

# Mochovce units 3&4 completion project

*Main Achievements and Near  
Future Targets*

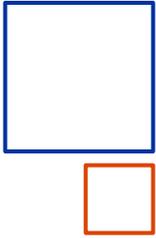
## 60 years for Nuclear Energy

***Peter Andraško***

Commissioning and Nuclear Compliance Director

Plzeň, 12.5.2016





# Mochovce 3&4

## Contents



- **Role of SE & Project Organization**
- Safety
- Project Progress
- Project Schedule
- Main Achievements

# MO34 as a growth engine



Man-hours on MO34  
Project

≈ 46

million

Peak at MO34  
construction site

5 200

workers

Investment

4.6 bn

euro



# Mochovce 3&4

## Role of Slovenské Elektrárne



- **Investor**
- **Owner**
- **Operator**
- **Architect Engineer**

### **ROLE OF ARCHITECT ENGINEER**

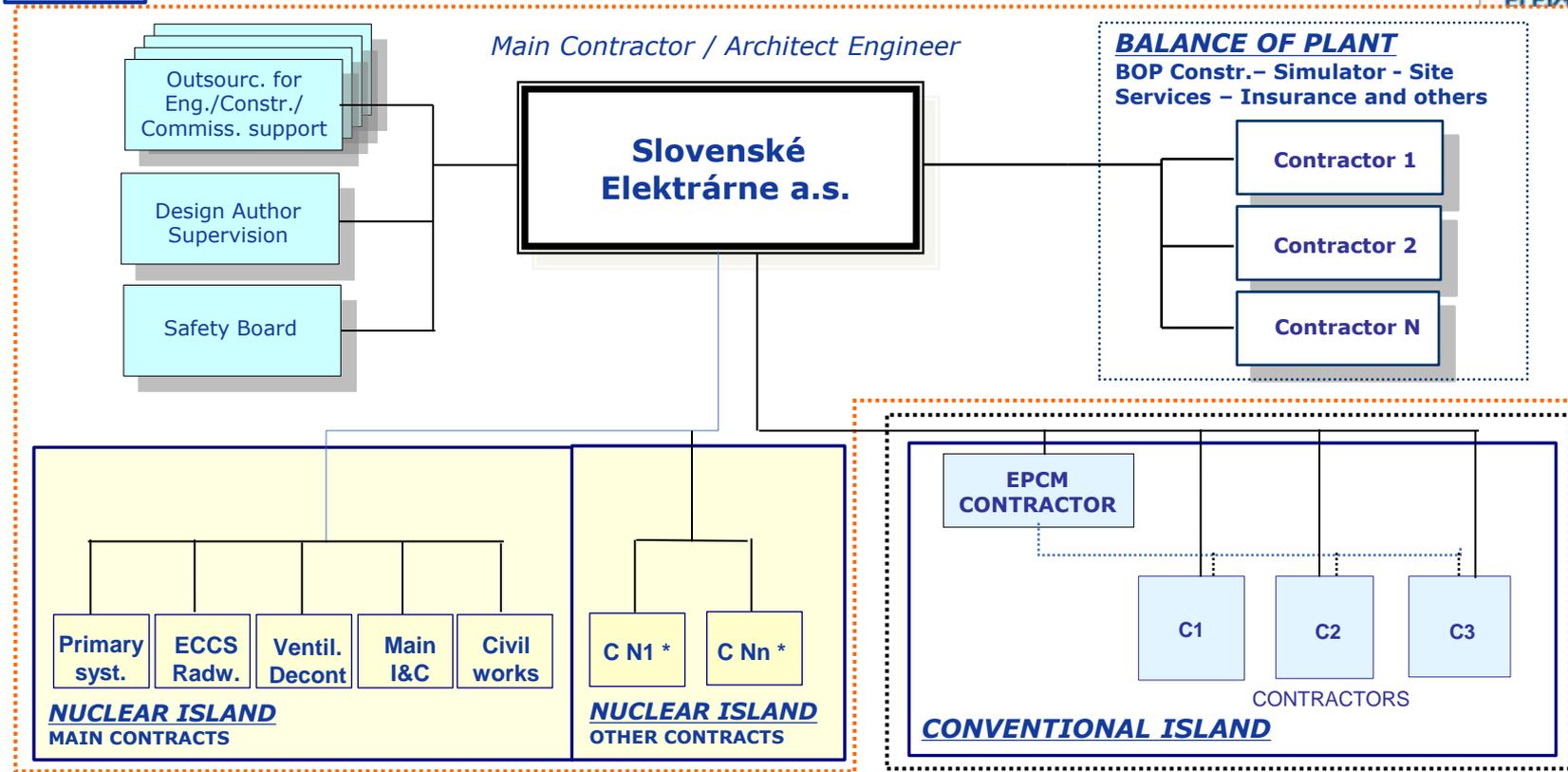
- Management of Project
- Management of Overall Project Schedule
- Budget and Cost Control
- Health, Safety and Environment
- Design Authority (INSAG 19, Act 541/04, Decree 50 and 56/06)
- Engineering Review and Approval
- Interface Management
- Quality Plans for Classified Equipment approval (UJD)
- Coordination of Construction
- Commissioning
- Management of Licensing activities



**Mochovce 3&4 Project Team** established by Slovenské Elektrárne with the purpose to act as **Architect Engineer for the Project**

# Mochovce 3&4

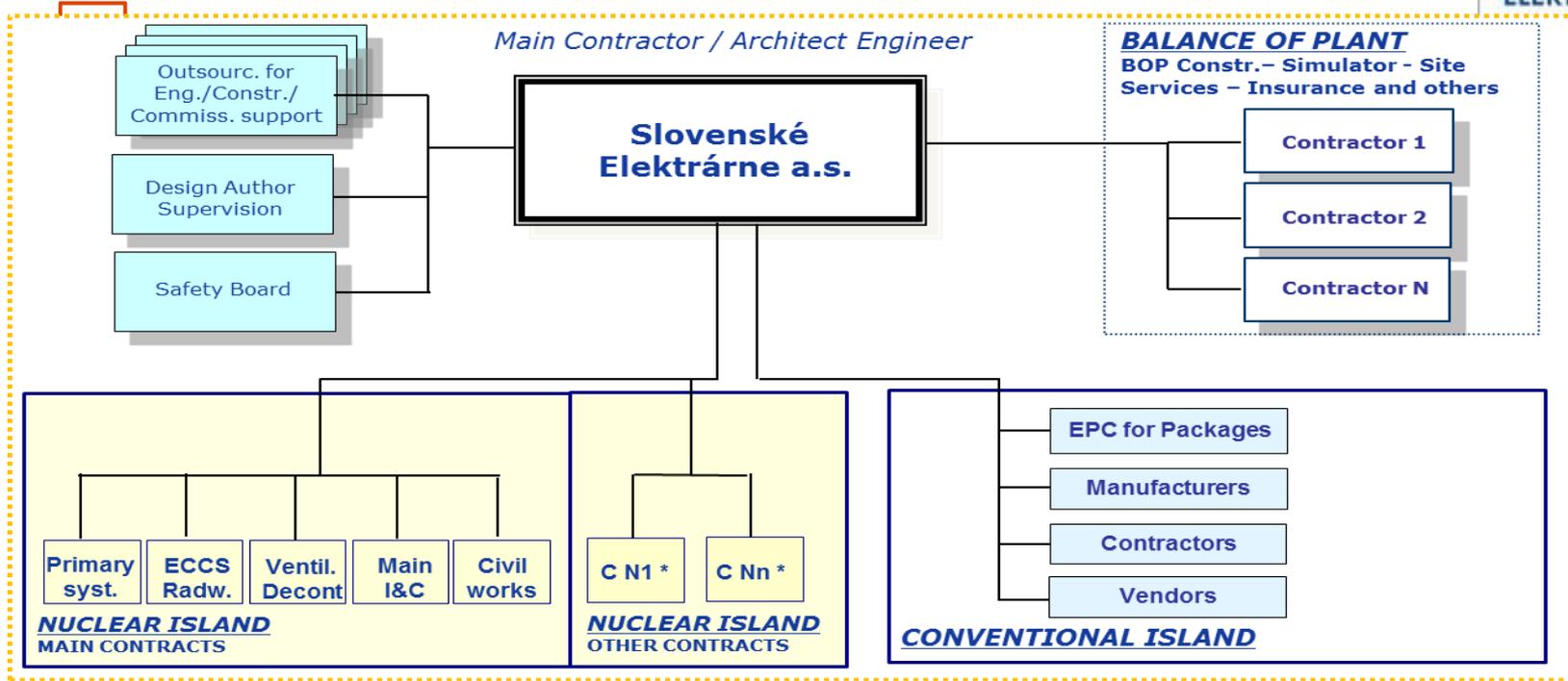
## Former Project Managerial Structure



\*Includes mainly: special I&C, supply and erection of field instrumentation and electrical systems

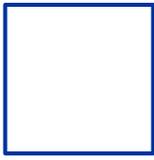
# Mochovce 3&4

## New Project Managerial Structure



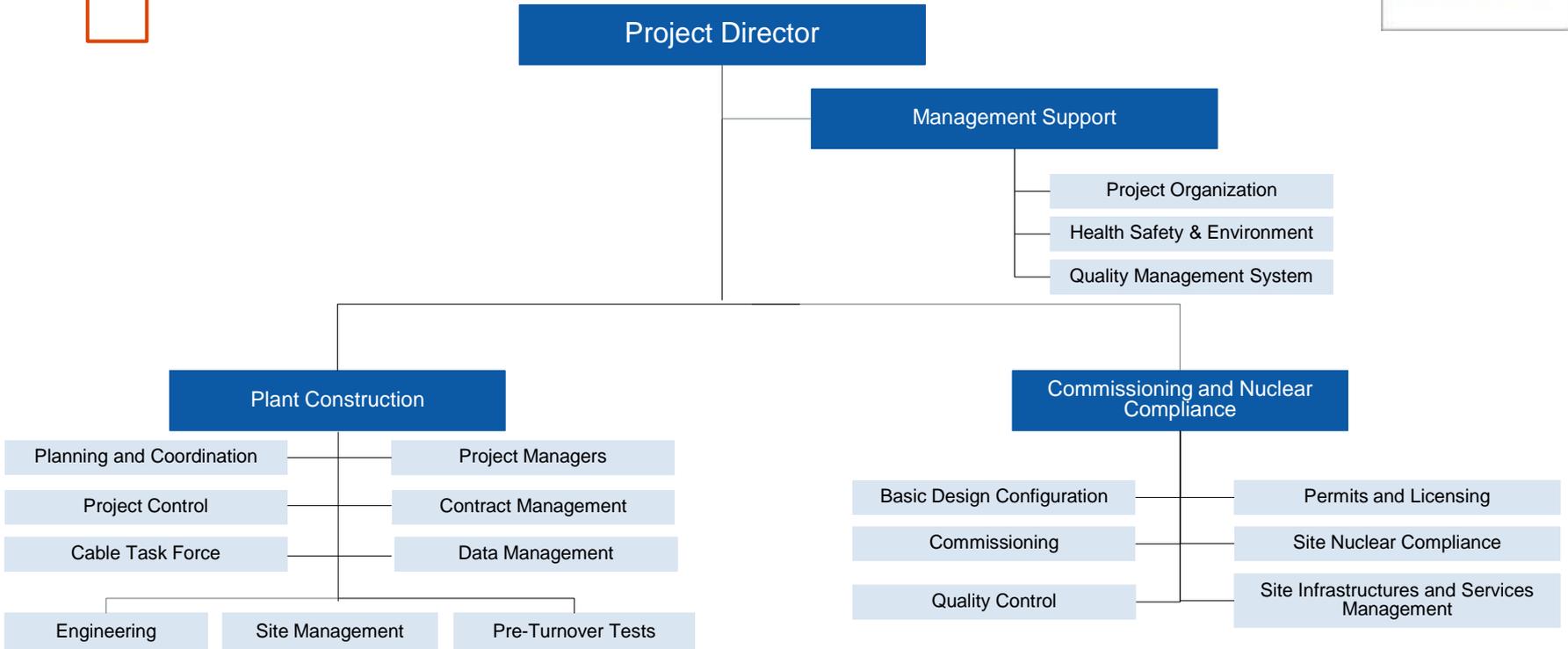
\*Includes mainly: special I&C, supply and erection of field instrumentation and electrical systems

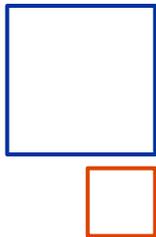
**This re-organization brings to the SE Project Team the task of managing the Conventional Island.**



# Mochovce 3&4

## Current Organization Structure





# Mochovce 3&4

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- Role of SE & Project Organization
- **Safety**
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# Mochovce 3&4 - Basic Information

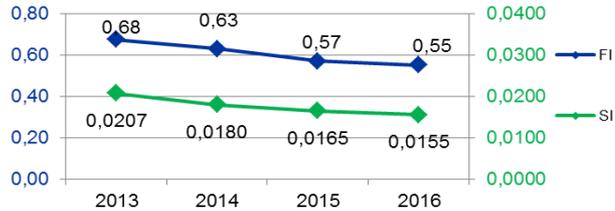
Data date: 31/03/16



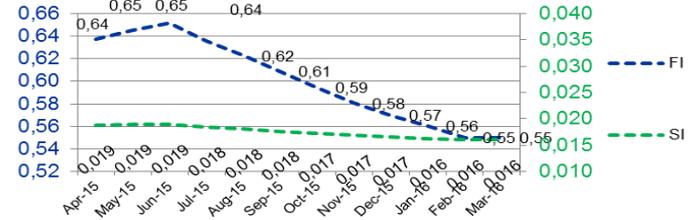
## Accident Level Statistics (project stats from 2009)

	2011	2012	2013	2014	2015	2016
Fatal accidents / Severe accidents	0/0	0/0	0/0	0/0	1/0	0/0
LTI injuries with sickness leave > 1 day	5	4	2	6	5	0
First aid cases	8	7	22	26	14	6
Near misses	11	5	11	40	40	13
Dangerous occurrences	2	4	2	3	0	0
Fires	2	2	1	0	0	0
Lost day totally	183	124	115	148	143	3
Man hours per year totally	5.416 731	5.820 423	7.420 031	11.424 854	12.527 882	3.325.987

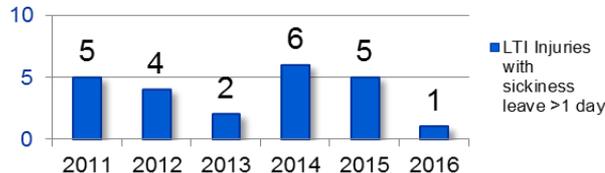
### Combined Frequency Rate (FI - SI) (\*)



### Combined FR trend (FI - SI) (\*)



### Total Number of Accidents



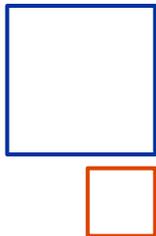
### Comments & Safety Highlights

- Reinforcement of human behavior in order to report dangerous works and behavior\*1112 (awarding of workers for reporting)

**1 FATAL ACCIDENT OCCURED ON MAY 28<sup>TH</sup> 2015**

(\*) FI = ( N° accident with sick leave x 1.000.000 ) / Total working hours

SI = ( N° days lost x 1.000 ) / Total working hours



# Mochovce 3&4

## Contents



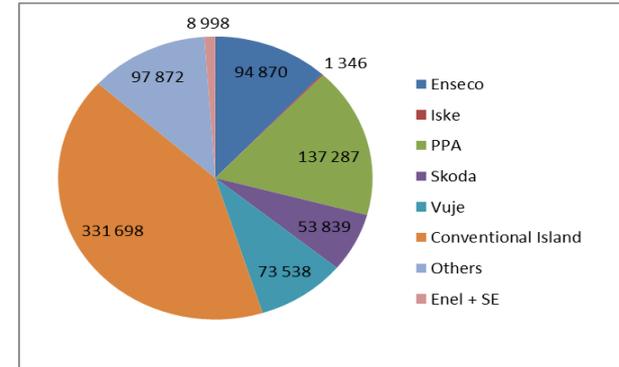
- Role of SE & Project Organization
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# Direct Manpower Trend

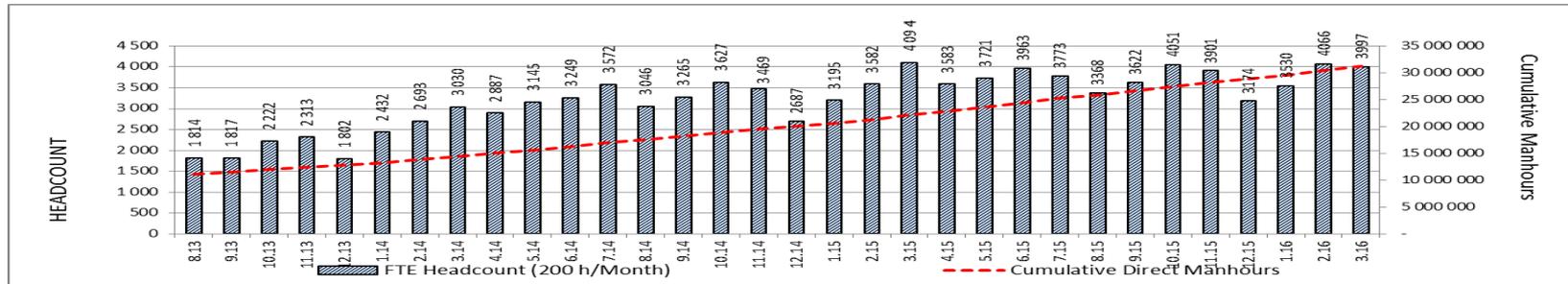
## Direct Manhours by Contractor – March 2016



Contractor	Direct Manhours (*)		Cumulative Manhours	Direct workers headcount in the month (FTE 200 h/month)	
	Last month	This Month		Last month	This Month
	Enseco	97 803		94 870	2 652 432
Iske	1 190	1 346	6 443 496	6	7
PPA	137 385	137 287	2 277 132	687	686
Skoda	54 742	53 839	1 588 061	274	269
Vuje	76 754	73 538	1 404 542	384	368
Conventional Island	334 806	331 698	15 334 311	1674	1658
Others	101 154	97 872	1 476 721	506	489
Enel + SE	9 399	8 998		47	45
<b>TOTAL</b>	<b>813 233</b>	<b>799 448</b>	<b>31 185 693</b>	<b>4066</b>	<b>3997</b>

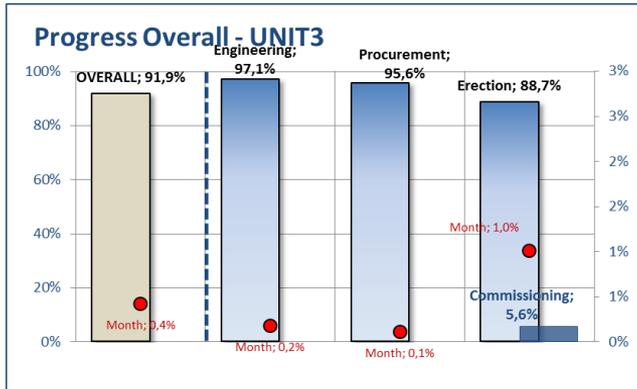
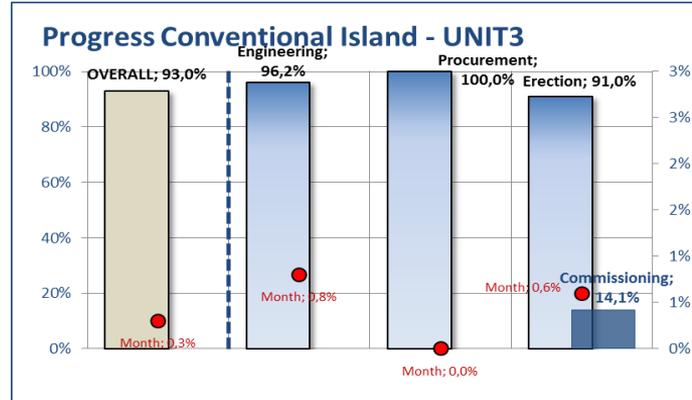
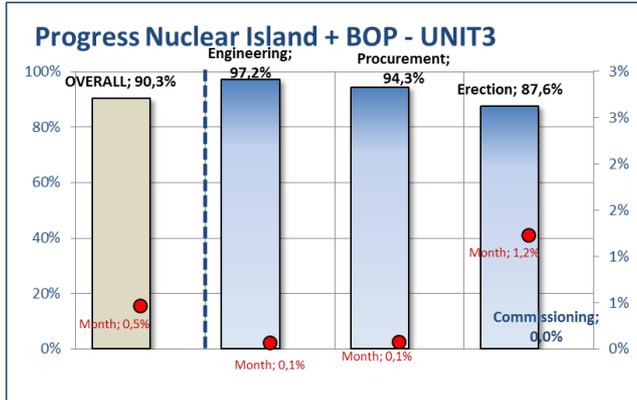


### Manpower Trend – Head Count and Cumulative Direct Manhours



# Mochovce 3&4

## Project Physical Progress UNIT 3 – March 2016



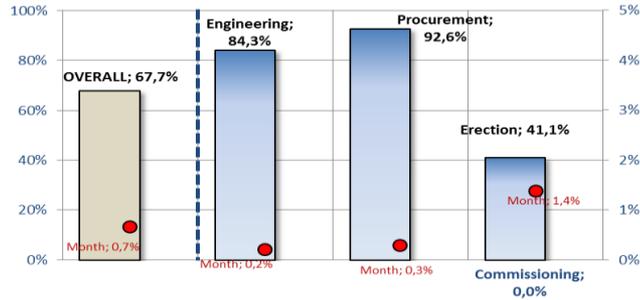
### U3 Progress by Island / Phase March 16 Vs. Nov 14

	Nuclear Island+BoP		Conventional Island		Overall	
	Nov-14	Mar-16	Nov-14	Mar-16	Nov-14	Mar-16
Engineering	90,3%	97,2%	91,7%	96,2%	93,0%	97,1%
Procurement	90,5%	94,3%	99,9%	100,0%	93,0%	95,6%
Erection	60,0%	87,6%	77,5%	91,0%	66,0%	88,7%
<b>Overall</b>	<b>76,4%</b>	<b>90,3%</b>	<b>90,4%</b>	<b>93,0%</b>	<b>81,4%</b>	<b>91,9%</b>

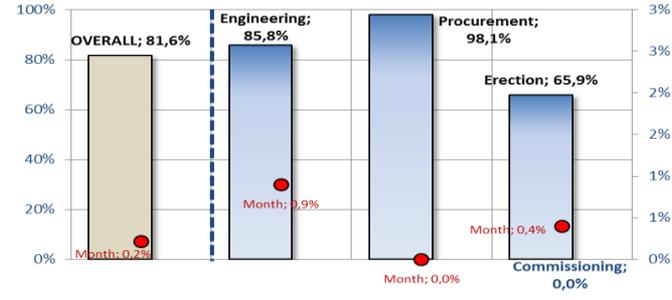
# Mochovce 3&4

## Project Physical Progress UNIT 4 - March 2016

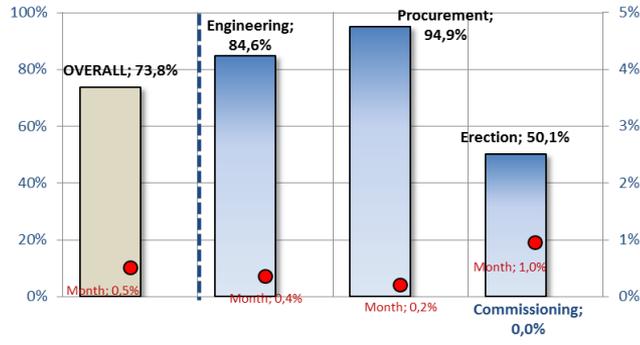
### Progress Nuclear Island - UNIT4



### Progress Conventional Island - UNIT4



### Progress Overall - UNIT4



### U4 Progress by Island / Phase March 16 Vs. Nov 14

	Nuclear Island+BoP		Conventional Island		Overall	
	Nov-14	Mar-16	Nov-14	Mar-16	Nov-14	Mar-16
Engineering	62,7%	84,3%	70,1%	85,8%	68,8%	84,6%
Procurement	83,7%	92,6%	93,3%	98,1%	87,8%	94,9%
Construction	26,2%	41,1%	49,4%	65,9%	35,4%	50,1%
<b>Overall</b>	<b>55,5%</b>	<b>67,7%</b>	<b>73,9%</b>	<b>81,6%</b>	<b>62,6%</b>	<b>73,8%</b>

# Mochovce 3&4

## Unit 3 – Electrical and I&C cables installation status March 2016



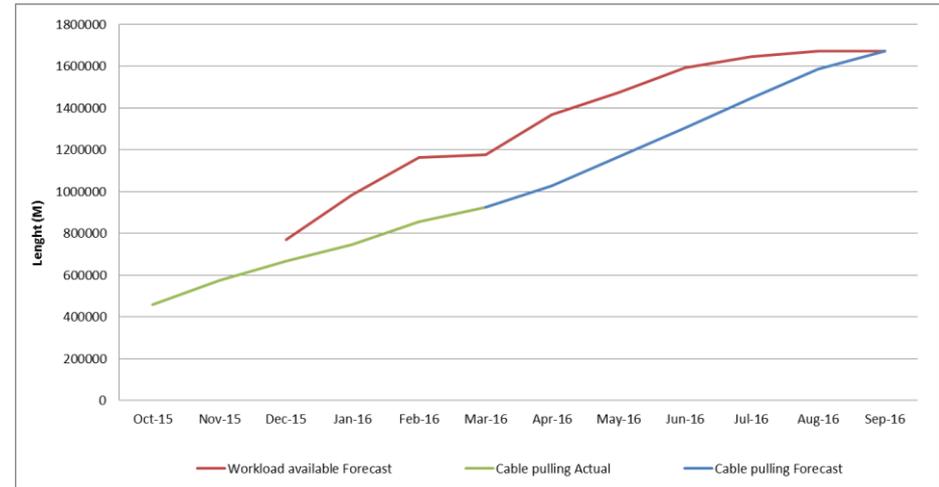
### UNIT 3 - Status of cabling

General Overview U3		Overall Cabling Summary			
		N.I.	C.I.	CAS (*)	Grand Total
Total cables	Km	1 739	2 318	492	4 549
Cables pulled - current values	Km	926	1 744	444	3 114
	%	53,2%	75,2%	90,2%	68,5%
previous progress (Jan. '16)	%	49,2%	74,3%	90,2%	66,4%

(\*) A) Excluding LOROM Cables (5.700 Cables almost all pulled)

B) Found a non conformity in the installation of the I&C cables. The replacement is started and the dismantling of the cables is ahead on the planned. An assessment of commissioning procedure is ongoing. The progress of the replacement is monitored by week.

### UNIT 3 - NI Cable Pulling Forecast



Month	Oct-15	Nov-15	Dec-15	Jan-16	Feb-16	Mar-16	Apr-16	May-16	Jun-16	Jul-16	Aug-16	Sep-16
Workload available Forecast			771,000	986,074	1,161,520	1,174,943	1,367,217	1,472,233	1,592,585	1,645,392	1,673,334	1,673,334
Cable pulling Forecast							1,026,000	1,166,000	1,306,000	1,446,000	1,586,000	1,673,334
Cable pulling Actual	459,000	576,000	666,000	748,000	855,000	926,000						

# Mochovce 3&4

## Status of Licensing documentation (packages)

Supplier		Unit 3 and Commons				Unit 4			
		Stages (*)				Stages (*)			
		R	M	E	C	R	M	E	C
SKODA JS	tot docum.	35	123	144	135	30	120	140	130
	% approved	100%	99%	99%	96%	100%	99%	97%	64%
ENSECO	tot docum.	113	125	238	221	50	85	133	132
	% approved	100%	100%	99,6%	77%	100%	98%	97%	64%
VUJE	tot docum.	9	108	113	90	4	97	97	76
	% approved	100%	99%	99%	99%	100%	100%	100%	100%
PPA	tot docum.	1	37	41	32	1	7	23	15
	% approved	100%	97%	98%	91%	100%	57%	48%	67%
ASE (U3+U4)	tot docum.	14		19	14				
	% approved	100%		87%	0%				
RR	tot docum.	3		3	3	3		3	3
	% approved	100%		100%	33%	100%		100%	33%
sub_total Nuclear Island	tot docum.	158	410	558	495	85	312	396	356
	% approved	100%	99%	99%	85%	100%	98%	95%	72%
ENEL E&R	tot docum.	35	258	293		34	196	223	
	% approved	100%	97%	96%		100%	88%	88%	
Overall Total	tot docum.	193	668	851	788	119	508	619	579
	% approved	100%	98%	98%	89%	100%	94%	92%	78%

(\*) Stage legend:

R : Refurbishment

M : Manufacturing

E : Erection

C : Commissioning

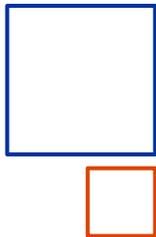
# Mochovce 3&4

## Unit 3 Non-Active Tests & Commissioning Activities

Main Activities – Feb. – Jul. 2016



System	Mar '16	Apr '16	May '16	June '16	Jul '16	August '16
6kV Switchboards BDK, BDL, BDM	Funct. Tests with DCS (OM part) <b>(Cont'd)</b>	Funct. Tests with DCS (OM part) <b>Completed</b>				
Low Voltage (0,4 kV) Switchboards	Funct. Tests with DCS (OM part) <b>(Cont'd)</b>	Funct. Tests with DCS (OM part) <b>(Cont'd)</b>				
Batteries Filling and Charging			Acid Filling	Functional Tests		
Main I&C Testing	Loop checks Electrical Ongoing	Loop checks <b>(Cont'd)</b>	Loop checks <b>(Cont'd)</b>	Loop checks <b>(Cont'd)</b>		
LP Air System	Functional tests	Functional tests <b>(Cont'd)</b>				
HP Air System			Functional Tests			
Deminerlized Water (HP)		Functional Tests	Functional Tests <b>(Cont'd)</b>			
Essential Service Water		Flushing started	Flushing <b>(Cont'd)</b>	Functional tests	Functional Tests <b>(Cont'd)</b>	Functional Tests <b>(Cont'd)</b>

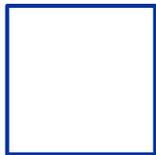


# Mochovce 3&4

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- Role of SE & Project Organization
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# Mochovce 3&4

## Next Main Milestones

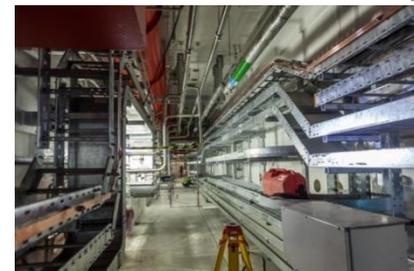


### Completion of Erection

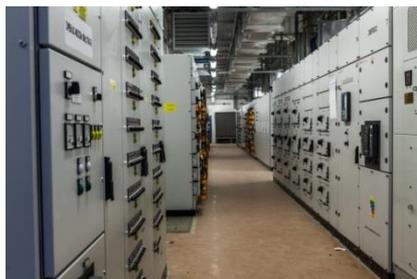
- Start flushing of Essential Service Water
- Completion of Reactor Assembly
- Start Thermal Cycle flushing
- Start flushing to Reactor
- Start SG blowdown flushing
- Pressure Tests of Separable Loops

2016				
Apr	May	Jun	Jul	Aug

✓	●			
	●			
	●	●		
		●	●	
			●	●
				●



Ongoing installation of cable trays



Ongoing individual testing and preparation for functional testing

### Testing + Commissioning

- HVAC for Electrical Panels Rooms
- Essential Service Water - train 2
- HP Air
- Procedure for Test of Fresh Fuel Storage
- Reactor Building HVAC outside Containment
- Main Control Pump
- Emergency Core Cooling System

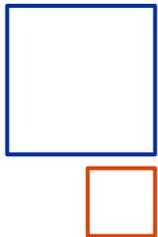
### Unit 3 Main Project Milestones:

Cold Hydro – 2H 2016

Fuel Loading – 1H 2017

COD – 2H 2017

➤ Unit 4 will follow in a 12 months time span

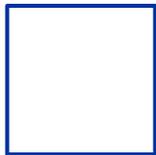


# Mochovce 3&4

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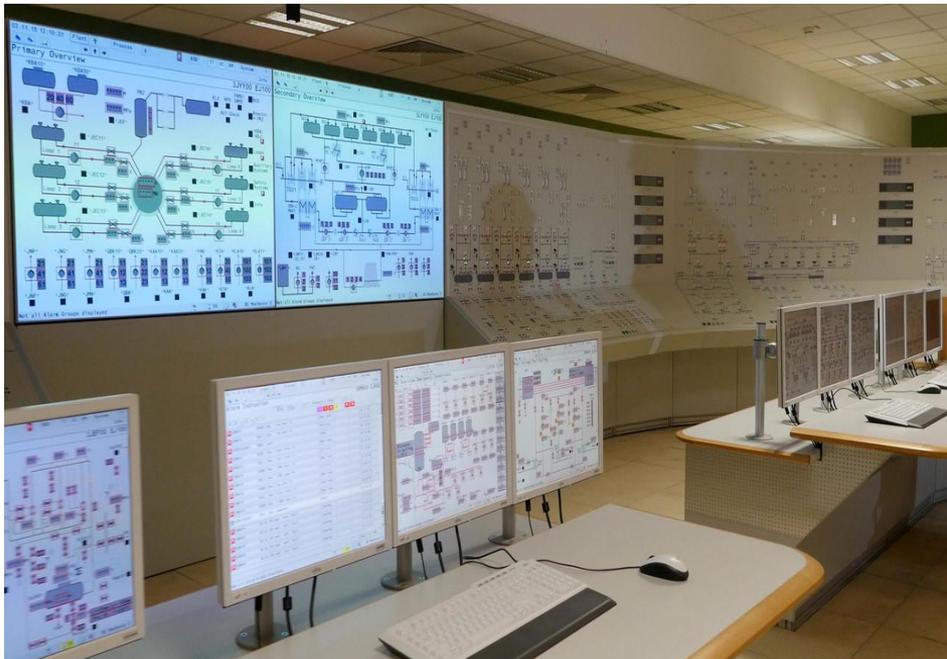


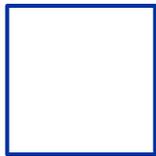
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# Mochovce 3&4

## Energization of DCS - Main Control Room Unit 3

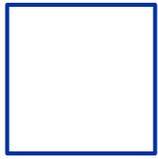




# Mochovce 3&4

## Turbine hall

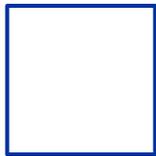




# Mochovce 3&4

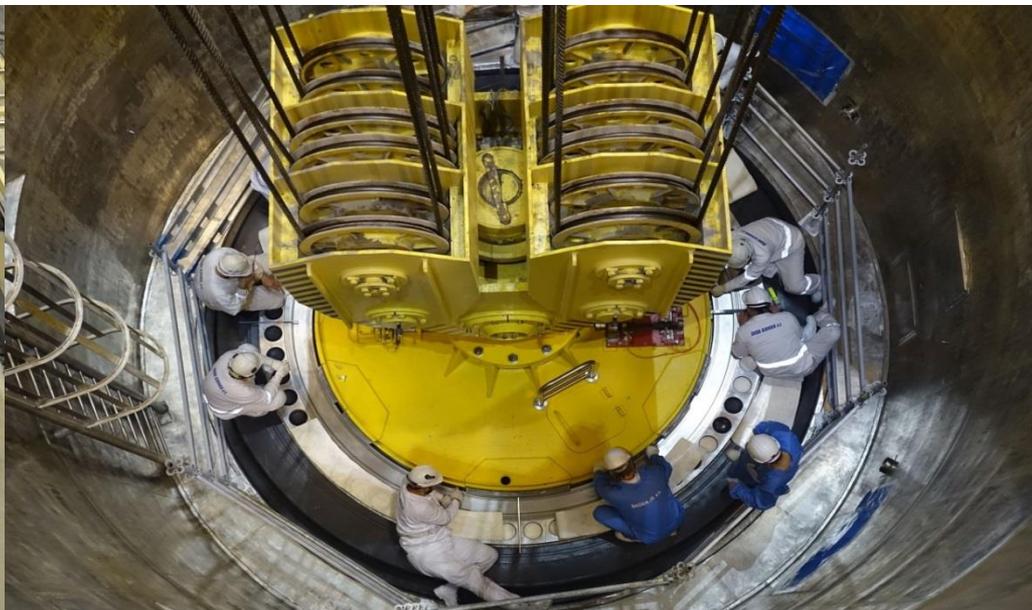
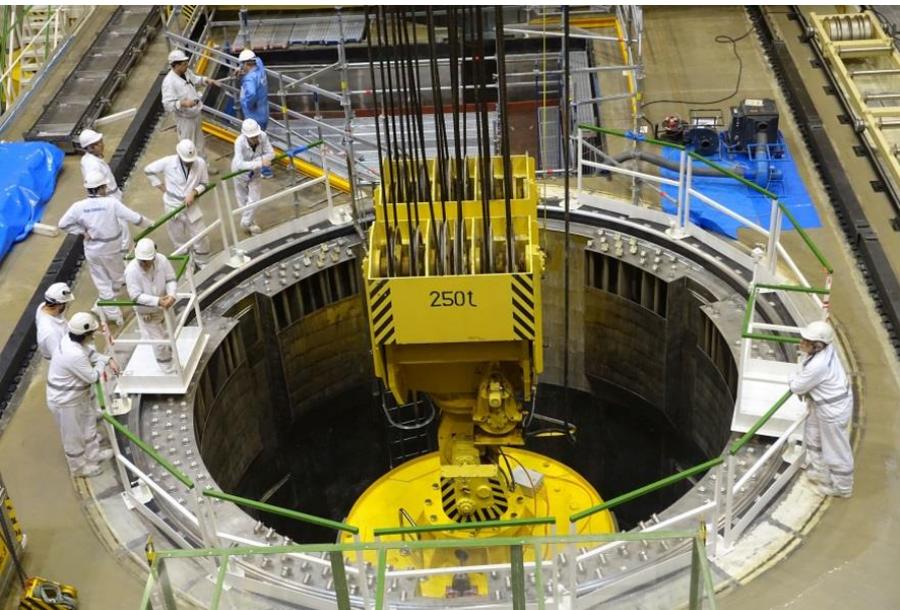
## Reactor hall





# Mochovce 3&4

## Reactor hall



# Mochovce 3&4

## Presence of Czech Companies on MO34 Completion

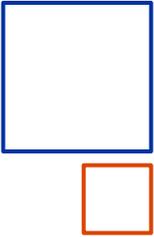


### Nuclear Island

	Company	Scope of delivery
Main Contractors	Škoda JS, a.s. Plzeň	<ul style="list-style-type: none"> <li>Reactor, primary piping and valves, main coolant pumps, steam generators, refueling machine</li> <li>Expert team for support to coordination</li> <li>Commissioning support</li> </ul>
	Chemcomex Praha	<ul style="list-style-type: none"> <li>Upgrade and completion of NI civil works</li> </ul>
Subcontractors	UJV Řež	<ul style="list-style-type: none"> <li>Author supervision</li> <li>Engineering activity for coordination of Contractors involved in the design and construction</li> </ul>
	EGP Invest	<ul style="list-style-type: none"> <li>Civil Design work activities</li> </ul>
	KP Ria	<ul style="list-style-type: none"> <li>Delivery and refurbishment of tanks, exchangers</li> </ul>
	Kabelovna Kabex	<ul style="list-style-type: none"> <li>Delivery of components, cables</li> </ul>
	Sigma Group	<ul style="list-style-type: none"> <li>Main Cooling Pumps</li> </ul>
	Vítkovice Power Engineering	<ul style="list-style-type: none"> <li>Steam Generators</li> <li>Refurbishment of Pressurizer</li> </ul>
	KIP Brno	<ul style="list-style-type: none"> <li>SW for Cable Management (Traceman)</li> </ul>
ZAT	<ul style="list-style-type: none"> <li>Reactor Rods Control System</li> </ul>	

### Conventional Island

	Company	Scope of delivery
Main Contractors	Škoda Power	<ul style="list-style-type: none"> <li>Steam Turbine</li> </ul>
	Chemcomex Praha	<ul style="list-style-type: none"> <li>Part of Mechanical Erection in Turbine Hall</li> </ul>
	ČKD Group	<ul style="list-style-type: none"> <li>Diesel Generator Station</li> </ul>
	BRUSH SEM	<ul style="list-style-type: none"> <li>Electrical Generator</li> </ul>
	SIGMA ENERGOINŽENÝRING	<ul style="list-style-type: none"> <li>Auxiliary &amp; Emergency feed water pumps</li> <li>Overhaul of multistage vertical/horizontal pumps</li> </ul>
Armatury Group	<ul style="list-style-type: none"> <li>Supply of pipes, fittings</li> </ul>	
Subcontractors	Invelt	<ul style="list-style-type: none"> <li>Excitation system</li> </ul>
	EGP Invest	<ul style="list-style-type: none"> <li>DD for CI Civil part</li> </ul>
	Alcatel-Lucent Czech	<ul style="list-style-type: none"> <li>Services and Technical Support</li> </ul>
	Vítkovice Heavy Machinery	<ul style="list-style-type: none"> <li>Forgings of rotor</li> </ul>
	Modřanské strojírný	<ul style="list-style-type: none"> <li>Pipes components</li> </ul>
	ZAT	<ul style="list-style-type: none"> <li>I&amp;C System, Cabling</li> </ul>
ALSTOM Power CZ	<ul style="list-style-type: none"> <li>Gland Steam Condenser</li> </ul>	



**UNIT 3**  
**at 92%**



**THANK  
YOU**