

Grid_side_demonstrations

Demonstracija mrežnih modula




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Javna prezentacija – Hrvatskog pilota

03.07.2019, Zagreb

Project co-funded European Union Funds ERDF, IPA

Icecream APPS



00:01

Grid_side_demonstrations

smart building – smart grid – smart city

Aplikacija za optimizaciju naprednog upravljanja tokovima snaga distribucijske mreže

- Back-end:
 - Samostalno i periodički pokretanje
 - Razmjena podataka s bazom podataka, SCADOM, Neplanom i drugim servisima
- Front-end
 - Web service
 - Korisničko sučelje
 - pristup i vizualizacija podataka i rezultata iz baze
 - Direktan pristup iz Internet preglednika

  2

Second pilot visit study, 02 July 2019, Zagreb

Icecream APPS

00:13

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3Smart Long Term Module

127.0.0.1:5000

3Smart App

Long-term planning AC OPF Analysis Intra-day Operation Report Add user Maintain users

Logout Paula

Long Term Workflow

Grid Choose...

Building Choose...

Contract New contract

Step	Activity	Link	Status
1	[DSO staff] is calculating flexibility needs, prices, penalty and quality of service by using "3Smart_LT module_v1.xism"	Template	✓
2	[DSO staff] is importing the results of "3Smart_LT module_v1.xism"	Import DSO Flex Table	✓
3	[Building EMS Microgrid module] is fetching data from LT database		✓
4	[Building EMS Microgrid module] is calculating flexibility offer		✓
5	[DSO LT module] is fetching data from Microgrid database	Building Flexibility	✓
6	[DSO LT module] is generating file from Building Flexibility table	Building Flexibility	✓
7	[DSO staff] is preparing contract in "3Smart_LT module_v1.xism"		✓
8	[DSO staff] is importing the prepared contract from "3Smart_LT module_v1.xism"	Import Contract	✓

05:57

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3Smart Long Term Module

127.0.0.1:5000

3Smart App

Long-term planning AC OPF Analysis Intra-day Operation Report Add user Maintain users

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Long Term Workflow

Grid Choose...

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1	[DSO staff] is calculating flexibility needs, prices, penalty and quality of service by using "3Smart_LT module_v1.xism"	Template	✓
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3	[Building EMS Microgrid module] is fetching data from LT database		✓
4	[Building EMS Microgrid module] is calculating flexibility offer		✓
5	[DSO LT module] is fetching data from Microgrid database	Building Flexibility	✓
6	[DSO LT module] is generating file from Building Flexibility table	Building Flexibility	✓
7	[DSO staff] is preparing contract in "3Smart_LT module_v1.xism"		✓
8	[DSO staff] is importing the prepared contract from "3Smart_LT module_v1.xism"	Import Contract	✓

3Smart_LT module_v1.xism

05:13

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3Smart Long Term Module

127.0.0.1:5000

3Smart App Long-term planning AC OPF Analysis Intra-day Operation Report Add user Maintain users Logout Paula

Long Term Workflow

Grid: Savica

Building: Choose...

Contract: Choose...
FER building

Step	Activity	Link	Status
1	[DSO staff] is calculating flexibility needs, prices, penalty and quality of service by using "3Smart_LT module_v1.xism"	Template	?
2	[DSO staff] is importing the results of "3Smart_LT module_v1.xism"	Import DSO Flex Table	?
3	[Building EMS Microgrid module] is fetching data from LT database		?
4	[Building EMS Microgrid module] is calculating flexibility offer		?
5	[DSO LT module] is fetching data from Microgrid database	Building Flexibility	?
6	[DSO LT module] is generating file from Building Flexibility table	Building Flexibility	?
7	[DSO staff] is preparing contract in "3Smart_LT module_v1.xism"		?
8	[DSO staff] is importing the prepared contract from "3Smart_LT module_v1.xism"	Import Contract	?

3Smart_LT module_v1.xism

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3Smart_LT module_v1.XLSM - Excel

Paula Mame

File Home Insert Page Layout Formulas Data Review View Help Team Search

AutoSave ON

Clipboard Font Alignment Number Styles Cells Editing Ideas

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
					Time	January - Weekdays	February - Weekdays	March - Weekdays	April - Weekdays	May - Weekdays	June - Weekdays	July - Weekdays	August - Weekdays	September - Weekdays	October - Weekdays	November - Weekdays	December - Weekdays
1	Thermal limit of cable/ line	0	kW														
2	Operational limit (January)	0	kW		0:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	Operational limit (February)	0	kW		0:15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	Operational limit (March)	0	kW		0:30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	Operational limit (April)	0	kW		0:45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	Operational limit (May)	0	kW		1:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	Operational limit (June)	0	kW		1:15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	Operational limit (July)	0	kW		1:30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	Operational limit (August)	0	kW		1:45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	Operational limit (September)	0	kW		2:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11	Operational limit (October)	0	kW		2:15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12	Operational limit (November)	0	kW		2:30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
13	Operational limit (December)	0	kW		2:45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
14	Calculate				3:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15					3:15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
16	Choose year:				3:30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17	2019				3:45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
18	Choose column for calculation check:				4:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
19					4:15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
20	Show calculation				4:30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
21					4:45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
22					5:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
23					5:15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
24					5:30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
25	The following input is needed for calculations:				5:45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
26	Cells B2-B13 : operational limit for the given month				6:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
27	Cell A18 : chosen year (updates data in Calendar sheet as well!)				6:15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
28	Cells F3-A098 : 15-minute load data input				6:30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
29	If Calendar sheet is valid, click on the Calculate button to run!																

Calendar Calculation input DSO Flexibility table Flexibility calculation Price and penalty Flexibility unit prices/penalty Building Flexibility table Output for long term contract

Grid_side_demonstrations

161.53.66.209 - Remote Desktop Connection

AN - (FER building calculations.neppj-Rootnet-Diagram 0)

Feeder Reinforcement/Control

3Smart_LT module v1.31.5M - Excel

Paula Mamec

	A	B	C	D	E	F	G	H
					Time	January - Weekdays	February - Weekdays	March - Weekdays
1	Thermal limit of cable/ line	0	kW					
2	Operational limit (January)	0	kW		0:00	0.00	0.00	
3	Operational limit (February)	0	kW		0:15	0.00	0.00	
4	Operational limit (March)	0	kW		0:30	0.00	0.00	
5	Operational limit (April)	0	kW		0:45	0.00	0.00	
6	Operational limit (May)	0	kW		1:00	0.00	0.00	
7	Operational limit (June)	0	kW		1:15	0.00	0.00	
8	Operational limit (July)	0	kW		1:30	0.00	0.00	
9	Operational limit (August)	0	kW		1:45	0.00	0.00	
10	Operational limit (September)	0	kW		2:00	0.00	0.00	
11	Operational limit (October)	0	kW		2:15	0.00	0.00	
12	Operational limit (November)	0	kW		2:30	0.00	0.00	
13	Operational limit (December)	0	kW		2:45	0.00	0.00	
14					3:00	0.00	0.00	
15					3:15	0.00	0.00	
16					3:30	0.00	0.00	
17					3:45	0.00	0.00	
18					4:00	0.00	0.00	
19					4:15	0.00	0.00	
20					4:30	0.00	0.00	
21					4:45	0.00	0.00	
22					5:00	0.00	0.00	
23					5:15	0.00	0.00	
24					5:30	0.00	0.00	
25					5:45	0.00	0.00	
26					6:00	0.00	0.00	
27					6:15	0.00	0.00	
28					6:30	0.00	0.00	

Calculate

Choose year: 2019

Choose column for calculation check:

Show calculation

The following input is needed for calculations:

Cells B2-B13 : operational limit for the given month

Cell A18 : chosen year (updates data in Calendar sheet as well!)

Cells F3-AO98 : 15-minute load data input

If Calendar sheet is valid, click on the Calculate button to run!

Calendar Calculation input DSO Flexibility table Flexibility calculation

Grid_side_demonstrations

161.53.66.209 - Remote Desktop Connection

AN - (FER building calculations.neppj-Rootnet-Diagram 0)

TS SAVICA

3Smart_LT module v3_FIXED.XLSM - Excel

Paula Mamec

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	A	B	C	D	E	F	G	H
					Time	January - Weekdays	February - Weekdays	March - Weekdays
1	Thermal limit of cable/ line	6320	kW					
2	Operational limit (January)	1150	kW		0:00	631.97	631.97	61
3	Operational limit (February)	1150	kW		0:15	631.97	631.97	61
4	Operational limit (March)	1150	kW		0:30	631.97	631.97	61
5	Operational limit (April)	1150	kW		0:45	631.97	631.97	61
6	Operational limit (May)	1150	kW		1:00	631.97	631.97	61
7	Operational limit (June)	1500	kW		1:15	631.97	631.97	49
8	Operational limit (July)	1500	kW		1:30	631.97	631.97	48
9	Operational limit (August)	1500	kW		1:45	631.97	631.97	48
10	Operational limit (September)	1150	kW		2:00	631.97	631.97	48
11	Operational limit (October)	1150	kW		2:15	631.97	631.97	48
12	Operational limit (November)	1150	kW		2:30	631.97	631.97	48
13	Operational limit (December)	1150	kW		2:45	631.97	631.97	48
14					3:00	631.97	631.97	48
15					3:15	631.97	631.97	48
16					3:30	631.97	631.97	48
17					3:45	631.97	631.97	48
18					4:00	631.97	631.97	50
19					4:15	631.97	631.97	52
20					4:30	631.97	631.97	52
21					4:45	631.97	631.97	52
22					5:00	631.97	631.97	59
23					5:15	631.97	631.97	66
24					5:30	631.97	631.97	66
25					5:45	631.97	631.97	66
26					6:00	631.97	631.97	74
27					6:15	631.97	631.97	
28					6:30	631.97	631.97	

Calculate

Choose year: 2019

Choose column for calculation check:

Show calculation

The following input is needed for calculations:

Cells B2-B13 : operational limit for the given month

Cell A18 : chosen year (updates data in Calendar sheet as well!)

Cells F3-AO98 : 15-minute load data input

If Calendar sheet is valid, click on the Calculate button to run!

Calendar Calculation input DSO Flexibility table Flexibility calculation

Grid_side_demonstrations

3Smart_LT module_v3_FIXED.XLSM - Excel

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Clipboard Font Alignment Number Styles Cells Editing Ideas

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C24

	A	B	C	E	F	G	H	J	K	L	M	N
	Month	Type of day	Flexibility requirement [kW]	Time interval (Start)	Time interval (Length)	Flexibility requirement [kWh]	Pos of type of day					
2	2019-01	WEEKDAYS	-11.38	11:30	3:50	-39.83	22					
3	2019-02	WEEKDAYS	-11.38	11:30	3:50	-39.83	20					
4	2019-06	WEEKDAYS	-23.22	10:30	0:50	-11.61	17					
5	2019-06	WEEKDAYS	-23.22	11:30	0:25	-5.81	17					
6	2019-06	WEEKDAYS	-73.63	13:00	0:50	-36.82	17					
7	2019-06	WEEKDAYS	-73.63	14:30	0:50	-36.82	17					
8	2019-07	WEEKDAYS	-23.22	10:30	0:50	-11.61	23					
9	2019-07	WEEKDAYS	-23.22	11:30	0:25	-5.81	23					
10	2019-07	WEEKDAYS	-73.63	13:00	0:50	-36.82	23					
11	2019-07	WEEKDAYS	-73.63	14:30	0:50	-36.82	23					
12	2019-08	WEEKDAYS	-23.22	10:30	0:50	-11.61	20					
13	2019-08	WEEKDAYS	-23.22	11:30	0:25	-5.81	20					
14	2019-08	WEEKDAYS	-73.63	13:00	0:50	-36.82	20					
15	2019-08	WEEKDAYS	-73.63	14:30	0:50	-36.82	20					
16	2019-12	WEEKDAYS	-11.38	11:30	3:50	-39.83	20					
17												
18												
19												
20												
21												
22												
23												
24												
25												
26												
27												
28												
29												
30												

The table on the left side shows the result of the calculation:

- Showing the exact month
- Showing the type of day (weekdays / saturday / sunday)
- Flexibility demand (in kW)
- Start of flexibility time interval
- Length of flexibility time interval (in hours, up to 2 decimals)
- Flexibility demand (in kWh)
- Sum of the given type of days for further calculations

Calendar Calculation input DSO Flexibility table Flexibility calculation Price and penalty Flexibility unit prices, penalty Building Flexibility table Output for long term contract

Grid_side_demonstrations

3Smart_LT module_v3_FIXED.XLSM - Excel

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B4

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
1	Calculation of flexibility resource																
2	WACC	4.00%															
3	Inflation	2.50%															
4	The cost of investment	120,360 EUR															
5	Ratio of used flexibility price	100%															
6	Year	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
7	WACC	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%
8	Inflation	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%
9	FV (Future Value)	120,360	123,369	126,453	129,615	132,855	136,176	139,581	143,070	146,647	150,313	154,071	157,923	161,871	165,918	170,066	174,317
10	Cost of investment (with consideration of inflation)	120,360	123,369	126,453	129,615	132,855	136,176	139,581	143,070	146,647	150,313	154,071	157,923	161,871	165,918	170,066	174,317
11	Minimum amount of money available to cover the future investment	118,624	121,590	124,629	127,745	130,939	134,212	137,568	141,007	144,532	148,145	151,849	155,645	159,536	163,525	167,613	171,801
12	Maximum price of flexibility	1,736	1,779	1,824	1,869	1,916	1,964	2,013	2,064	2,115	2,168	2,222	2,278	2,335	2,393	2,453	2,514
13	Used price of flexibility (maximum ratio)	1,736	1,779	1,824	1,869	1,916	1,964	2,013	2,064	2,115	2,168	2,222	2,278	2,335	2,393	2,453	2,514
14	Free amount of money after flexibility price	118,624	121,590	124,629	127,745	130,939	134,212	137,568	141,007	144,532	148,145	151,849	155,645	159,536	163,525	167,613	171,801
15	Unused source	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	Calculation of unit prices																
17	Reservation ratio	50.0%															
18	Penalty price multiplier	2															
19	Reservation part of Flexibility unit price	0.027 EUR/kWh/(15min)															
20	Activation part of Flexibility unit price	0.109 EUR/kWh															
21	Penalty	0.219 EUR/kWh															
22	Quality threshold (max. deviation in size of service without penalty)	-10 %															
23																	
24																	
25																	
26																	
27																	
28																	
29																	
30																	

Calendar Calculation input DSO Flexibility table Flexibility calculation Price and penalty Flexibility unit prices, penalty Building Flexibility table Output for long term contract

Grid_side_demonstrations

Smart Building – Smart Grid – Smart City

Dan-unaprijed operacije

Ulazni podaci

- Izgled mreže
- Opterećenje mreže po čvorištima
- Rezervacija usluga fleksibilnosti definira ugovorom
- Predviđeno ponašanje zgrade



AC OPF
 $H = \min\{P_g\}$

Interreg Danube Transnational Programme 3Smart

Second pilot visit sutdy, 02 July 2019, Z...eb

Icecream APPS

Grid_side_demonstrations

Smart Building – Smart Grid – Smart City


Dan-unaprijed operacije

Ulazni podaci

- Izgled mreže
- Opterećenje mreže po čvorištima
- Rezervacija usluga fleksibilnosti definira ugovorom
- Predviđeno ponašanje zgrade

Izlazni podaci

- Naponske i strujne prilike mreže
- Aktivacijski profil fleksibilnosti za zgradu

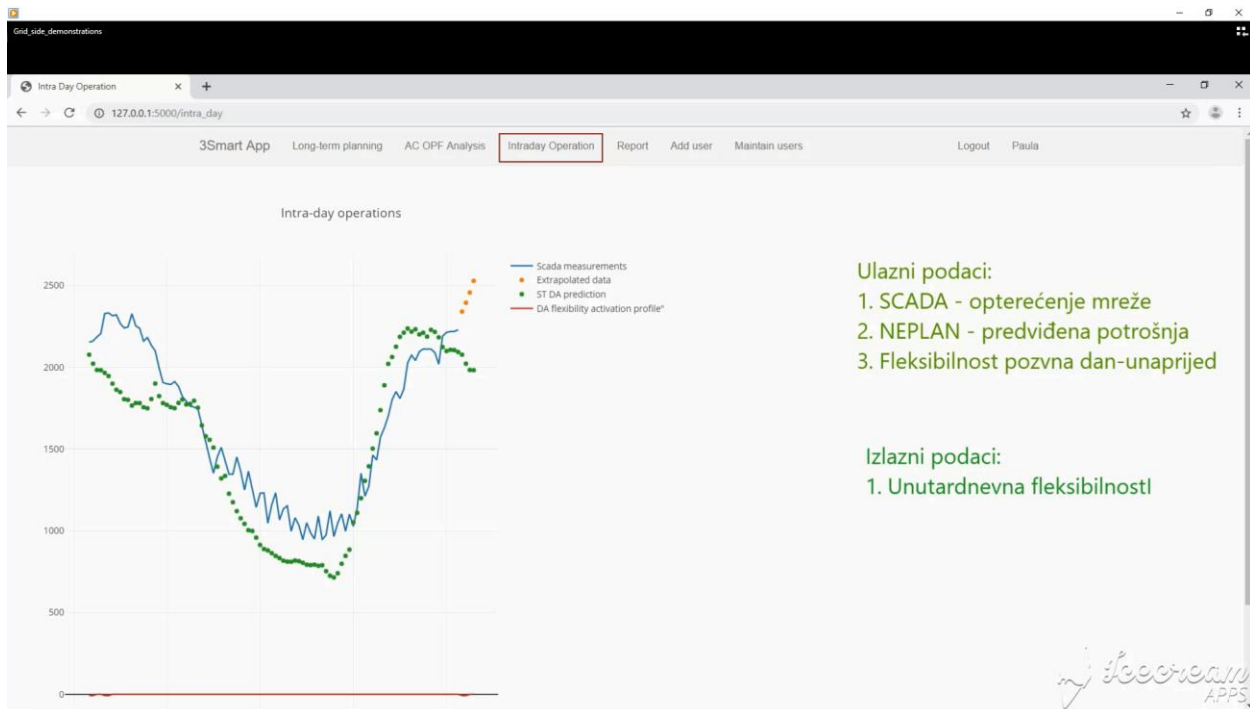


AC OPF
 $H = \min\{P_g\}$

Interreg Danube Transnational Programme 3Smart

Second pilot visit sutdy, 02 July 2019, Z...eb

Icecream APPS



Grid_side_demonstrations

Energy Consumption

127.0.0.1:5000/report

3Smart App Long-term planning AC OPF Analysis Intra-day Operation **Report** Add user Maintain users Logout Paula

Grid
Savica

Building
FER building

Energy Consumption

Date	Feeder consumption	Predicted building consumption	Realized building consumption	Requested building flexibility	Realized building flexibility
2019-06-04	121404.0	24.5092	25.2445	-36.418	-34.5971
2019-06-05	121404.0	24.5092	25.2445	-36.418	-34.5971
2019-06-06	121404.0	24.5092	25.2445	-36.418	-34.5971
2019-06-07	121404.0	24.5092	25.2445	-36.418	-34.5971
2019-06-08	121404.0	24.5092	25.2445	0.0	0.0
2019-06-09	121404.0	24.5092	25.2445	0.0	0.0
2019-06-10	121404.0	24.5092	25.2445	-36.418	-34.5971
2019-06-11	121404.0	24.5092	25.2445	-36.418	-34.5971
2019-06-12	121404.0	24.5092	25.2445	-36.418	-34.5971
2019-06-13	121404.0	24.5092	25.2445	-36.418	-34.5971
2019-06-14	121404.0	24.5092	25.2445	-36.418	-34.5971
2019-06-15	121404.0	24.5092	25.2445	0.0	0.0
2019-06-16	121404.0	24.5092	25.2445	0.0	0.0

Gridside APPS