failed
--------------	-------------	-------------	--------	----------	----------

 **Samples** Count: 0Date Created Sample Type Sample Size Passed # Tested # Failed

[illegible]

# Meter Manager's MAM Capabilities

- Handles many different device types, including AMI modules, HAN devices, load control devices, and user-defined device types.
- Tracks ancillary devices embedded in the meter, each with its own serial #, hardware version, and firmware version are tracked, including permanent components, factory exchangeable components, and utility exchangeable components.
- Cradle to grave tracking of all devices, including tracking down to the truck or person
- Extensive warranty and RMA functionality, including separate warranties for ancillary devices, if applicable



# Meter Manager's MAM Capabilities

- Precise control of workflow, including any number of tasks performed at any number of steps
- Firmware tracking, including integration with head end systems. Meter Manager prevents devices with obsolete firmware from being shipped.
- Quality management functions, including tracking occurrences of specific defects
- All testing activity, including functional testing as well as accuracy testing, is stored together in Meter Manager
- Meter Manager will integrate with manufacturers' AMI software, either using UI automation to run the software and screen-scrape the results, or through APIs when available.



# Control of Work Flow

- The tasks performed on a device, and the order in which they are completed, are controlled by Work Flows, Work Flow Steps, and Tasks
- Consider this example requirement: New meters, either 100% or a sample, are put on a multi-position qualification board, have their firmware version verified, are tested for network communication, and then a remote service switch test is done. With this done, the meters are tested on a test board, with an accuracy test, and a demand test if the meter has a demand display.
- Here is the work flow for this example



# Work Flow Example: New AMI Meter

- Step 1: Functional Testing
  - Task 1: Verify firmware, display check
  - Task 2: Register meters on network, verify communication
  - Task 3: Test Remote Service Switch (if present)
- Step 2: Metrology Testing
  - Task 1: Do accuracy testing, with appropriate test sequence
  - Task 2: Do reverse test (NEM meter only)
  - Task 3: Do demand test (demand meter only)
- In this example we have created two Work Flow steps, with multiple tasks for each one.



Workflows x

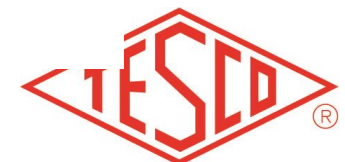
Workflow Count: 4

Workflow	
Electric Meter Test - Accuracy Only	
New AMI Electric Meter Test	
New Gas Meter Test	
Used Gas Meter Test and Paint	

Count: 1

▲ New AMI Electric Meter Test

- ▲ Functional Testing
  - Verify firmware, display segment check
  - Register meters on network, verify communication
  - Test Remote Service Switch (if present)
- ▲ Metrology Testing
  - Do accuracy testing, with appropriate test sequence
  - Do reverse test (NEM meter only)
  - Do demand test (demand meter only)



# Tasks

- Tasks are any activity performed on a device
- Tasks are self-aware, and can determine if they are applicable.
  - If a remote service switch test is part of a Work Flow, it will only be presented when the meter actually has a remote service switch
  - A gas meter test could include an ERT ping and read verification, if the meter has an ERT
- Optional Tasks may be added to Work Flow Step
  - If you make a Demand test an optional task on the Accuracy Test step, a user could run a demand test if desired, when the meter has demand
  - If it is a required task, it will always be presented to the user when applicable





# Controlling Stocking Meters

- All mandatory tasks must be completed for a meter to be restocked
- If optional tasks have been added, they must also be completed or deleted.
- All tasks that have a pass/fail criteria must pass
- For accuracy tests, each meter, based on type, can be assigned different accuracy limits. Within each limit, three levels are defined:
  - Utility: This is your internal criteria for passing used meters
  - Regulatory: This is your commission's criteria, and is used primarily for reports
  - New: This is your internal criteria for accepting new meters



# Tracking Device Inventory

- Every device is tracked at every location, with the full history of all inventory events
- Devices may be in containers, which can be pallets, gaylords, bins, etc.
- The entire contents of a container may be moved, shipped, retired, or returned to manufacturer in a single step
- Unlimited inventory locations are supported
- An inventory location may have areas within it
- Inventory areas may be mapped
- Every shelf/floor location may be marked on the map





# Pass / Fail Limits

- **Multiple sets of pass / fail limits may be defined**

Each set of electric limits includes:

- Separate electric values for full load, light load, and weighted average
  - Separate gas values for full, check, differential
  - Threshold to display a warning (results in yellow)
  - Threshold for failure
  - Separate thresholds for internal, regulatory, and new meter acceptance
- Any device model may be assigned any pass / fail limit



Electric Test Limits

Limit Name
Limit for Mechanical
Limit for Solid State

Electric Test Limits

Count: 2

Regulatory
New
Utility

HL

Warning limit:

to

Fail limit:

to

Fail on:

LL

to

to

WA

99.50

to

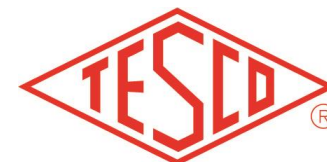
100.50

98.00

to

102.00

Avg



Item Search
x

Device


☒ Meters Only
☒ Show All Tests

Count: 1

Location

Receive Batch

Company #
Manufacturer #

Barcode #

Type

Group

Manufacturer

Manufacturer Model
Catalog #

Description

Tests

Count: 0

Test Type	Status	Source	Test Date	Due Date	Requested By	Tester
-----------	--------	--------	-----------	----------	--------------	--------

# AMI Module Tracking and Testing

- **Testing of AMI modules is supported**

Each type of device may have its own test with its own data elements.

- **AMI Module results may be manually entered, imported, or fully integrated**

TESCO is currently integrating Silver Spring AMI testing directly into MM, and supports other AMI devices

- **UI Automation allows MM to execute Windows-based software from AMI vendors automatically without user input**

MM can run vendor software, make the required entries, and then extract and store the results.









# Testing Remote Service Switch

- **Remote Service Switches are a supported device**  
They can be integrated into the meter or on a separate collar
- **Pass/fail testing is supported, with test load documented, and optionally with multiple tests at different loads**
- **Remote Service Switch testing can be done at the accuracy test board, or on a multi-meter board, as required.**
- **Currently the results of the test are entered manually, but automated results support will be added if a test board supports it.**





Mass Task Completion x



Count: 0

Date

Completed By

Task Type

Meter	Pass/Fail
-------	-----------

Complete



# RMA and Warranty Tracking

- Each manufacturer may have any number of different warranties on different products, or warranties may change for new purchases.
- Warranties may be based on date purchased, date received, or date installed, as applicable
- Warranties can apply to any type of device, including meters, AMI modules, ERTs, CTs, VTs, etc.
- Meter Manager knows which devices are under warranty
- The warranty for a specific set of existing devices may be extended







# RMA and Warranty Tracking

- Failed devices under warranty are added to an RMA queue, and usually placed in a specific container
- Batches of devices are shipped back to the manufacturer as volume dictates
- Meters may be repaired and returned, returned with no problem found, or credit issued
- If the manufacturer denies the warranty claim (perhaps due to physical damage, for example) this too may be tracked
- If credit has been issued for a defective meter, and the same meter is received as part of another purchase, the system recognizes and handles this scenario



Warranties x



Warranties		
Vendor	Device	Description
General Electric	Electric Meter	GE Electric Meters
Itron	Electric Meter	Itron Openway Meters
Itron	Gas Meter	Itron Gas Meters
American	Gas Meter	American Gas Meters

Vendor

General Electric

Device

Electric Meter

Description

GE Electric Meters

Expires

5

years

from

Purchase Date



Ship RMA Devices x

RMA Devices Count: 0

RMA

Shipping Method

Tracking Number

Shipment #

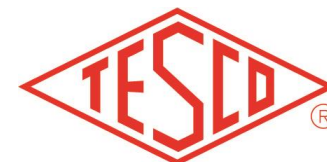
Shipping Date


☒ Containers ☐ Meters

Count :

Devices

Devices
---------



 Extended Warranty x

Vendor


Device

Description

☒ Extend an extra  days

☐ Good Until

☐ File ☐ Serial # Range ☐ Date Range



# Meter Tests

- In Meter Manager, Work Orders describe the test classification, and point to a set of work steps and tasks to be performed.
- Work Orders are user-defined and can be created to match your existing test classifications
- When required, As-Left results may be added for reads and tests
- Each device model can be associated with an accuracy criteria record, and each record has values for Utility, Regulatory, and New Meter limits (described earlier)
- Notes, pictures, and files may be attached to a test





# Tests for Existing Meters (cont)

- Normally all tasks for a test must be completed in order to complete the test. If a meter fails, the test may be aborted and the reason for failure selected.
- Meter Manager tracks device warranties, and failed devices may be added to the RMA process.
- Devices may be retired after a failed or a successful test
- Only devices that have been tested successfully may be stocked







Item Search     Meter Test 

053193339


Test


Work Orders

 Notes


 Photos


 Tasks

 Reads

 Test Sequence

LED

 Turn Voltage On

 Turn Current On

Reset Device

Complete Test

Close

053193339

Type  Setup Code

Form  Volts  Amps  Phase  Wires

Kh

Test

Test Date  Tested by  Test Type

Work Orders

Type  Due Date

Type	Due Date	Status	Requested by
Office Test	07/20/2014	Pending	Supervisor

Notes

Photos

Reads

AF

KWH

Test Sequence

Test Sequence

AF

Start  End  Board

WA

SF  AFL  APF











SP  BFL  BPF

SL  CFL  CPF

Mesh ☐ Seal ☐

Run



Tests

Count: 0

Test Type	Status	Source	Test Date	Due Date	Requested By	Tester
-----------	--------	--------	-----------	----------	--------------	--------

Item Search x
Meter Test x

005636068
Test
Work Orders
Notes
Photos
Tasks
Reads
Gas Meter Test 070
Leak Test

Complete Test
Close

005636068

Manufacturer AM
Type AM269
Size 1400
Dials 5

Test

Test Date 6/25/2014
Tested by mm
Test Type 01 - CLASS 1 - TIME TEST

Work Orders

Type 01 - Time Test
Due Date 1/2/2013

Type	Due Date	Status	Requested by
01 - Time Test	01/02/2013	Pending	6908

Notes

Photos

Reads

In

Index
Seal Year

Gas Meter Test 070

In Out

Start 01:00:00
End 01:00:00
Prover # 2
Temp 070
Tested By 6908
Open 100.40
Check 100.20
Delta 0.20

Leak Test

In

Pass Fail
Leak Test Date 6/25/2014
Tested By mm

# Associating Devices

- Meter Manager can track any associated devices, including AMI and AMR modules
- A complete history of associations is maintained
- Modules may be disassociated and retired or restocked
- In a single step, a defective AMI module may be disassociated from a meter and placed into RMA processing, and a new module associated with the meter
- Meter Manager checks if the firmware version of a meter is current when a meter is checked in, and when it is checked out. If integrated with vendor software, the reported firmware version can be captured. Manual firmware checks may be added to the work flow.



Associate Module x

Meter

Module

Description

Module Defective ☐

Failure Reason

☒ Put in RMA queue☐ Retire

New Module

Description



Check In Meters x

Serial Number

☒ Manual Entry

Manufacturer  Take picture after barcode ☐

Device Type

Reason	Due Date
--------	----------

Reasons Count: 0

Reason for Removal

Due Date

Test  Retire

Failure

Blank display

Requested By

Email Test Results

Notes

Attachments Count: 0

Filename	Description
<input type="text"/>	<input type="text"/>



# Updating Device Information

- Test Records may be imported from files. This is typically used for third party meter tests.
- Mass retirements may be done in a single step.









# Reporting

- Reports definitions are stored in the database, allowing new reports to be added without code changes
- Titles and report parameters can be changed, and default values can be stored
- Reports can be exported to PDF or XLS files
- As part of the requirement analysis process, typically 30 to 40 reports are identified as required, and are made available. In many cases an existing report is sufficient, while sometimes a modified version is needed, or an entirely new report
- Users can design their own reports and add them to Meter Manager for other users




File Go View User: **Superuser**

 Run Report x

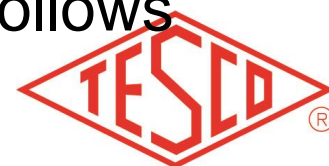
Year  Report Type  Report

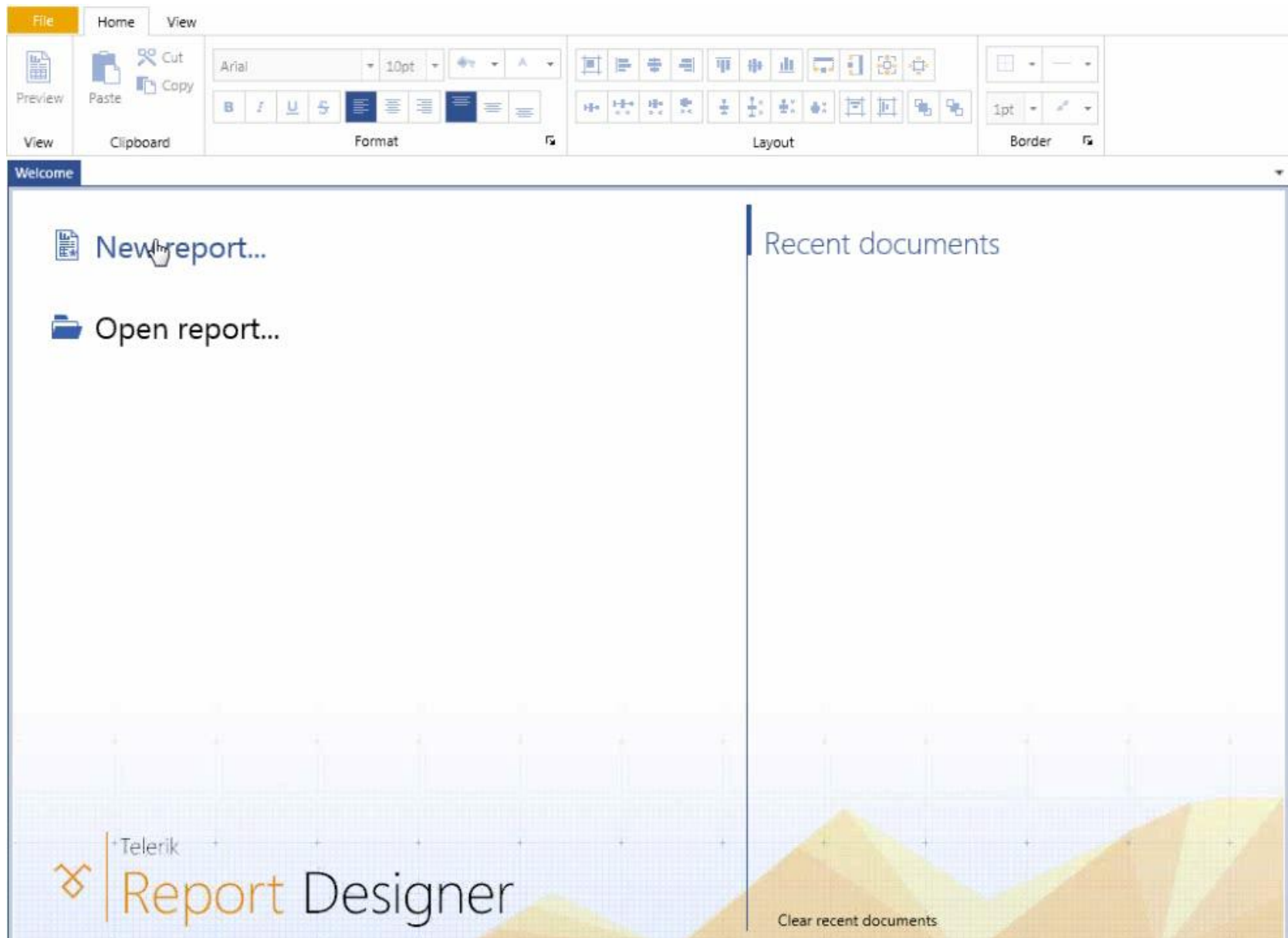
 Parameters



# Ad hoc Reporting

- TESCO simultaneously provides exceptional ad hoc reporting and reduces the need for it
- Meter Manager utilizes the Telerik Report Generator.
- The Telerik Report Generator comes in two versions, a developer version and an end-user version
- TESCO uses the developer version for built-in reports, while users build reports with the end-user version
- Reports created by end-users can be integrated into Meter Manager and run by other users, if desired
- Other tools may also be used against the SQL db
- An example of a report being built from scratch follows





# Meter Manager Touch Points

- TESCO uses the same code for all the base functionality of Meter Manager for all customers
- Integration with your other systems is custom developed, without customizing Meter Manager itself
- Touch Points are places where integration with other systems are possible or where some custom processing might be needed for a particular utility
- Touch Points are “black boxes” to the main application, and interact in carefully defined ways, eliminating the need to customize Meter Manager itself.



# Meter Manager Software Architecture

- Modern 3-tier application, with software client, application server, and database layer
- Two clients available, native Windows WPF and browser-based client using Microsoft Silverlight
- Core users typically run native app, rest of the utility use the browser application - UI is identical
- Role-based security, logins may be integrated with Active Directory
- Database does not need to be accessible to users
- Powerful end-user report generator is included, using the same engine as the built-in reports
- User-designed reports may be seamlessly added to the application with full security



# Our Deployment Process

- During the initial phase, we try to learn as much as we can about your operation and your needs.
- We want to observe all the tasks being performed in your shop, and understand how best to utilize Meter Manager in your environment.
- We work with key stake-holders to define what is required.
- Typically we add functionality during this process as we learn more about your operation and how we can best integrate Meter Manager into it
- This new functionality is almost always without extra cost



# Questions?

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