

How to Develop HVDC Skills

An interactive discussion on what needs done and how to do it.

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Outline of Session



- Objectives
 - Discuss HVDC skills development priorities
 - Consider options and resources
 - Stimulate action

- Method
 - PowerPoint prompts
 - Slido polls
 - Open discussion



HVDC Centre Training Services

The National HVDC Centre

- Provide training to support ESO, TOs and HVDC projects
 - Offer training to others as requested
 - Develop a set of 'pick-and-mix' training modules
- Disseminate knowledge from all projects
 - Publications, webinars, events, etc.
 - Train others in application of standardised methods
- Maintain and grow our team of experts
- Build external engagement and training offerings
 Universities, HVDC owners/operators, vendors
- Provide a focal point and impetus for industry-relevant training

 Be a facilitator of training provided by others
- Medium-long term: establish an "HVDC Academy"



Collate 'gold dust' learning points from HVDC experience



PhD level skills development



Strathclyde awarded PhDs with HVDC focus (since 2019)

- 1. 2019: Control and Operation of Offshore Wind Farms Connected with Diode Rectifier HVDC Systems
- 2. 2019: Control and operation of MMC-HVDC system for connecting offshore wind farm
- 3. 2020: Modelling of HVDC Systems
- 4. 2020: Design and Operation of Low Frequency AC (LFAC) Transmission System for Connecting Offshore Wind Farms
- 5. 2020: DC Fault Protection in HVDC System and the Impact on AC Frequency Response
- 6. 2020: Small-signal impedance modelling and stability assessment of HVDC systems
- 7. 2020: Control and Operation of HVDC Connected Offshore Windfarm with Particular Emphasis on Fault and Black Start
- 8. 2020: Analysis and Design of the Modular Multilevel Converter for Secure Systems
- 9. 2021: Hybrid AC/DC Hubs for Network Connection and Integration of Renewables
- 10. 2022: Protection of Future Power Systems with High Amounts of Power Electronic Converters
- 11. 2023: Novel Hybrid HVDC System for resilient and efficient operation of offshore wind farms
- 12. 2023: Modelling, Control and Analysis of HVDC Voltage-Source Converters in Weak AC Grids





- Prerequisites
- Delivery (who / where)
- Setup & content maintenance (especially if online)
- Legal liability
- Accreditation (if required)
- Export Controls
- Assessment
- Costs

University of Manchester

Distance Learning, 30 months, ~15 hr/wk

MSc Sustainable Electrical Power System Engineering

£13,000 UK / £33,500 International

Electric Energy Systems University-Enterprise Training Partnership (EES-UETP)

4-day tutorial

Control of power systems dominated by power electronic converters

€490 members / €2000 non-members



ΤΓΑΝΣΜΙΣΣΙΟΝ



Slido Poll Results



Do you think HVDC skills shortages are a problem now?



:	S6 Part 1 - Do you think HVDC skills shortages are a problem now? Multiple Choice Poll ② 30 votes 왕 30 participants	
	Yes - 24 votes	
		80%
	No - 4 votes	
		13%
	Not sure - 2 votes	
		7%





In 10 years, do you think HVDC skills shortages will be...? O The National HVDC Centre

∷≡	In 10 years, do you think HVDC skills shortages will be?	
	Multiple Choice Poll 🗹 35 votes 🔗 35 participants	
	Worse than now - 11 votes	
		31%
	Pottor than now 10 votos	
	Better than now - 10 votes	
		29%
	Much the same - 11 votes	
		31%
	Don't know (or impossible to say) - 3 votes	
		9%

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Rank these training topics in order of priority for improvement

Ranking Poll 🗹 31 votes 🖧 31 participants 1. HVDC control and protection 2.3 2. AC/DC system integration 2 HVDC basics 1.6 4. Simulation and analysis (general) 1.4 Converter station equipment 1.3 5. Specialisms in modelling and simulation 1.3 5. AC/DC system planning and design 1.3 8. Testing and commissioning 0.9 9. New technologies and applications 0.7 10. Operation and maintenance 0.6 11. HVDC lines and cables 0.5 12. Construction 0.4 13. Real-time hardware-in-loop simulation (RTDS) 0.3 13. Permitting and environment 0.3 15. Costs and financing 0.2 slido

Please rank these training topics in order of priority for improvement - pick your top 5.



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Other training topics you would highlight as important and needing attention



Any other training topics you would highlight as important and needing attention?

Wordcloud Poll 🖸 27 responses 🔗 21 participants



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How good is HVDC training in your organisation?



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Rank these training types in order of priority for improvement





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Rank these training methods in order of what you think is most effective



Please rank these training methods in order of what you think is most effective (rank all J↑ 4) ☑ 29 votes 원 29 participants Ranking Poll 1. On-the-job training 3.3 2. Workshops with 'hands-on' exercises 3.2 Classroom teaching 3. 2.2 Self-learning at home 4. 1.3

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Rank these training stakeholders in order of who you think needs to do more



l↑	Plea pick	Please rank these training stakeholders in order of who you think needs to do more - pick your top 5.				
	Rank	ing Poll 외 votes 왕 31 participants				
	1.	Transmission System Operators	3			
	2.	HVDC owners/operators	3			
			2.4			
	3.	HVDC manufacturers/vendors	2.3			
	4.	Regulators/Government	210			
			2.2			
	5.	Schools	10			
	0		1.9			
	ю.		1.6			
	7.	Technical colleges				
			1.2			
	8.	Other manufacturers/vendors	0.4			
			0.4			
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Have we missed any training types, methods or stakeholders you think important?



Have we missed any training types, methods or stakeholders you think important?

Open text poll 🖸 14 responses 🔗 8 participants

- Anonymous Industries with transferable skills such as oil & gas.
- Anonymous adjust salaries to demand
- Anonymous Attractive remuneration
- Anonymous The important thing is an unbreakable heart
- Anonymous Increase the presence and visibility of HVDC - create positive connections
- Anonymous Contribute & improve the material for self-studying to remove the barrier to become an expert
- Anonymous Short videos - Tik Tok & Work experience introduced in secondary schools at engineering companies.

BenM being less picky- if you have STEM and enthusiasm, why not?

Anonymous human collaboration ESO/TO <-> vendor <-> Research/Academy

Anonymous Social media

В

Anonymous Method: excite people about HVDC

Anonymous HVDC construction

Anonymous Funding for those who want to upskill

BenM hybrid on the job and qualification

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How much time do you think your engineers should spend on HVDC-related training?



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Rank the statements that best describe your involvement in training and skills development



Please rank the statements that best describe your involvement in training and skills development? Ranking Poll 2 34 votes 34 participants I'm constantly learning new things 1. 4.1 I provide support and guidance to colleagues as required 2. 3.4 I try to attend training as often as I can 3. 2.3 I have identified my training needs but haven't found time (or funding) for it yet 4. 1.9 5. It's one of my main activities and priorities 1.7 It is someone else's responsibility 6. 0.2



TRANSMISSION

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What is one thing you think should be done to improve HVDC skills?



What is one thing you think should be done to improve HVDC skills?
Wordcloud Poll 🗹 35 responses 🔗 26 participants
Motivate by showing higher pay career
Workshop issues
Prioritise training while delivering
More onsite training hands on traninings Specialised training
Standard level NVQ More hands on trainings Training
Inspire others Passion can be infectious!
IET certified HVDC apprenticeship
recognise and highlight areas of skills
accreditations- apprentice to post doc
Set up HVDC engineering roles



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