eV/atch DSM

Deviation Settlement Mechanism



Goal setting

- Business goal
- Stakeholders interview
- Module setting
- Team allocation



Research

- Insights
- Epic and user stories
- User personas



Engineering

- Information architecture
- Lo-fi flow maps
- Hi-fi wireframes



Design

- Design research
- Design concept
- Usability testing

SAMAST - Scheduling, Metering, Accounting and Settlement of Transactions in Electricity



Program Vision

Be a dependable solution provider for system operators and its participants to manage their business process efficiently and economically, by delivering them a reliable, scalable, secure, and easy to use integrated solution make them responsible and proactive in maintaining grid discipline.

Program Goals

Deliver as per the expected quality and scope a reliable, scalable, secure, easy to diagnose, and intuitive to use, solution for robust data acquisition, scheduling, dispute free billing & settlement, energy accounting with data validation, which will enable system operators and its participants in maintaining and discipline and its reliability.

Baseline Start Date

Baseline Finish Date

eWatch DSM, this program will cater the following major goals:

- 1. Meter data capture at 5 min SIP;
- 2. SLDC process automation for meter data collection;
- 3. Billing and Settlement for Genco segment only;
- 4. Energy Accounting and VEE for SLDC;
- 5. New gateway as DCU;
- 6. Firmware of DCU;
- 7. Meter specific changes to fulfil the data capturing at 5 min interval.

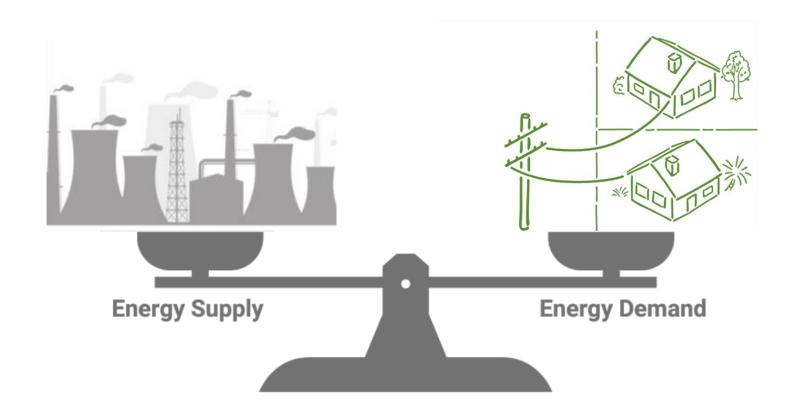
Program is divided into 2 phases:

Phase 1 - delivery of DAS / VEE / EA module along with modification in the Clem / mCubed / KMS / Meters hardware.

Phase 2 - delivery of Scheduling and Billing & Settlement module for Genco segment only.

DSM

Deviation Settlement Mechanism





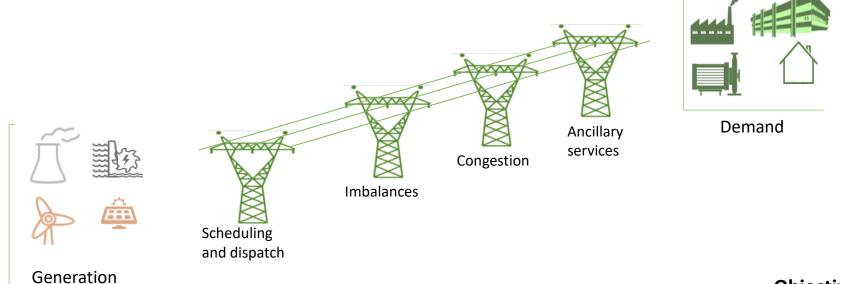








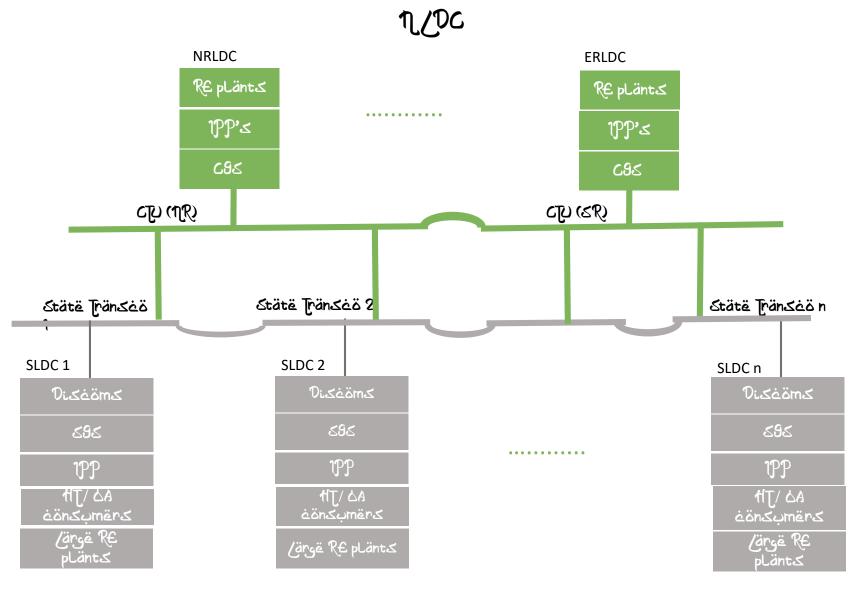
Pillars of electricity market design



Objectives:

- ✓ Reliable and secure system
- ✓ Low cost of power
- ✓ Green power
- ✓ Balancing grid in real time
- ✓ Congestion free
- ✓ Dispute free billing and settlement
- ✓ Fast response to grid contingency
- ✓ Low losses

Wholesale grid participants



eWatch DSM - Modules



ELECTRIC METER

shutterstock.com • 1197056479

Grid Meter

- ✓ Configurable to 15/5min.
 - SAMAST compliant



DCU/Gateway

- ✓ Data storage
- ✓ LAN/WAN communication



AMR/DAS

- Reliable and acc
- ✓ 100% data



Web scheduling

- Access to all participants
 - ✓ Real time updation



Loss an (Energy Audit)











The project aims to implement a robust, scalable and transparent framework of scheduling, metering, accounting and settlement of energy transactions at intra-state as well as interstate level in India.

Business goal

- Reliable, scalable,
- Secure, easy to diagnose
- Robust data
- acquisition, scheduling,
- Dispute free billing &
- Easy settlement
- Energy accounting
- Data validation
- Maintaining grid discipline

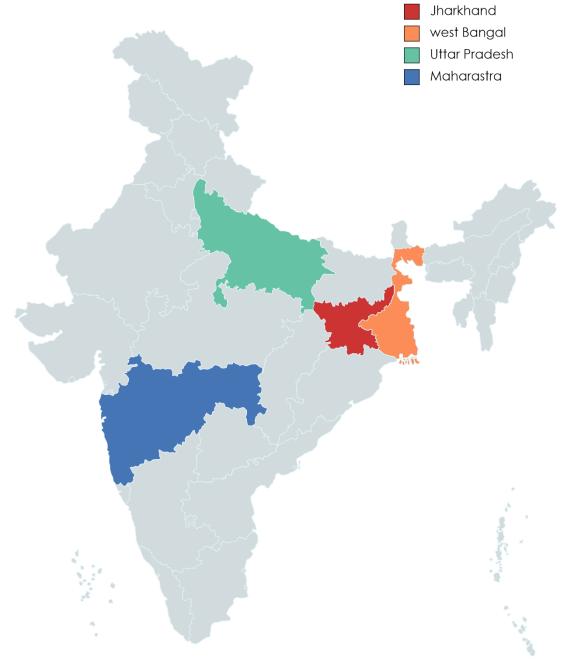
UX goal

- Easy day to day work
- Auto generated report
- Monitoring intuitive reports
- Power quality
- Real-time monitoring of power
- Notification for threshold
- Break out the monotones work
- Optimized equipment use
- Improved reliability
- Regularities in report schedule/

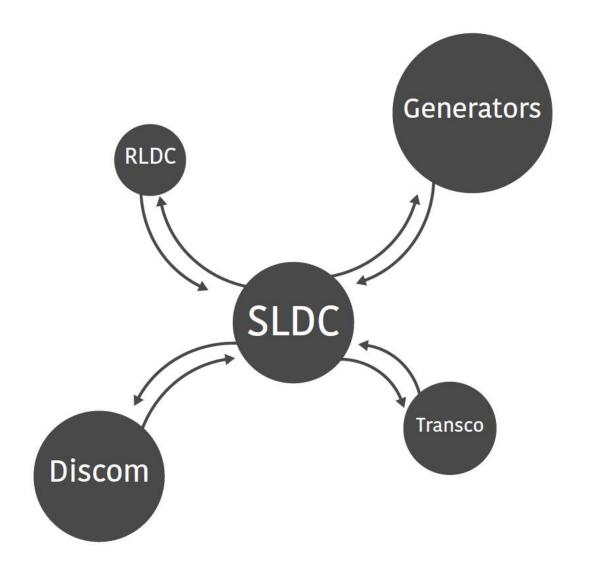
Employee goal

- Maintain and control computer resources
- Intuitive to use
- Scale without restraint
- Rising generating capacity,
- Easy handle in existing distribution networks
- Greater sensitivity to customer service.
- Work productivity
- Reduced line loss
- Fast billing process

User research: Customer visit



SLDC (State Load Dispatch center)



Organizational Structure

Reporting

Chief Engineer

Superintendent Engineer

Executive Engineer/Shift In charge

Junior Engineer/Assistant Engineer

State Load Dispatch Centre

Functions of SLDC

Scheduling and dispatch of electricity within a State

Monitor grid operation

Energy accounting

Commercial settlement of energy

Regulating frequency - 50 Hz

State Load Dispatch Centre

Data validation

Data acquisition

Open access approval

Scheduling

Energy accounting

Billing and settlement

User registration & SLDC charges

Team allocation

- RA/ UX team (2 persons): User research, IA, Wireframe/prototype
- RA/ UX team (1 persons): RA with UX on page level detailing and validation by Dev/PV team

Task list

Team Lead	Vinay Choudhary / Atul Koleshwar /Pratap Aditya	
Status Summary		Common Guidelines
Status	Count	This sheet to be used for task level planning & updation by Program teams & To be maintained by Team Leads.
Yet to start	6	This task planning sheet must be in sync with Milestone level schedule maintained in Agile.
In process	3	Efforts estimation - 8 working hrs./ day. Efforts calculation (in Man months) 20 working days/ month. Duration calculation (in Weeks) - based on 4 weeks/ month
Complete	52	This sheet to be added as an attachement under at program root. Naming convention of this XL file should be "Task sheet_Program Number_Function.xlsx"
Hold	3	
Total	64	Task level planning should include design block level planning in products, & module level planning in softwares.
%age comp.	81%	TLs to enter names of team members by replacing the "Team member n" mentioned in work sheet" Team Members" under coloumn "A". Enter TL name in cell B8.



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Insight 1: Use of manual methods within the system and processes

- Manual meter reading
- Manual data validation process
- Scheduling (Manual/Excel)

"There's this junior engineer sitting in control room, He calls each and every substation in charge. Takes the reading over call and note it down in this register."



Insight 2: Irregularities in schedule

- Discoms are not sending requisition schedule (UP & Jharkhand)
- Genco's are not sending generation schedule (Jharkhand)

"Pain hi Pain he."



Insight 3: Billing and accounting processes are irregular

- No subject matter expert in the organisation (Accounts)
- No state pool account (UP & Jharkhand)
- Slow billing process

"State DSM bill is paid by state discom and there is no role of SLDC"

"We don't even have an accounts person in our organisation"



Insight 4: Billing and accounting processes are irregular

- No subject matter expert in the organisation (Accounts)
- No state pool account (UP & Jharkhand)
- Slow billing process
- "State DSM bill is paid by state discom
- and there is no role of SLDC "
- "We don't even have an accounts
- person in our organisation"



Insight 5: Participants are not accepting the authority of SLDC

SLDC is considered as a department of Transco whereas as per regulation it's an independent body



Insight 6: Data entry major issue

Slow	Inefficient in task processing
Complex	Difficult to master—approximate 2-month learning period for new employees
Clumsy	Causing stress both for the employee and customer
Outdated	Decreasing employee motivation
Insecure at times	Leading to human errors
Overfeaturized	Takes a lot of time to find the necessary function
Fragmented	Causing mishaps in communication within departments and clients

Persona (Role based)

ASSISTANT ENGINEER, SCHEDULING

Basic info

Age: 29

Education: B.E. (Electrical) M.E. (Power systems)

Experience: 4 years

Hometown: Rudrapur



Tushar Singh

Rooted | SEC As | Married with 2 year old kid | Owns a TVS Starcity

Typical day at work

АМ	Shift A	4 PM	Shift 8	TI AM	Shift C	
Sch	heduling		Scheduling revisions		Same as Shift A	
Re	celves schedules		Final scheduling from DA			
	Generation		(After IXL/PXIL)			
	· Open access		RLDC website data download	1		
	- State		Final schedule to:			
	Discom		- Discoms			
	Open access consumers		- Generators			
Co	mbine all schedule		 Open access 			
RL	DC data download		Merit Order Dispatch (MOD)			
Co	mpilation in system		Contingency management			
Re	vision handling		Critical case handling			
Mo	onitor schedule		Approval to (SI)			
Co	ntingency management					
Ru	le based decisions					

Friendly

Practical

Attentive

Organized

scheduling

engineer,

Assistant

Disciplined

Professional

TECHNOLOGY



Schedule management Checking Emails Monitoring





General use of android smart-phone internet browsing Tickets Social Media

Work related needs

 Day to Day activities should be automated Simple & easy process of flow Reliable & security aspects are most important

Life goals

To live a healthy life and want to travel abroad

 To own a house in Dehradun UPSC exams (Second attempt)

Experience Goals

 Minimum manual Interventions Automation in scheduling download/upload process Alorts & alarms in critical cases

 Revisions maintenance automation Web portal type of solutions

Frustrations

Lots of manual and repetitive jobs

No excuse Job (High risk)

 Full time screen monitoring work

 Daily routine job changes as rotating shifts (Personal life hamper)

19

Education: B.E. (Electrical)

Experience: 2 years

Hometown: Akola

Friendly

Helpful

Jolly

Casual

Easy Going

Professional

TECHNOLOGY

DAS & DV

Checking Emails

(f) (b) (c)

General use of androld

smart-phone

Internet browsing Tickets Social Media

validation

8

acquisition

ata

7

engineer,

Assistant

Roshan Jha

Modern | SEC As | Single, lives with flatmate | Owns a Yamaha FZ

Typical day at work



Work related needs

- Hassie free data Simple & easy process acquisition of flow
- Better Inter departmental. coordination

Life goals

 Wants to settle down In Lucknow

 Starting his own food business

· Wants to travel abroad

Experience Goals

- A easy to operate system for dispute free DAS
- Validation checks should be automated
- · Alorts & alarms for Irrelevant data encountered

 Minimum manual. Interventions

Frustrations

- Tedious and time consuming -- Lots of manual process data validation

 Inter departmental & follow ups

20

Ajay Singh

Rooted | SEC As | Married with s kids | Owns a Maruti Alto & Hero Spiendor

Hometown: Varanasi

Education: B.E. (Electrical)

Experience: 20 years in Trans-co 5 years in SLDC

Expert

Focused



General use of android smart-phone Internet browsing

Typical day at work

Shift A Shift B Shift C = AM Scheduling Scheduling revisions Same as Shift A Compilation in system Approves schedule for: Discoms Revision handling Generators Monitor schedule Open access Contingency management Merit Order Dispatch (MOD) Rule based decisions Contingency management Critical case handling Approval to (S.E.)

- Day to Day activities should be automated
- Simple & easy process
- Reliable & security aspects are most important

- Wants to have a secure retirement plan
- critical cases

automation

Frustrations

 Lots of manual and Repetitive Jobs

Daily routine job changes

- + No excuse job (High risk)
- Full time screen monitoring work
- as rotating shifts (Personal life hamper)

+ To settle both the + To be part of regulatory daughters commission Automation in scheduling Alorts & alarms in download/upload process

Shift in charge, scheduling Active thinker Over loaded Disciplined Professional Work related needs TECHNOLOGY Life goals Schedule management Experience Goals Checking Emails Monitoring Minimum manual Interventions Revisions maintenance

Education: B.E. (Electrical)

Experience: 9 years

Hometown: Kota

Age: 32

Janardhan Joshi

Rooted | SEC As | Married with 2 kids | Owns a Maruti 800 & Activa

Friendly

Focused

executive

service delivery

installer,

System

Expert

Empath

Dedicated

Simple

TECHNOLOGY



All organisational software Emails



General use of androld smart-phone Movie tickets Social Media

Ramesh Sharma

Modern | SEC As | Married, lives with family | Owns a Hero Maestro

Typical day at work



Work related needs

- Intuitive & self explanatory system UI
- Simple & easy process of flow
- · Clients demands to be taken care

Life goals

- To excel in the organisation
- · Wants to own a flat In Delhi
- . To live a comfortable and simple life

Experience Goals

- Hassle free conflouration of the system
- · To train the team efficiently to have zero errors
 - Alorts & alarms for Important updates

· Happy and satisfied client

Frustrations

- Repeated calls from the dient after system configuration
- · Requires to travel to remote locations

Multitasker

Expert

settlement

8

billing

engineer

Executive

Overloaded

Organized

Calculative

Professional

TECHNOLOGY



Billing & settlement Checking Emails Creating reports (Excel)



General use of androld smart-phone News

Typical day at work

EXECUTIVE ENGINEER, BILLING & SETTLEMENT



Work related needs

 Hassie free billing & settlement process

Meaningful MIS with Information of tasks Better Inter departmental coordination

Life goals

 Wants to live a stress free life

Wants to contribute towards social causes Wants to have a secure retirement plan

Experience Goals

 A robust & easy to operate Timely billing system for dispute free billing

 Enhanced & transparent process for customers

 Simplified end to end process

Frustrations

- + Tedious and time consuming + Complex bill preparation data validation
 - processes
- Attending legal disputes is stressful

Inter departmental & vendor follow ups

21

Epics

Sr. No.	Business Process	Epic	Context
	(Name of the Business Process	(Name of the Epic)	(Brief description of the Epic giving the context)
	area)		
1	Master definition	Installation & Commissioning	Refer object no. EPICooo88 for details in agile
2	Read meter data	Data acquisation	Refer object no. EPICooo89 for details in agile
3	Validate meter data	Validation, Estimation & Editing	Refer object no. EPICooo90 for details in agile
4	Web based schedule	Schedule Management	Refer object no. EPIC00091 for details in agile
5	Open access approval	Open access approval	Refer object no. EPIC00092 for details in agile
6	Commercial settlement	Billing & Settlement	Refer object no. EPICooo93 for details in agile
7	User Management	User Management	Refer object no. EPICooo94 for details in agile
8	Diagnostic support	Diagnostic support	Refer object no. EPICooo95 for details in agile
9	Problem & Defect reporting	Problem & Defect reporting	Refer object no. EPICooo96 for details in agile
10	Performance requirement	Performance requirement	Refer object no. EPICooo97 for details in agile
11	Security requirement	Security requirement	Refer object no. EPIC00098 for details in agile
12	Energy accounting	Energy accounting	Refer object no. EPICoo110 for details in agile

Phase 2 Functional requirements

Business	Epic	User Story	Grou	Cate	Prio	Ent	As a	I want to	so that	Acceptance criteria	Remarks	Plan	Planr	Expecte	eWatch	Expected	Expected
Process	Name	Name	p	gory	rity	ity						ned	ed	d	ABT	walkthrou	baseline date
Area												Phas	Build	screens	mappin	gh date	
												e			g		
Scheduling	ule Manag ement		Core feature		33		strator			1. Update the data once schedule revision is downloaded from LDC website.		P2	B4		1 Partial	5/17/2021	5/25/2021
Scheduling	ule Manag	O	Core feature	A	34		strator	template with following	schedule preparation and compilation.	Any new schedule parameter can be added in future.		P2	B4		6Yes	5/17/2021	5/25/2021
Scheduling	ule Manag	0	Core feature		35		strator	Configure Dispatch schedule template with the following details - ISGS, MTOA, STOA, LTA, IEX, PXIL, URS, RRAS, SCED, Custom parameter	I can configure standard Dispatch schedule template for each plant			P2	B4	4	4Yes	5/17/2021	5/25/2021
Scheduling	ule Manag		Genco holdin g	A	60	Gen co Hol din g	user	View Latest Revision no., MW, MU, MVAr,		1. Update the data once schedule revision is downloaded from LDC website.		P2	B5		1No	5/17/2021	5/25/2021
Scheduling		Configure term ahead	Advan ce	В	36			configure no of days for advance scheduling	It can be used in term ahead	Enable it if required by customer		P2	B4	:	1No	5/27/202	6/3/2021

Phase 2 User stories

	Business Process Area	Epic Name	User Story Name	Group	Category	Entity	As a	I want to	so that
1		Installation & Commissioning	Define 15 min to 5 min migration	Master definition	#N/A	Genco	Administrator	Define migration from 15 min time blk to 5 min time blk from a specific date	I can run all commercial activity on 5 min time blk
2		Installation & Commissioning	Define Entity	Master definition	#N/A		Service engineer	Define Entities like SLDC, Transco, Genco, Discom, OA Customer	I can identify the entity.
3		Installation & Commissioning	Define Participants	Master definition	#N/A		Service engineer	Define Participants like Generators (ISGS, InSGS), CPP, IPP, Discoms, Open Access Consumers etc.	I can identify pool participants.
4		Installation & Commissioning	Define Traders	Master definition	#N/A		Service engineer	Define Trader like IEX, PXIL, private traders (Tata, Reliance, Manikaran etc.)	I can manage energy contracts.
5		Installation & Commissioning	Define Meter Manufacturer	Master definition	#N/A		Service engineer	Define meter manufacturer like Secure, L&T, Genus etc.	I know meter manufacturers in our system.
6		Installation & Commissioning	Define MODBUS mapping.	Master definition	#N/A		Service engineer	Define MODBUS meter mapping	I can read meter on MODBUS protocol i.e. Profile reading to be done from meter, with selective sending to headend.
									24



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- Hi-fi wireframes



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- Design concept
- Usability testing

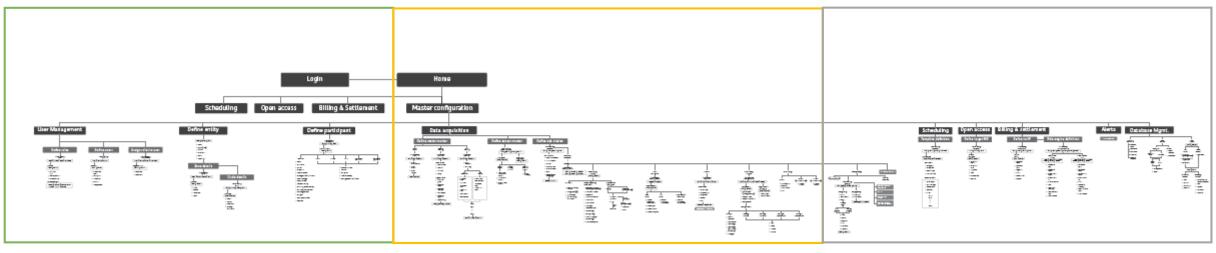
Information Architecture

Part A

Level o: Login | Home

Level 1: Scheduling | Open access | Billing & Settlement | Master configuration

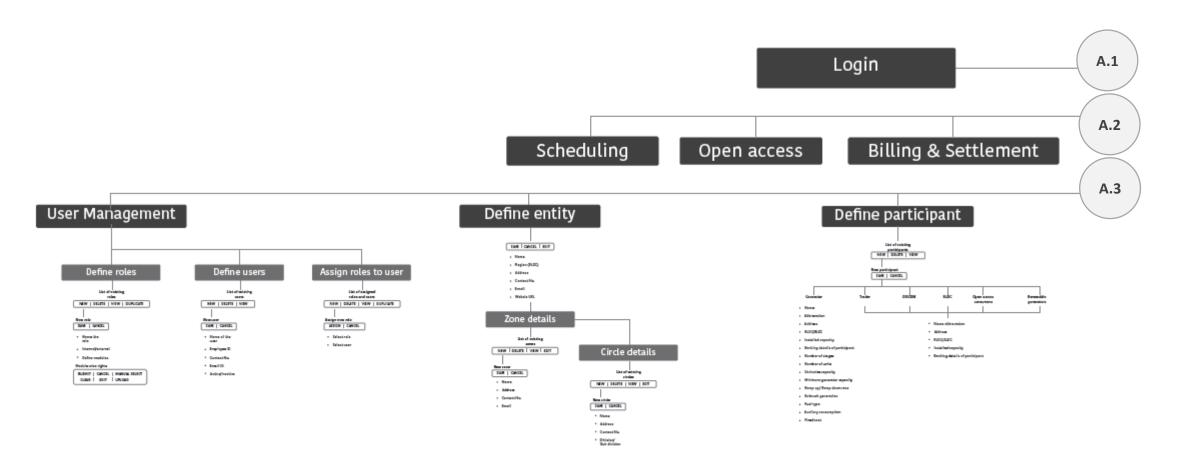
Level 2: User Management | Define entity | Define participant | Data acquisition | Scheduling | Open access | Billing & settlement | Alerts | Database Mgmt



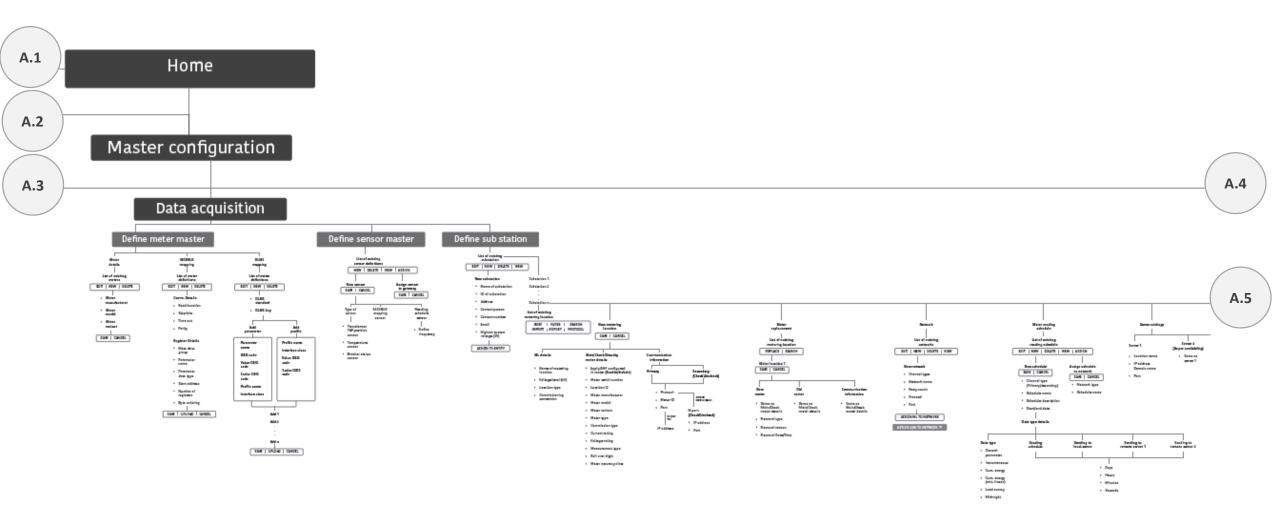
wing A.1 wing A.2 wing A.3

Part A | wing A.1

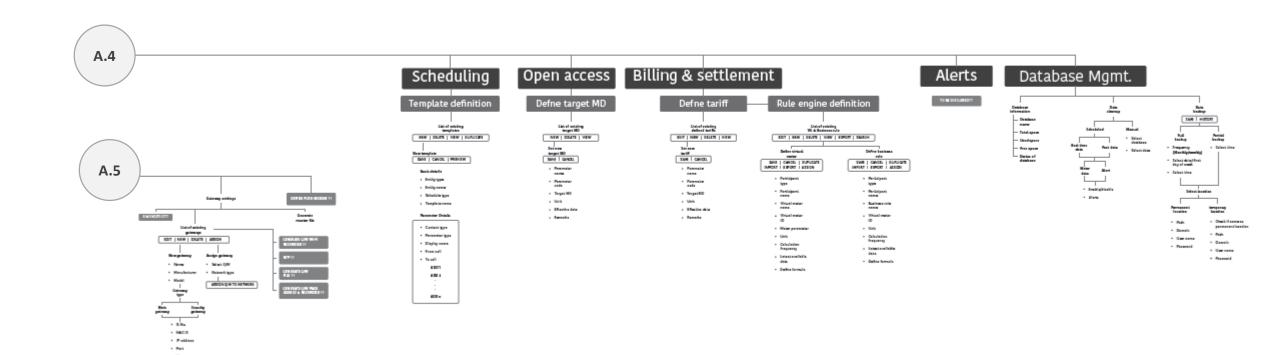
Information Architecture (IA-1)



Part A | wing A.2

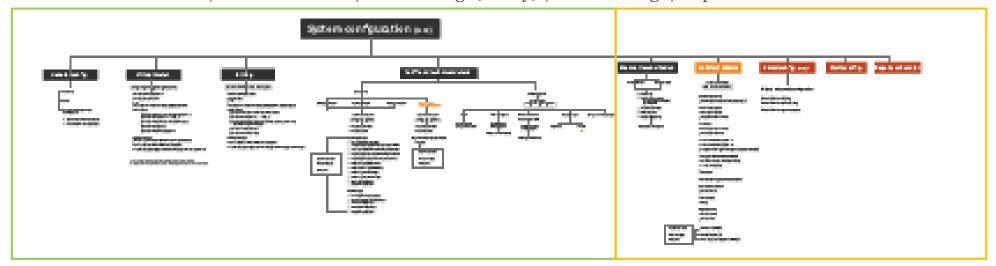


Part A | wing A.3



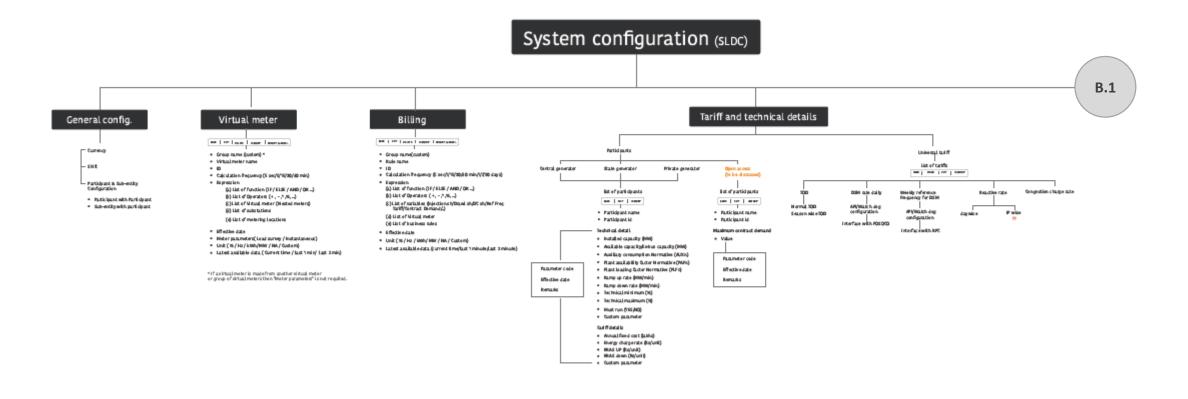
THE CASE

System configuration (SLDC): General config | Virtual meter | Virtual meter Billing | TariE and technical details | Manual reconciliation | Contract details | Email config. (Entity) | Alerts config. | Reports scheduler

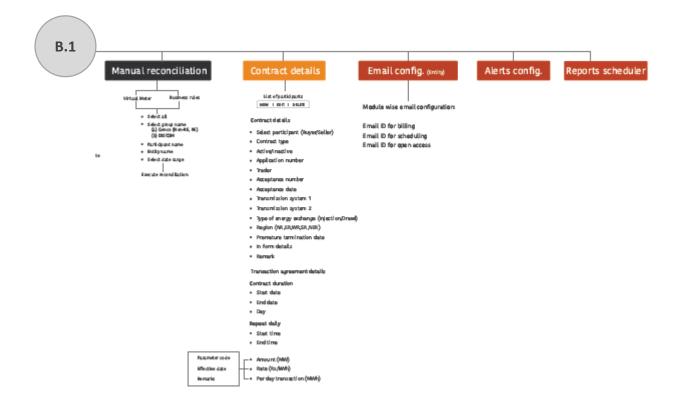


wing B.1 wing B.2

Part B | wing B.1

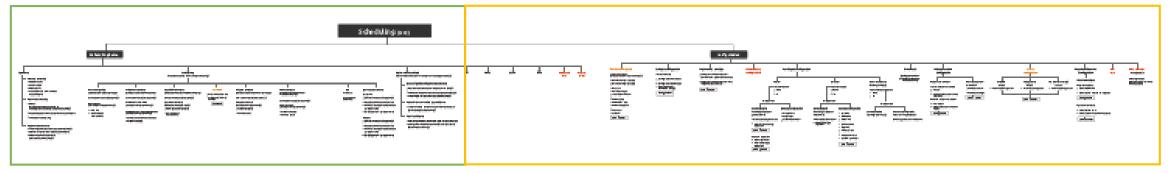


Part B | wing B.2



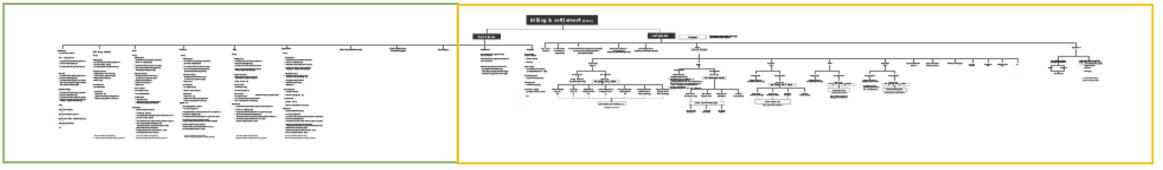
Information Architecture (IA-3)

Scheduling (SLDC): Scheduling home | Configuration



wing C.1 wing C.2

Billing & settlement (SLDC): B & S's home | Configuration



/05/2022

Data acquisition > Master definition Master definition

Devices & Sorval Substations

Personneler meters
Import meter assets
Import geteway assets
Upgrade gateway formwork

Pair meters

pair meters

Endi

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ML piame : []
Meder type: MO COSO

Metor Serial No:

Effective date:

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1	- 1	CHAIN!
- FO		

Councle [Save]

End 1 @ End 2 0 Substation Name:

Mr name

Meter tipe : Mocoso

Metor sound 110:

Motor pair list

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Time	84mC	Berver
Sync	data	

Lo-	Fi	•			

t.	5.0	E-	ndl		End	ls or b	Relationship	Effective date	
		Substation	Marme	Metor	Substator	mcme	Melor Belial		
	1	NTPC-KI	120	1001	NTPC-KI	120	2002	m-c	1/5/2022
	2	HTPC-KI	70	1 1005	NTPCKL	140	1 2004	m- m	7/6/2012
	3	NTPC-KZ	50	1006	NTPC-KZ	60	2009	m-5	9/3/2012
-6	4			1.	11.	1	1		2

Match

History model page

perm Def	NTPC-	KI H	story									Close	97.6	0
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Ske	tch			3	HTPC-	163	50	(00	2 25	TPC-Val	10	2609	m-s	9/8

Delete confirmation 05/2022 Councle Save Pair motors End 1 @ Substation Name: Substian Name: FR ML nome Metal tipe : Moco 30 Impact geleway assold Are you confirm to dele upgrade patrices from NTPC-KI MS Pairing) Pair metors 1 or End 2 Relationship Effective Yes Substacton in L Substation manne name 1/5/2012 NTPC-KI HTPC-KI M-W 7/6/2002 0 NTPC-KZ M-S 9/8/2012 Lo-Fi: Sketch









Modules

Scheduling



Data acquisition



Validation, estimation and editing



Dashboard



Reports



Configuration and administration

System settings



Tariff and technical details



Virtual group and business rules



Alerts configuration



Participants



Entity



User management



Database management









Scheduling Configuration

Summary

View and prepare schedule

Reports

Dispatch schedule (DS)

Current time block 60 (13:45 to 14:00 Hrs)

NTPC-KHL (current day dispatch schedule)

KHSTPP-1

143 89 23
Revision Average MW Energy (MU)

1 block(s) impacted

KHSTPP-2

143	93	24	\
Revision	Average MW	Energy (MU)	/

1 block(s) impacted

KHSTPP-3

143	91	20	\
Revision	Average MW	Energy (MU)	/

1 block(s) impacted

KHSTPP-4

143 89 23

KHSTPP-1

Current day

Г			
	Revision	Average MW	Energy (MU)
	143	89	23

Auto	10.05.2021	10.0
770000	10-0-2-6021	17.0

Declared capacity (DC)

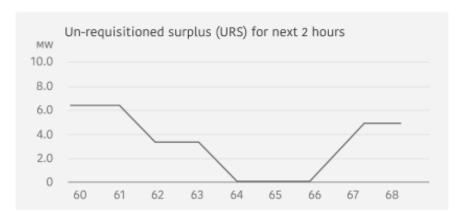
Revision	Average MW	Energy (MU)
152	97	32

Manual | 10.05.2021 19:05

Rate and grid frequency

Frequency (Hz)	DSM (₹/unit)	Fuel (₹/unit)
49.05	2	5





Next day

	Revision	Date and time	Average MW	Energy MU
spatch schedule	36	10/05/2021 19:07	89	187
eclared capacity	42	10/05/2021 19:07	96	166

Implemented schedule

Revision	Week detail	Date and time
3	<u>19</u>	10/05/2021 19:07
4	<u>19</u>	10/05/2021 19:07
		33

Hi-Fi: Wireframe





Data acquisition Master definition

System summary Dashboards Reports On-demand meter reading Upload meter data

Data acquired from 17/06/19 00:00 to 18/06/19 16:40 C Refresh

Meters, substations and gateways

Search

Critical alerts

No data received from

30

Substations

Last gasp in

05

Gateways

Time drift in

02

Gateways

Poor signal in

80

Gateways

Time drift in

05

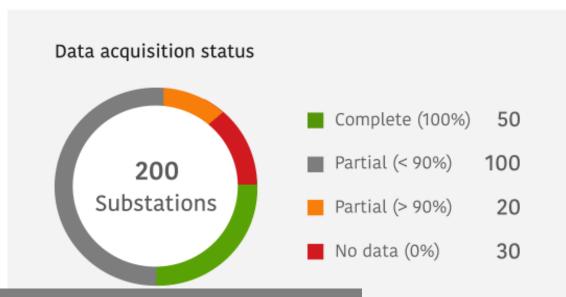
Meters

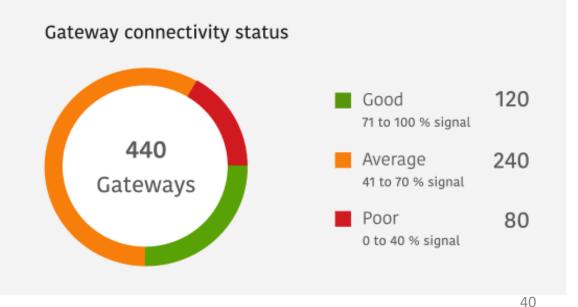
View all substations >

Total: 200

View all gateways >

Total: 440







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Design

- Design research
- Design concept
- Usability testing

Visuals Design

Colors : Secure color palette

Typeface: Secure brand font (Kohinoor)

*e*Watch

Name

gui

gui2

← → C (i) localhost:86/Substation

Data acquisition > Master definition

Master definition

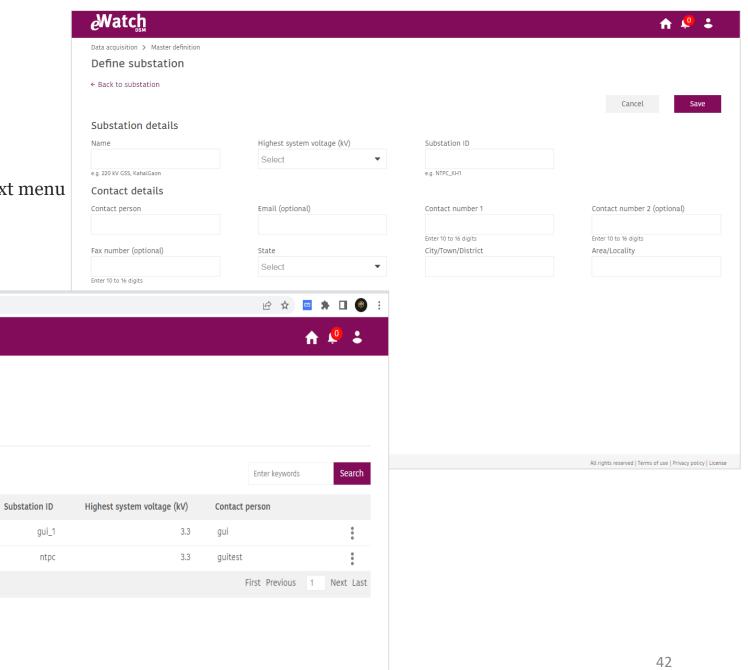
Devices and servers

Substations 💆 Define substation

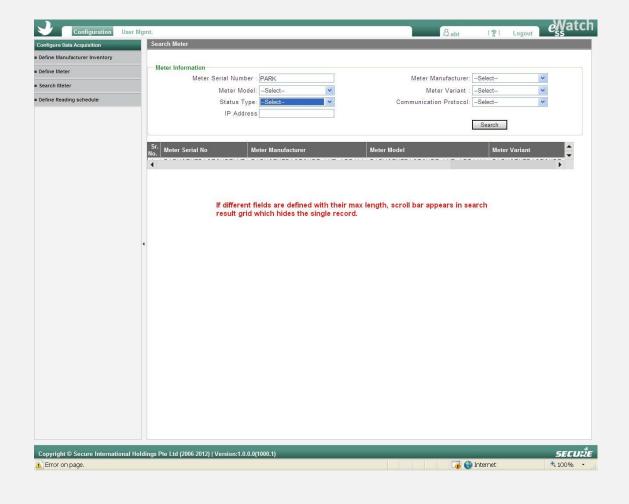
Micro-interactions: Carousal widget, Row dots context menu

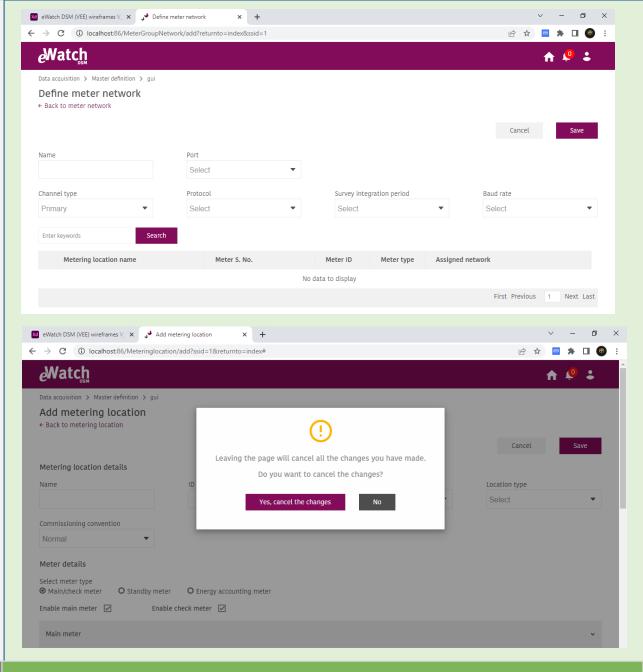
Substation

Metering locations

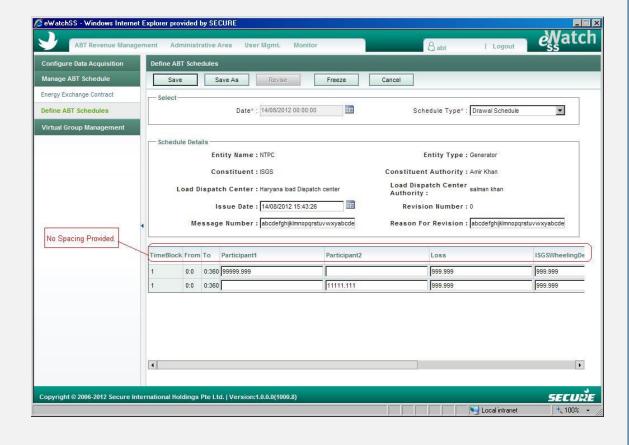


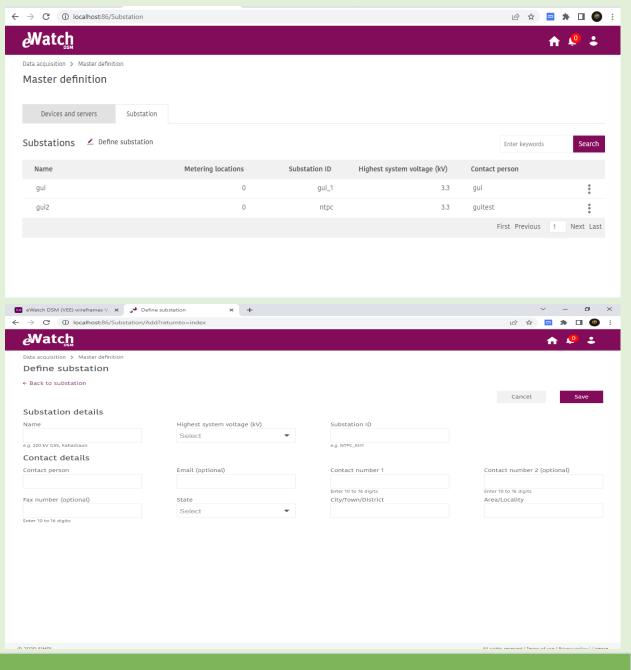
A/B testing (ABT version vs DSM version)

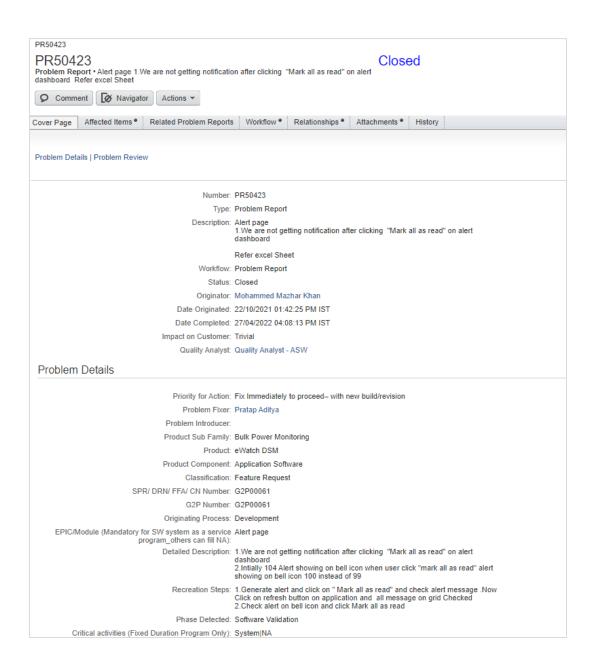


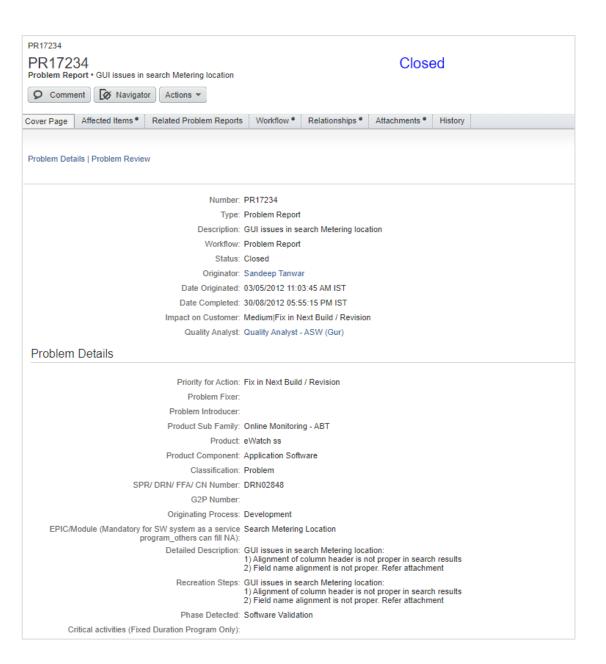


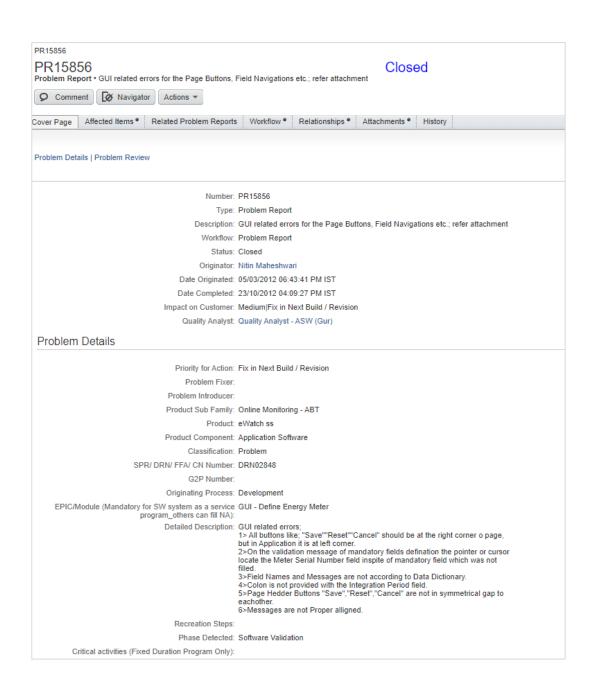
A/B testing (ABT version vs DSM version)

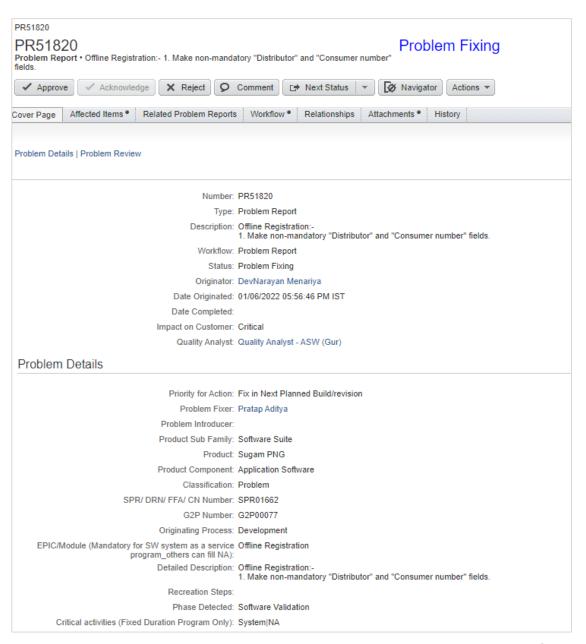












Thanks