ERASMUS+ PROJECT

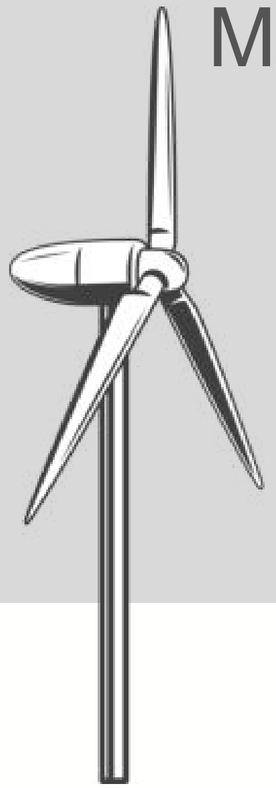
windEXT

ADVANCED MAINTENANCE, LIFETIME EXTENSION & REPOWERING OF WIND FARMS SUPPORTED BY ADVANCED DIGITAL

Co-funded by the Erasmus+ Programme of the European Union

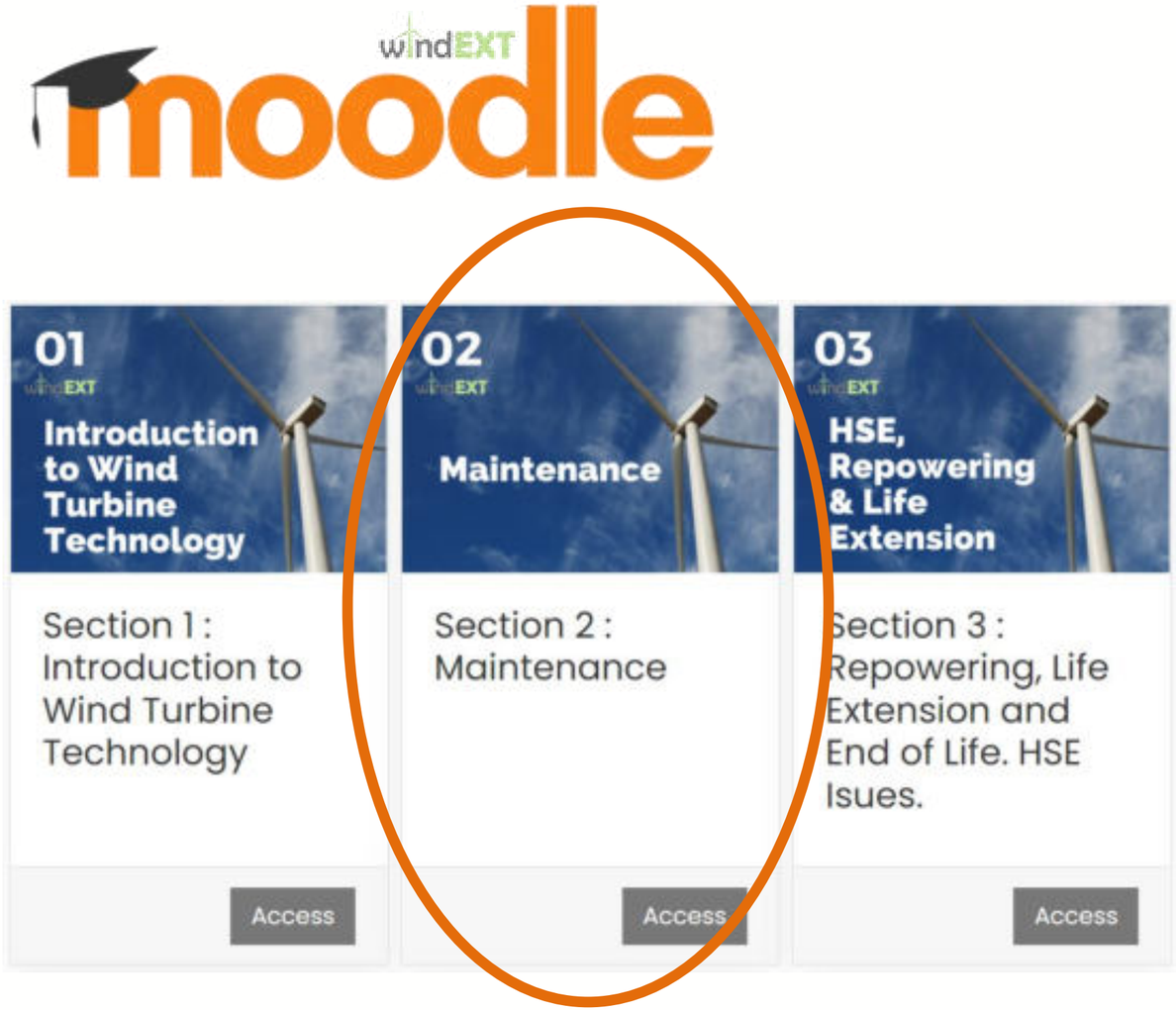
SECTION 2 MOODLE: MAINTENANCE. HANDBOOKS AND VIRTUAL TOOLS

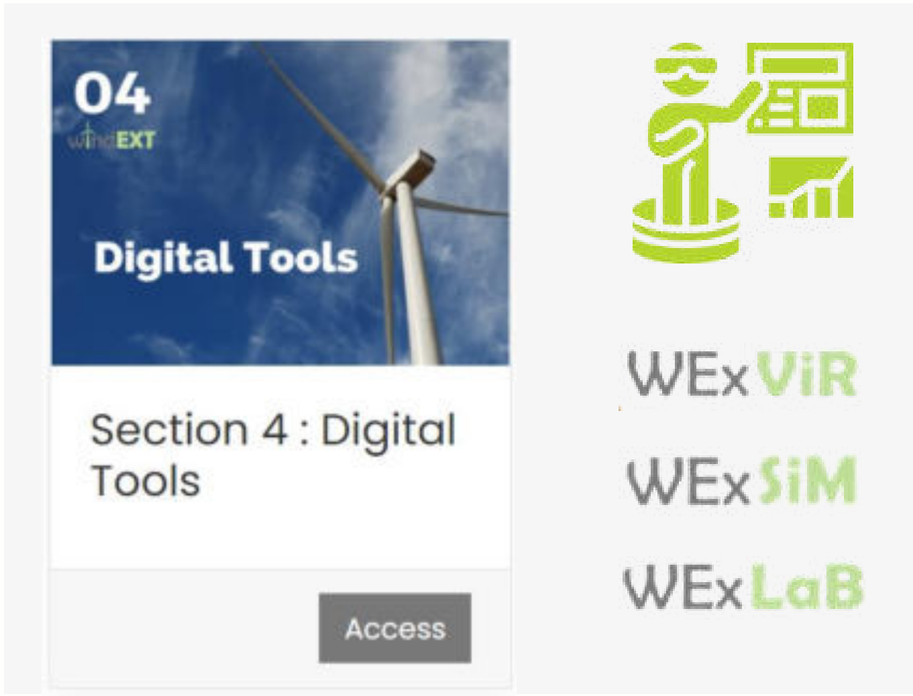
ESTEFANÍA ARTIGAO
UCLM



PROJECT STRUCTURE

Documentation + Virtual Reality





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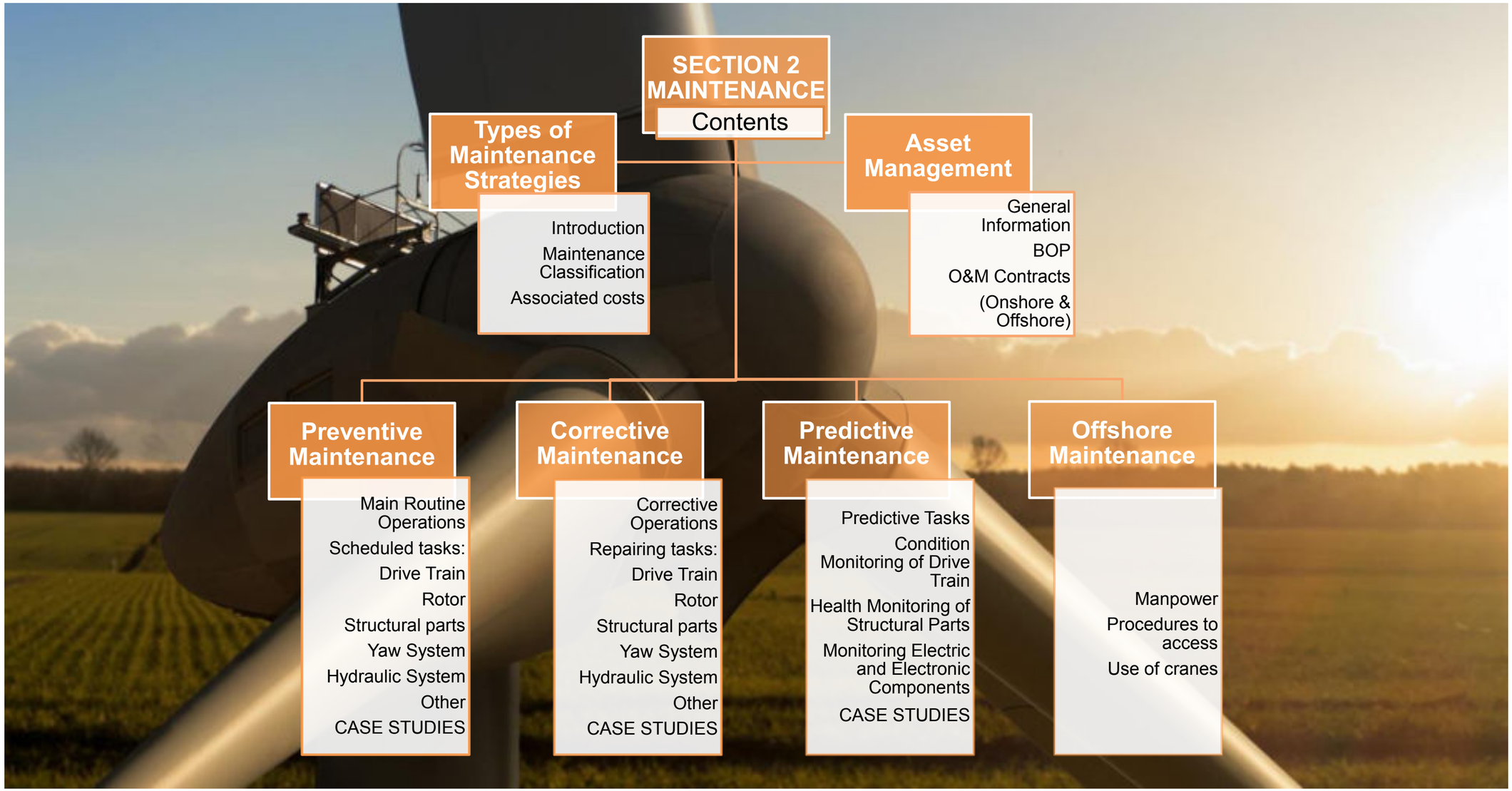

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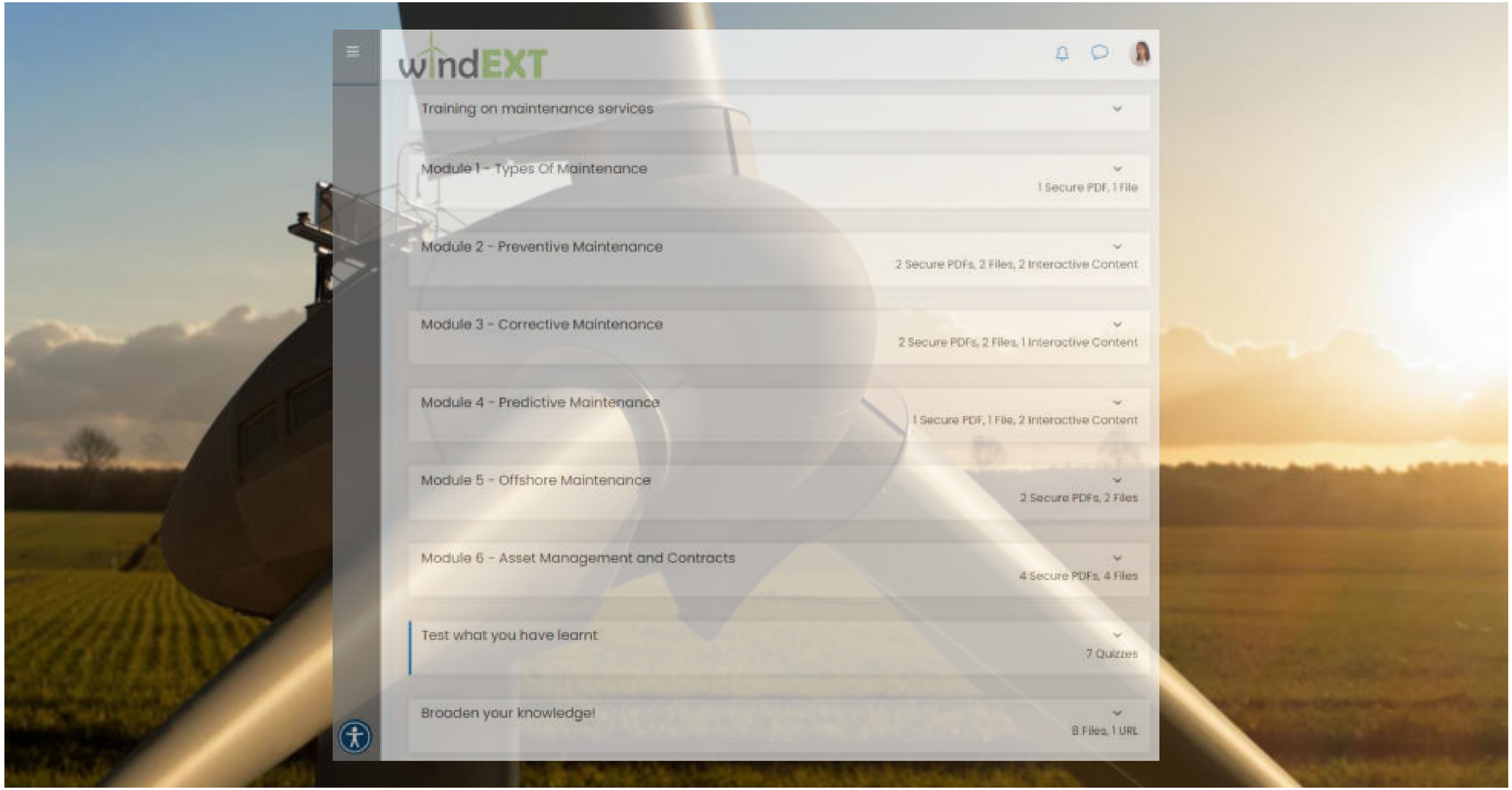
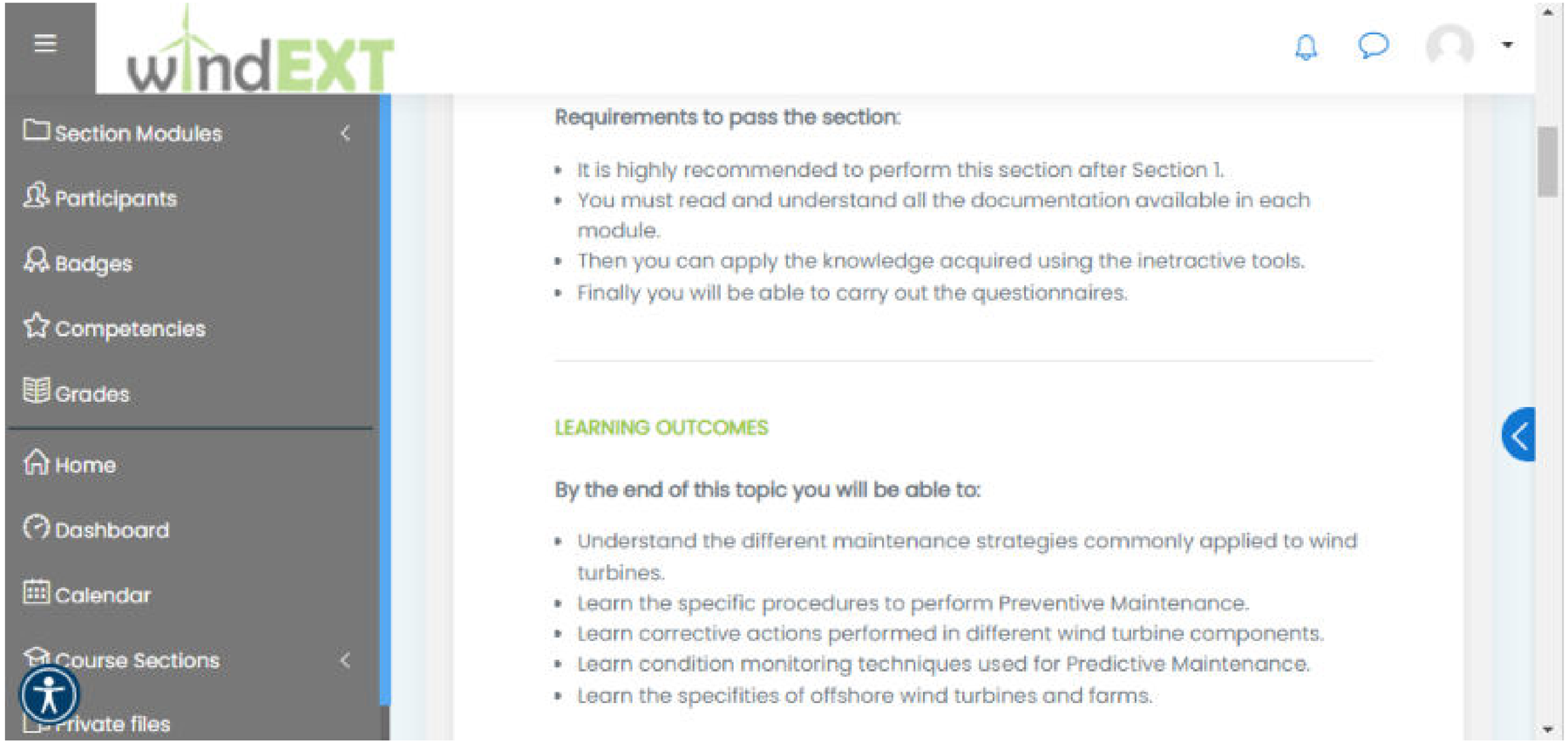
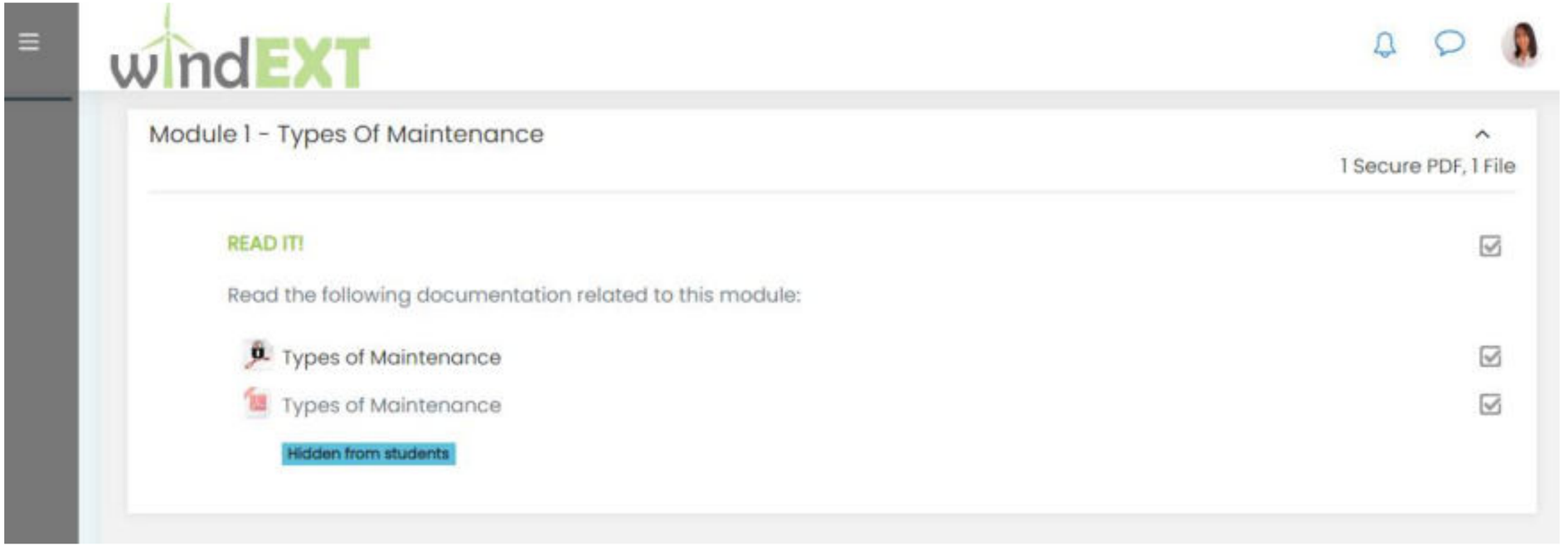
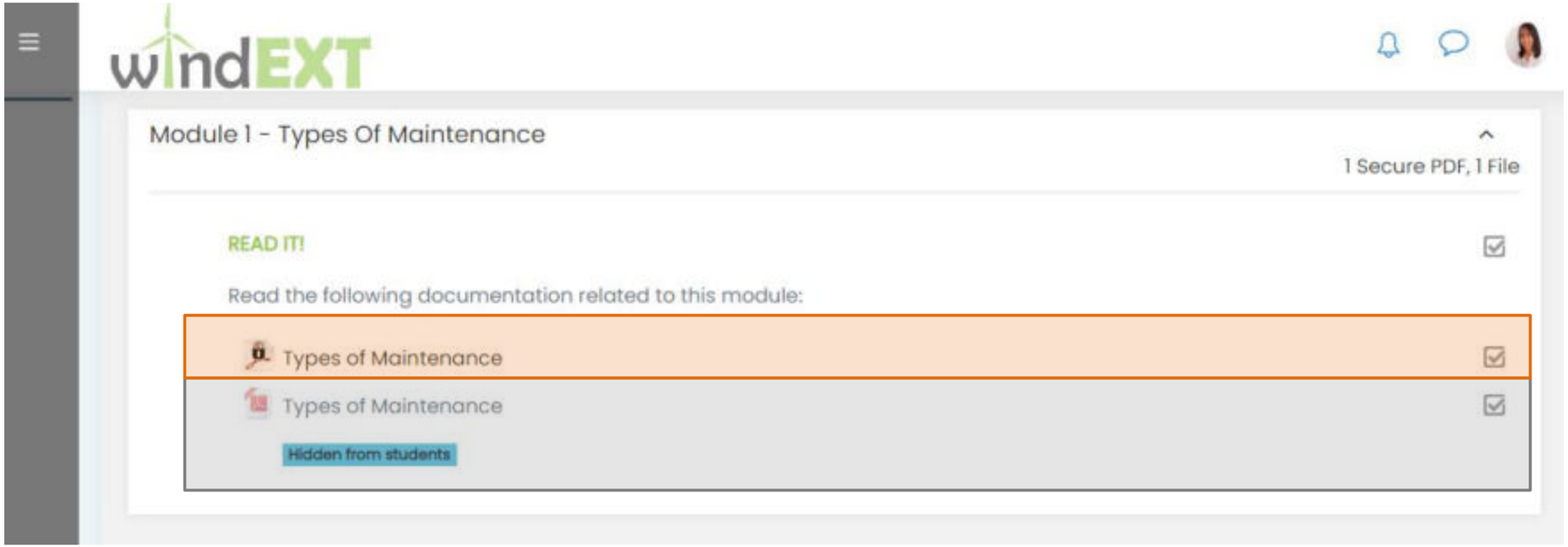



windEXT
Section Modules
Participants
Badges
Competencies
Grades
Home
Dashboard
Calendar
Course Sections
Private files
Requirements to pass the section:
It is highly recommended to perform this section after Section 1.
You must read and understand all the documentation available in each module.
Then you can apply the knowledge acquired using the inetractive tools.
Finally you will be able to carry out the questionnaires.
LEARNING OUTCOMES
By the end of this topic you will be able to:
Understand the different maintenance strategies commonly applied to wind turbines.
Learn the specific procedures to perform Preventive Maintenance.
Learn corrective actions performed in different wind turbine components.
Learn condition monitoring techniques used for Predictive Maintenance.
Learn the specifities of offshore wind turbines and farms.


windEXT
Module 1 - Types Of Maintenance
1 Secure PDF, 1 File
READ IT!
Read the following documentation related to this module:
Types of Maintenance
Types of Maintenance
Hidden from students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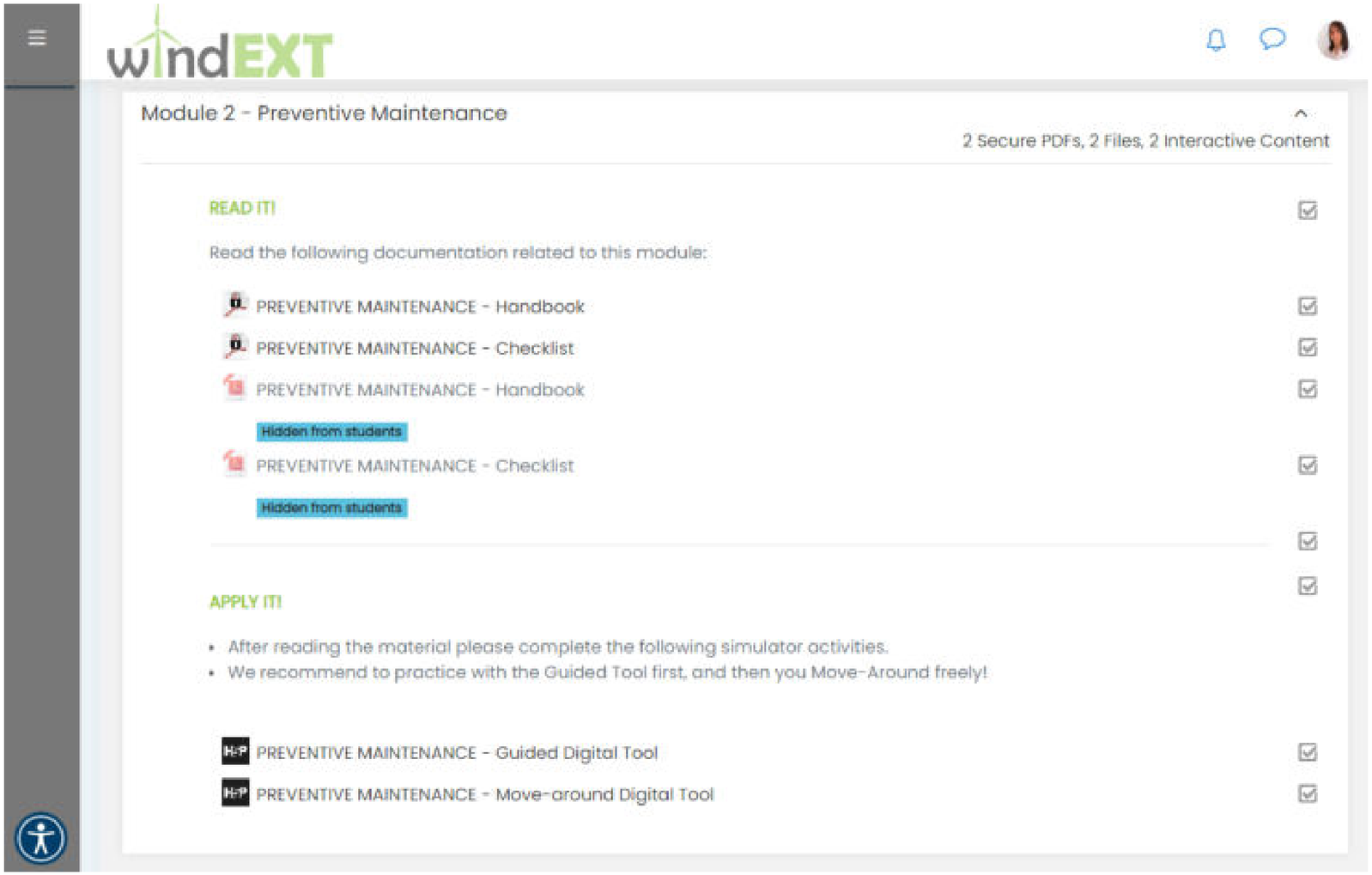
Module 1 - Types Of Maintenance
1 Secure PDF, 1 File
READ IT!
Read the following documentation related to this module:
Types of Maintenance
Types of Maintenance
Hidden from students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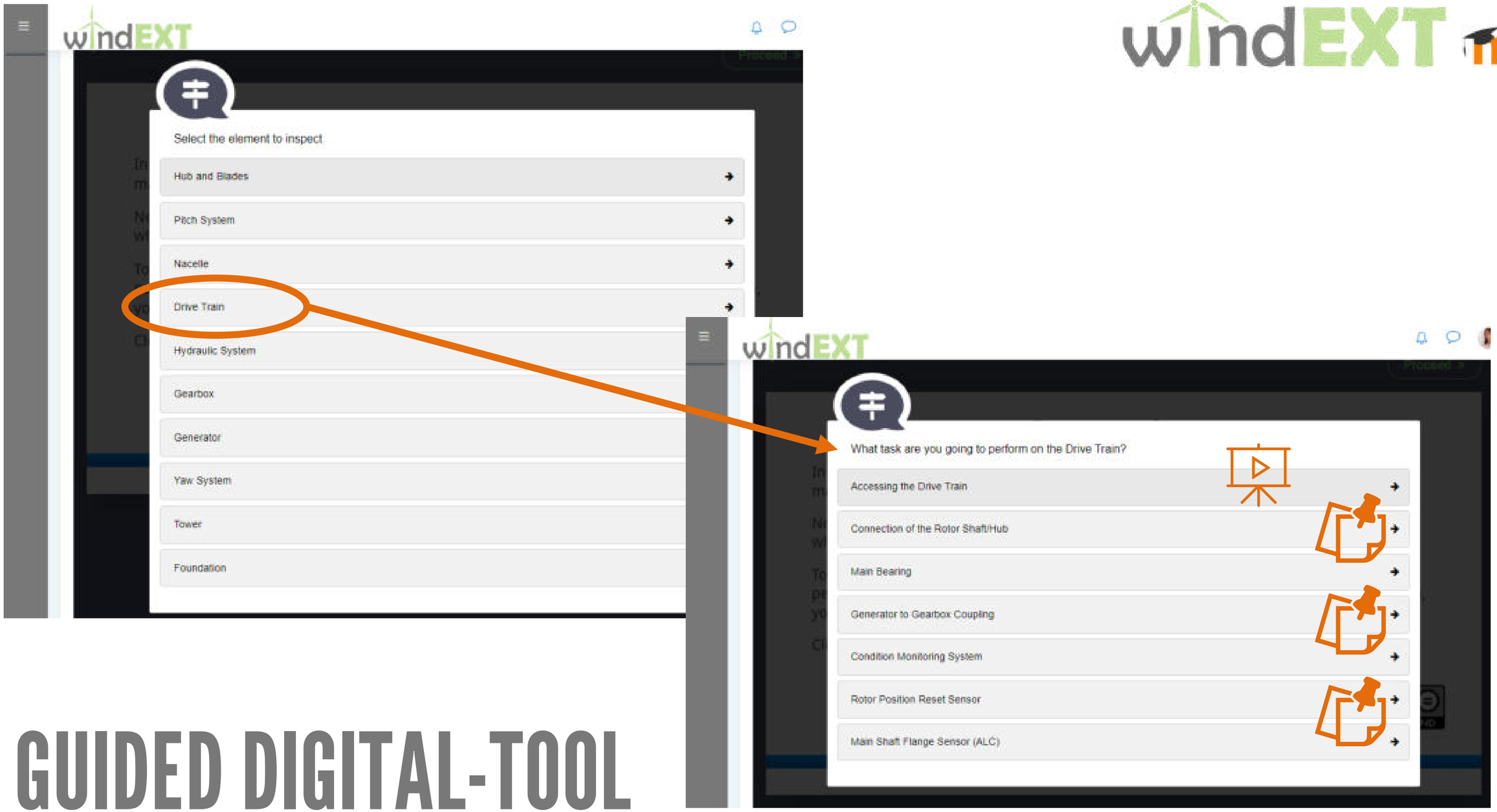
Module 2 - Preventive Maintenance
2 Secure PDFs, 2 Files, 2 Interactive Content
READ IT!
Read the following documentation related to this module:
PREVENTIVE MAINTENANCE - Handbook
PREVENTIVE MAINTENANCE - Checklist
PREVENTIVE MAINTENANCE - Handbook
Hidden from students
PREVENTIVE MAINTENANCE - Checklist
Hidden from students
APPLY IT!
After reading the material please complete the following simulator activities.
We recommend to practice with the Guided Tool first, and then you Move-Around freely!
PREVENTIVE MAINTENANCE - Guided Digital Tool
PREVENTIVE MAINTENANCE - Move-around Digital Tool

HANDBOOK

Wtg numb DATE:
Wtg model Commissioning Date:
Hours of w Technicians:
Company:

	Description	Okay	Not ok	N / A	PENDING	OBSERVATI	RANGE - TIME 6 M	12 M	18 M	24 M	30 M	36 M
4	HUB AND BLADES											
4.1	Nose Cone and External Hub General Condition											
	Visual Inspection											
	Cone fiber cleaning (inside)						x	x	x	x	x	
	No cracks in the cone fiber and metal ties						x	x	x	x	x	
	State of stickers access to hub						x	x	x	x	x	
	Absence of grease leaks from the outer seals of the blades						x	x	x	x	x	
4.2	Hub Internal General Condition											
	Visual Inspection											
	Checking the bushing-Main Shaft joint tightening torque									x		
	Greasing the bearings of the 3 blades						x	x	x	x	x	
	Ballut recalibration in hydraulic cylinders (Hydraulic Pitch)							x		x		
	Valve setting in pitch cylinder blocks							x		x		
	Rod inspection in pitch cylinders						x	x	x	x	x	
	Limit switch calibration							x		x		
	TOP-HUB communication check						x	x	x	x	x	
4.3	Gear Ring and Driving Pinion											
	Visual Inspection											
	Checking and greasing the teeth on slewing rings						x	x	x	x	x	
	Change Automatic lubrication device batteries if used							x		x		
4.4	Hub Cabinets											
	Visual Inspection											
	Airtightness in closet/s HUB						x	x	x	x	x	
	Change of air filters in cabinet/s HUB							x		x		
	Check electrical connections											
	Variator adjustment on electric motors (Electric Pitch)							x		x		
4.5	Blades											
	Visual Inspection											
	Visual inspection from the ground of the 3 blades + hub zone						x	x	x	x	x	
	Checking the tightening torque of the blade-hub joint									x		
	Blade-Bearing Blade Union Tightening Torque Check									x		
	Telescope Inspection of Pressure Shell Cracks (Blade 1)									x		
	Telescope inspection of cracks in suction shell (Blade 1)									x		
	Telescope inspection of leading edge damage (Blade 1)									x		
	Telescope inspection of trailing edge damage (Blade 1)									x		
	Telescope inspection of the lightning rod system (Blade 1)									x		
	Inspection from nacelle of the lightning rod system, measurement o						x	x	x	x	x	
	Inspection from nacelle of cracks in the blade base (blade 1)						x	x	x	x	x	
	Telescope Inspection of Pressure Shell Cracks (Blade 2)									x		
	Telescope inspection of cracks in suction shell (Blade 2)									x		
	Telescope inspection of leading edge damage (Blade 2)									x		
	Telescope inspection of trailing edge damage (Blade 2)									x		
	Telescope inspection of the lightning rod system (Blade 2)									x		
	Inspection from nacelle of the lightning rod system, measurement o						x	x	x	x	x	
	Inspection from nacelle of cracks in the blade base (Blade 2)						x	x	x	x	x	
	Telescope inspection of pressure shell cracks (Blade 3)									x		
	Telescope inspection of cracks in suction shell (Blade 3)									x		
	Leading edge damage inspection with a telescope (Blade 3)									x		
	Telescope inspection of trailing edge damage (Blade 3)									x		
	Telescope inspection of the lightning rod system (Blade 3)									x		
	Inspection from nacelle of the lightning rod system, measurement o						x	x	x	x	x	
	Inspection from nacelle of cracks in the blade base (Blade 3)						x	x	x	x	x	
4.6	Battery System											
	Visual Inspection											
4.7	Secondary Brake System											
	Visual Inspection											
4.8	Brake Pad Exchange											
	Visual Inspection											
4.9	Absolute Encoder Exchange											
	Visual Inspection											
5	Scheduled tasks of Pitch System											
5.1	Pitch Bearing											
	Visual Inspection											
	Change Automatic lubrication device batteries if used							x			x	
5.2	Pitch Bearing Lubrication											
	Visual Inspection											
5.3	Pitch Drives and Motors											
	Visual Inspection											
	Measure and record pitch motor brush length ALC units:										x	
	Measure and record pitch motor brush length non-ALC units:											
5.4	Pitch Motor Brush Exchange											
	Visual Inspection											
5.5	Pitch Gear Ring Teeth Lubrication											
	Visual Inspection											
5.6	Pitch System Limit Switch Inspection											
	Visual Inspection											
5.7	Pitch Position Sensors											
	Visual Inspection											
6	Nacelle											
6.1	Nacelle											
	Visual Inspection											
	Leaks in nacelle						x	x	x	x	x	
	Review of the condition of the nacelle fiber and insulating elements							x			x	
	Aisle and rack cleaning						x	x	x	x	x	
	Nacelle fire fighting kit check: revision date, expiration date, pressur						x	x	x	x	x	
	Nacelle cooling motor operation						x	x	x	x	x	
	Clearance light check and day / night switching						x	x	x	x	x	
6.2	Nacelle Hoist											
	Visual Inspection											
	Review of stairs access to nacelle						x	x	x	x	x	
	Functional check of the hoist load lifting system						x	x	x	x	x	
	Review of the condition of the bridge crane: anchorage on beams, silent blocks						x			x		
	Review of ventilation flaps						x	x	x	x	x	
	Air filter change							x		x		
6.3	Nacelle Mounting Brackets											
	Visual Inspection											
6.4	Anemometer and Wind Vane											
	Visual Inspection											
6.5	Obstruction Light/Aviation Lights (if equipped)											
	Visual Inspection											
	Nacelle weather station and lightning rod inspection						x	x	x	x	x	
	Azimuth alignment servo station						x	x	x	x	x	
	Checking the functioning of all emergency mushrooms in nacelle						x	x	x	x	x	
6.6	Steps and Grating											
	Visual Inspection											
6.7	Top Box											
	Visual Inspection											
	Exterior access hatch condition						x	x	x	x	x	x
	Review of the mooring points for operators inside nacelle and roof						x	x	x	x	x	x
7	Scheduled task of Drive Train											
7.1	Connection of the Rotor Shaft/Hub											
	Visual Inspection											
	Absence of internal and external net leakage						x	x	x	x	x	x
	Absence of noise and friction						x	x	x	x	x	x
7.2	Main Bearing											
	Visual Inspection											
	Check tightening torque Main shaft and frame									x		
	Inspection of possible cracks in the frame						x	x	x	x	x	x
	Inspection of possible cracks in the rear frame						x	x	x	x	x	x
	Checking the tightening torque of the bolted connection between the front and rear frames									x		
	Grease main shaft bearing/s at 300rpm						x	x	x	x	x	x
	Change Automatic lubrication device batteries if used							x		x		x
7.3	Generator to Gearbox Coupling											
	Visual Inspection											
	Check tightening torque for bolted connections							x		x		x
	Axial measurement						x	x	x	x	x	x
	Checking for cracks or deformations in the fiber elements						x	x	x	x	x	x
7.4	Condition Monitoring System (if equipped)											
	Visual Inspection											
7.5	Rotor Position Reset Sensor (if equipped)											
	Visual Inspection											
7.6	Main Shaft Flange Sensor (ALC) (if equipped)											
	Visual Inspection											
8	Scheduled tasks of Hydraulic System											
8.1	Accumulator											
	Visual Inspection											
	Check nitrogen pressure in emergency accumulators						x	x	x	x	x	x
	Calibration of pressure limiting valves						x	x	x	x	x	x
	Functioning tests and setting of solenoid valves: cycle and negative						x	x	x	x	x	x
8.2	Checking Hydraulic Oil Level											
	Visual Inspection											
	No leaks in hydraulic unit						x	x	x	x	x	x
	Taking oil sample for laboratory analysis							x		x		x
	Oil level 100%						x	x	x	x	x	x
	Exchange hydraulic oil							12/36 MONTHS				12/36 MONTH
	Exchange hydraulic filter							12/36 MONTHS				12/36 MONTH
8.3	Hydraulic System Filter Exchange											
	Visual Inspection											
8.4	Purging the Hydraulic System											
	Visual Inspection											
8.5	Bleeding Hydraulic System Lines											
	Visual Inspection											
8.6	Hydraulic System Accumulator Check											
	Visual Inspection											
8.7	Brake Pad Air Gap Adjustment											
	Visual Inspection											

CHECKLIST



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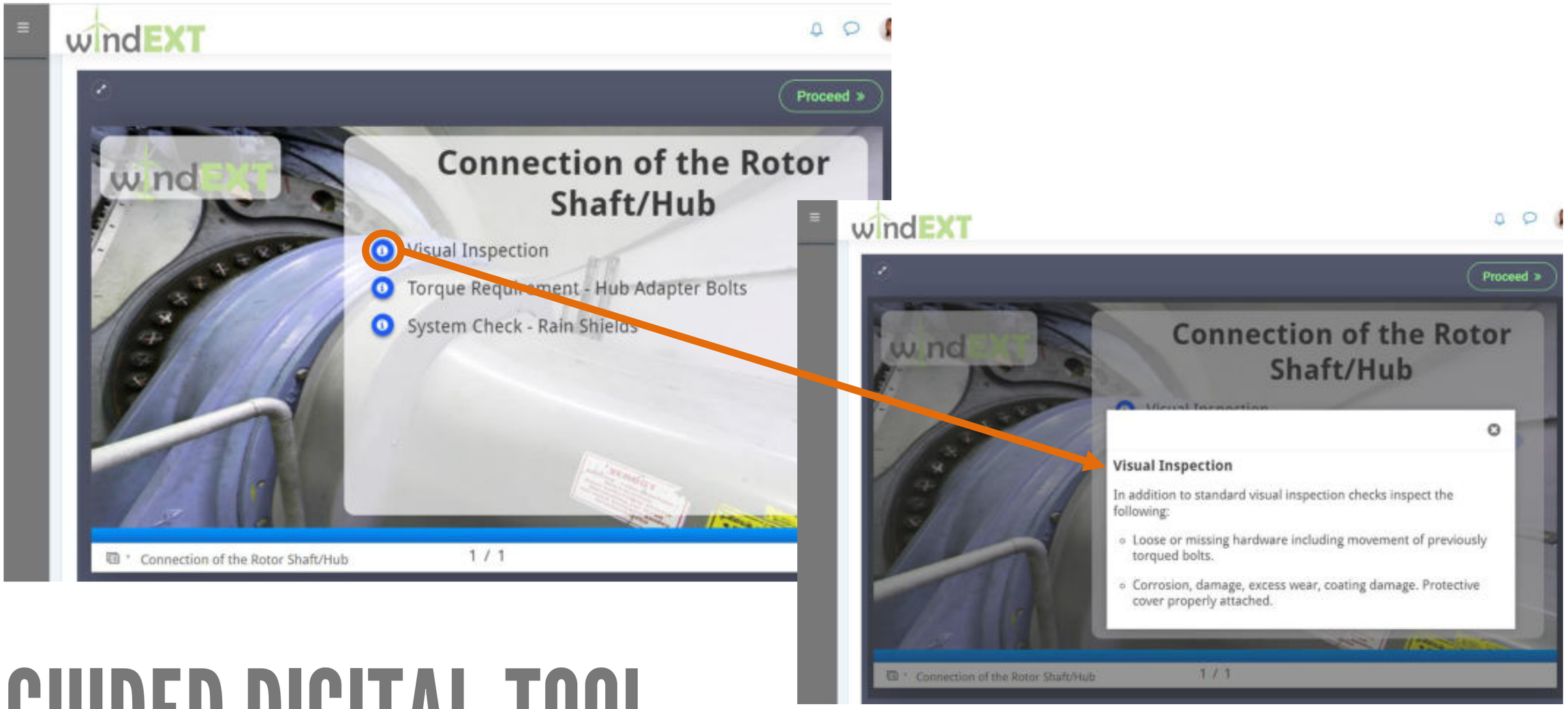

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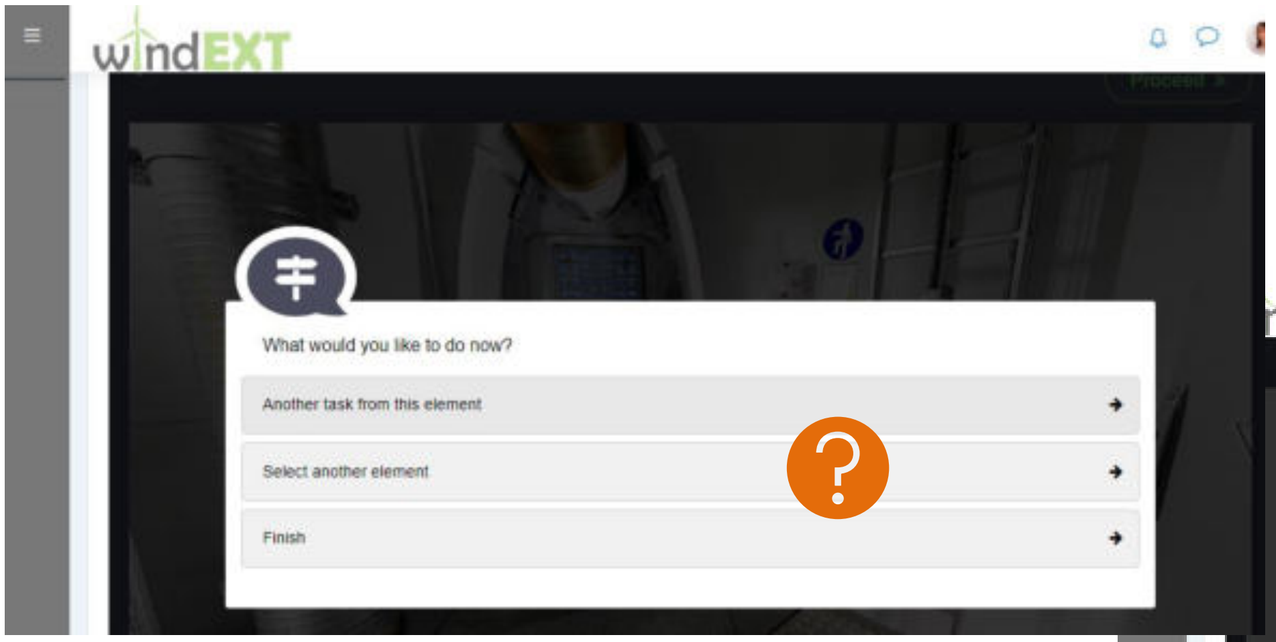

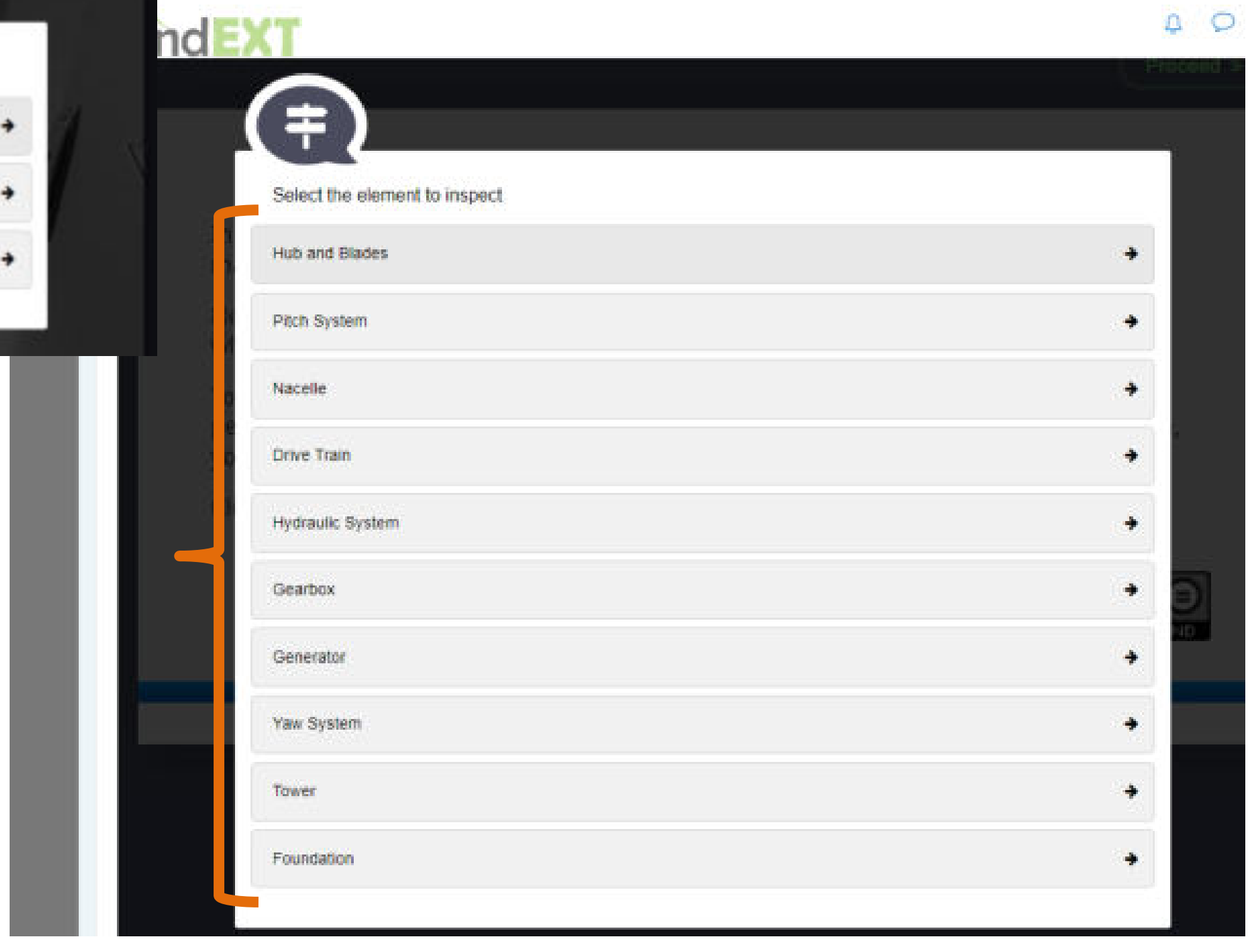

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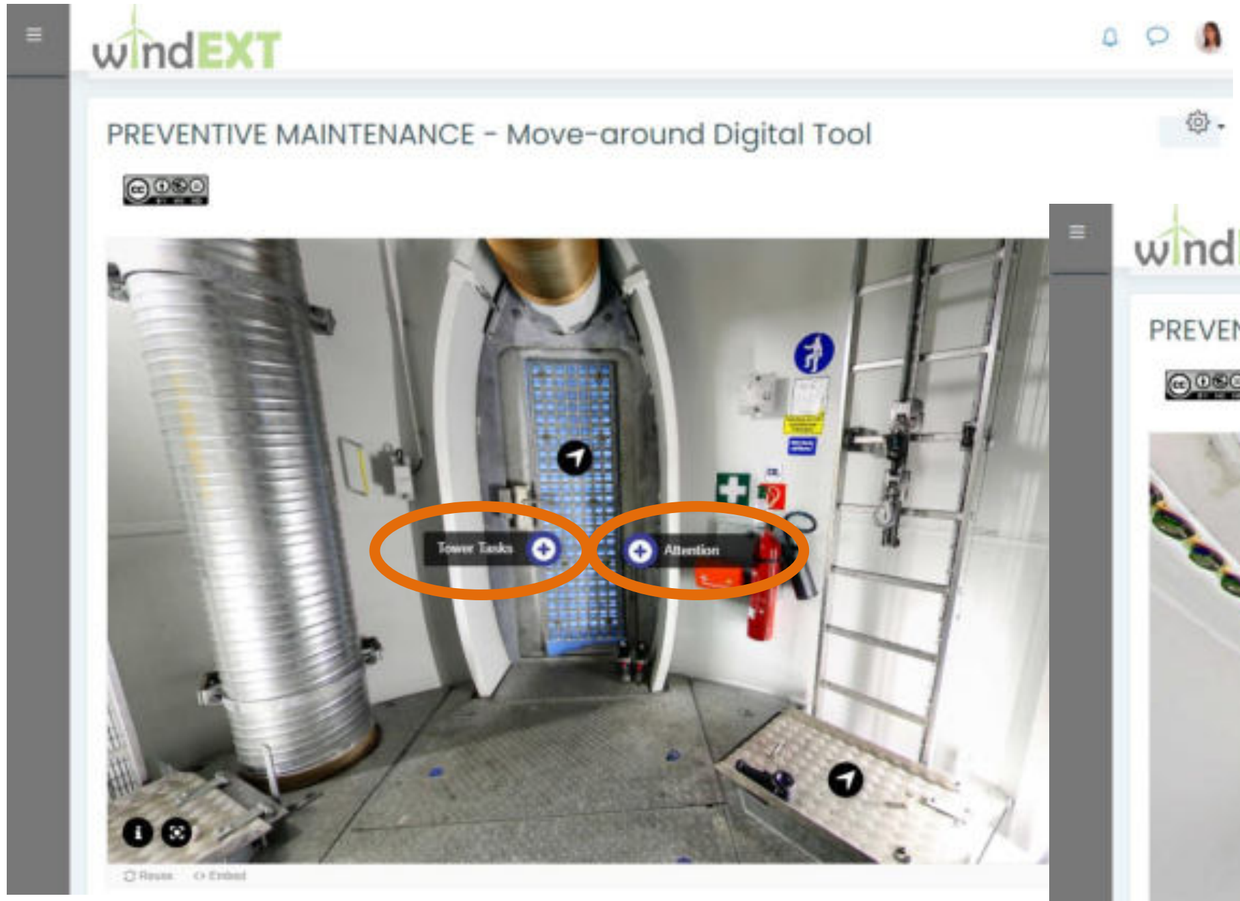
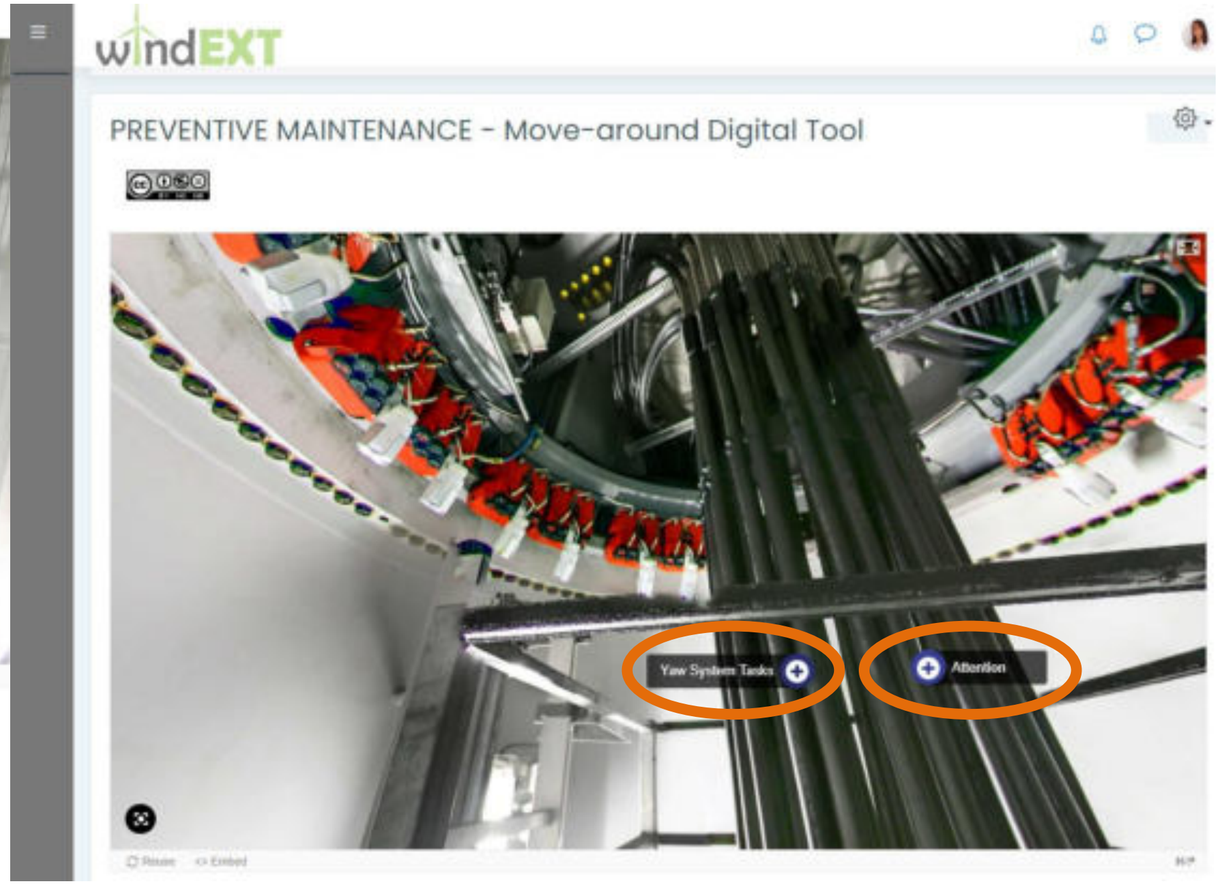
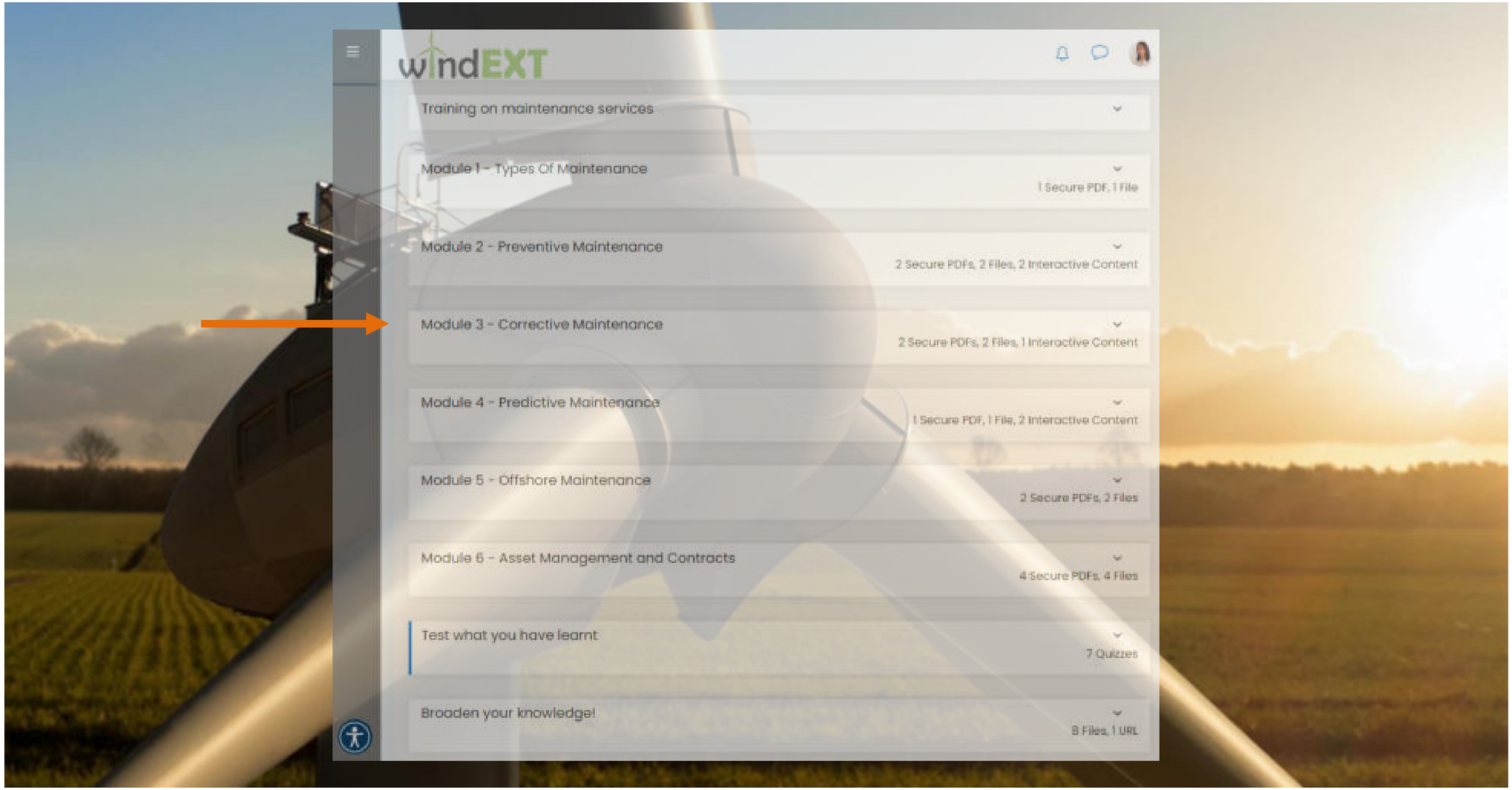




MOVE AROUND DIGITAL-TOOL

SECTION CONTENTS



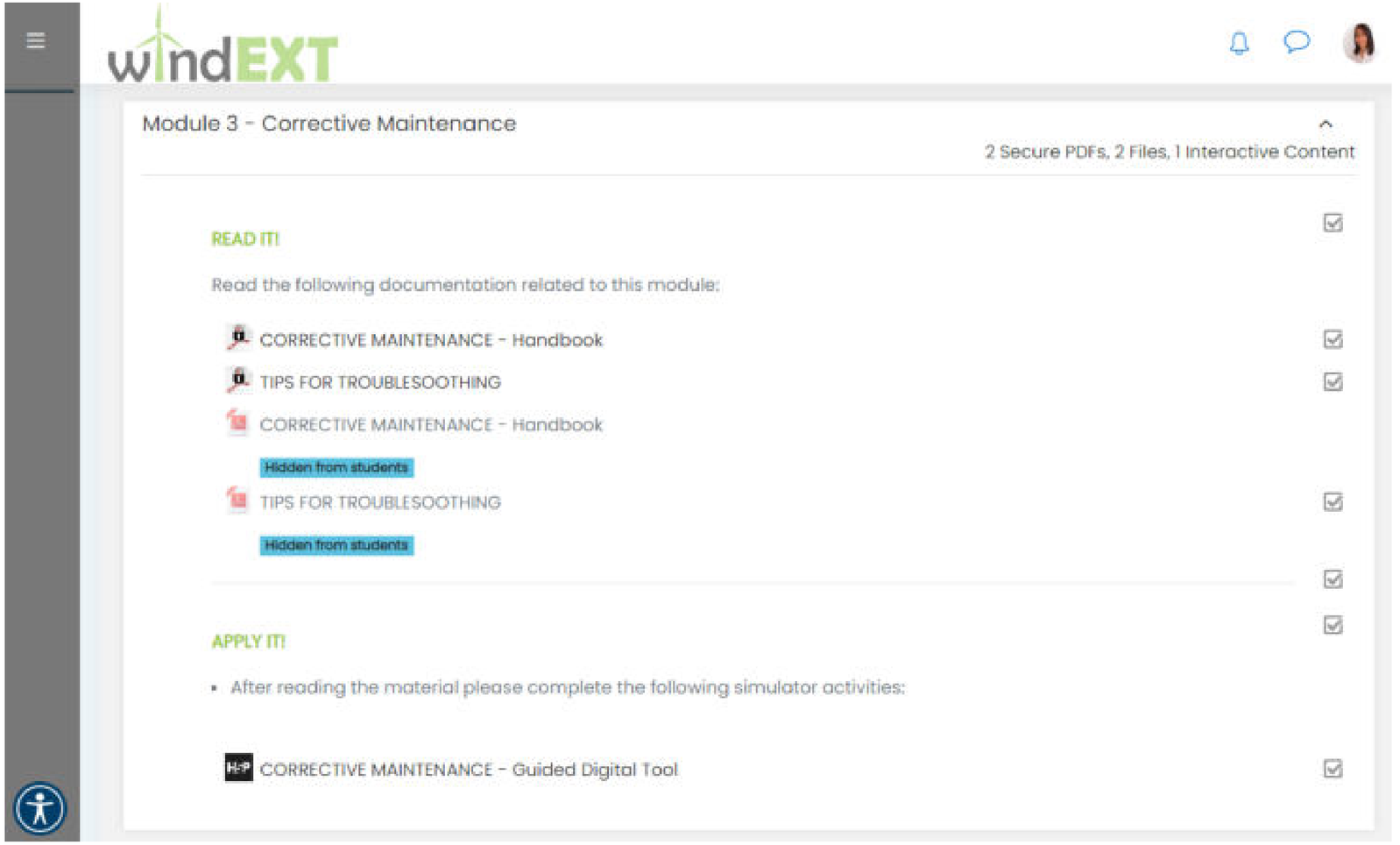
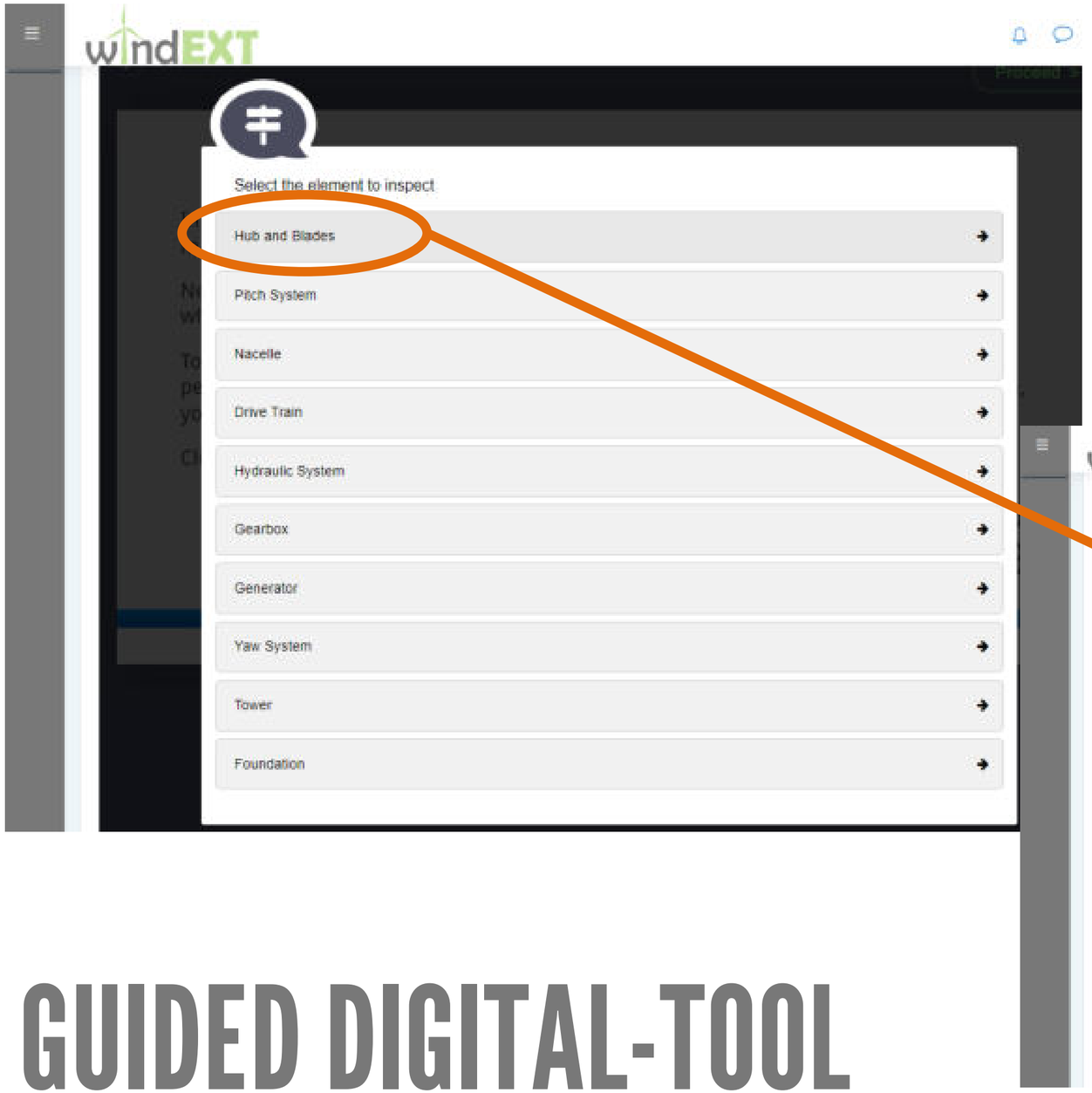
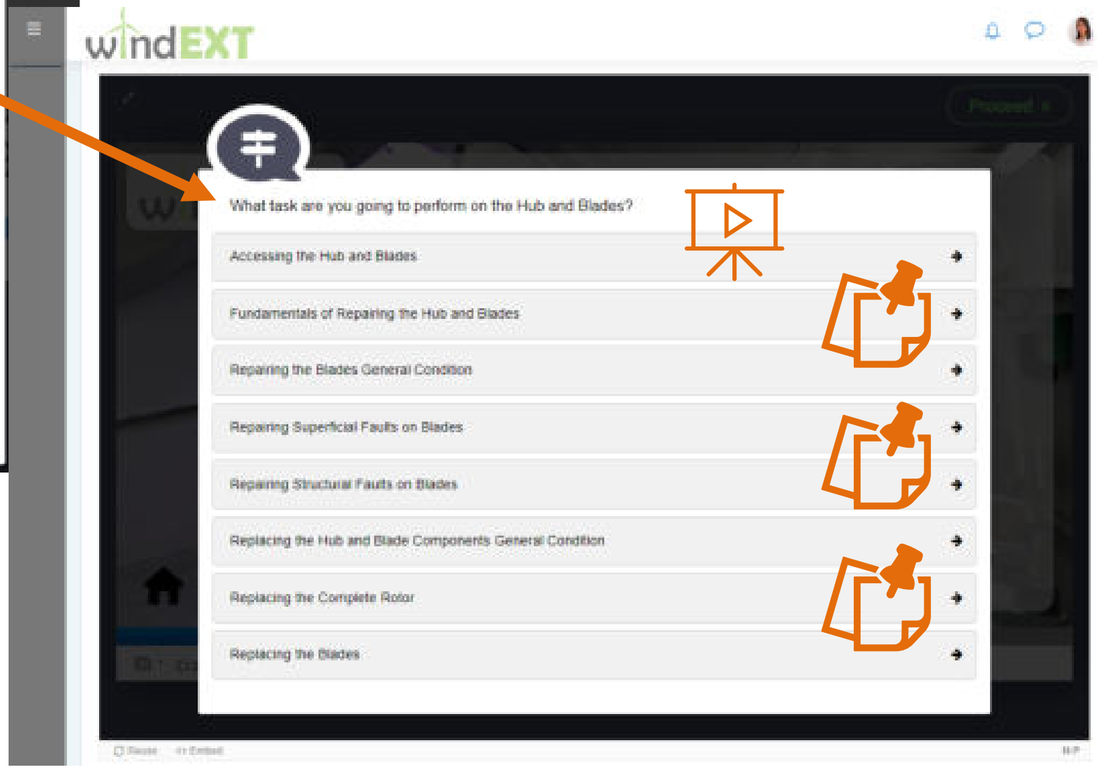

windEXT
Module 3 - Corrective Maintenance
2 Secure PDFs, 2 Files, 1 Interactive Content
READ IT!
Read the following documentation related to this module:
CORRECTIVE MAINTENANCE - Handbook
TIPS FOR TROUBLESOOTHING
CORRECTIVE MAINTENANCE - Handbook
Hidden from students
TIPS FOR TROUBLESOOTHING
Hidden from students
APPLY IT!
After reading the material please complete the following simulator activities:
CORRECTIVE MAINTENANCE - Guided Digital Tool

Table of contents

HANDBOOK





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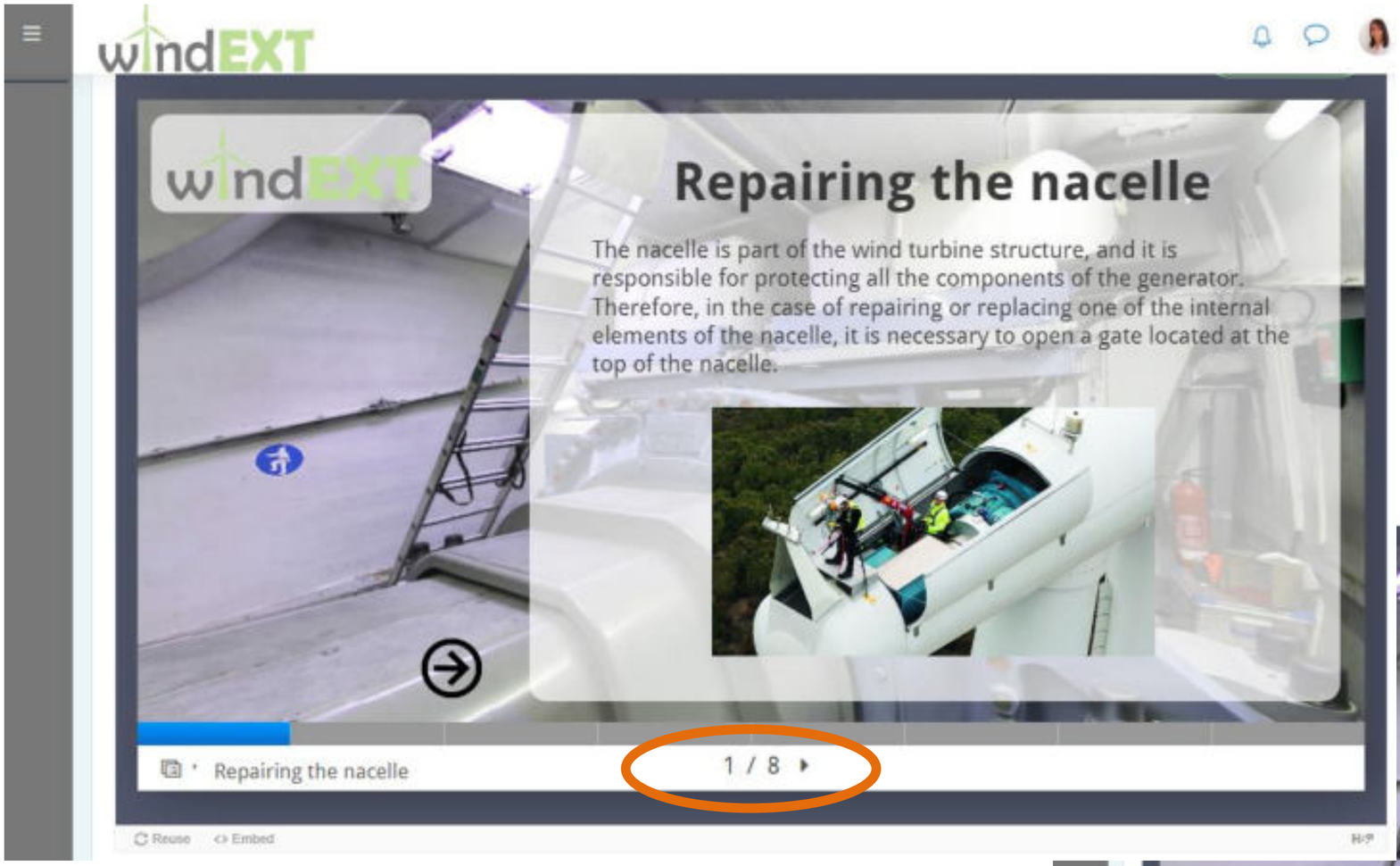

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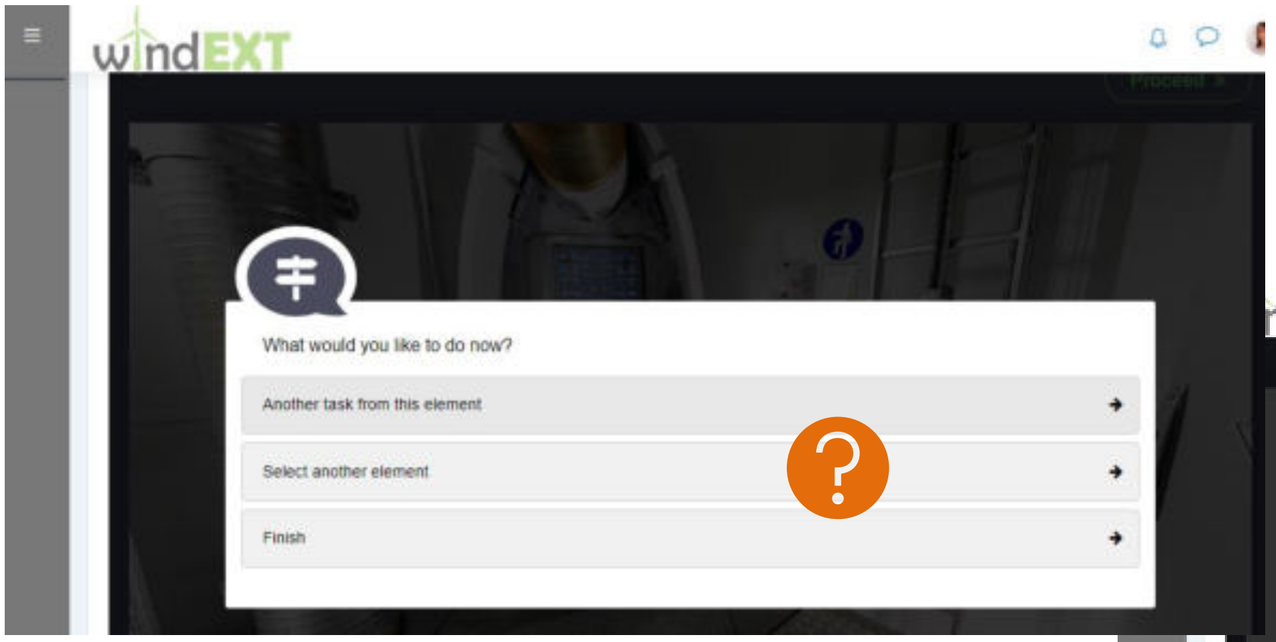

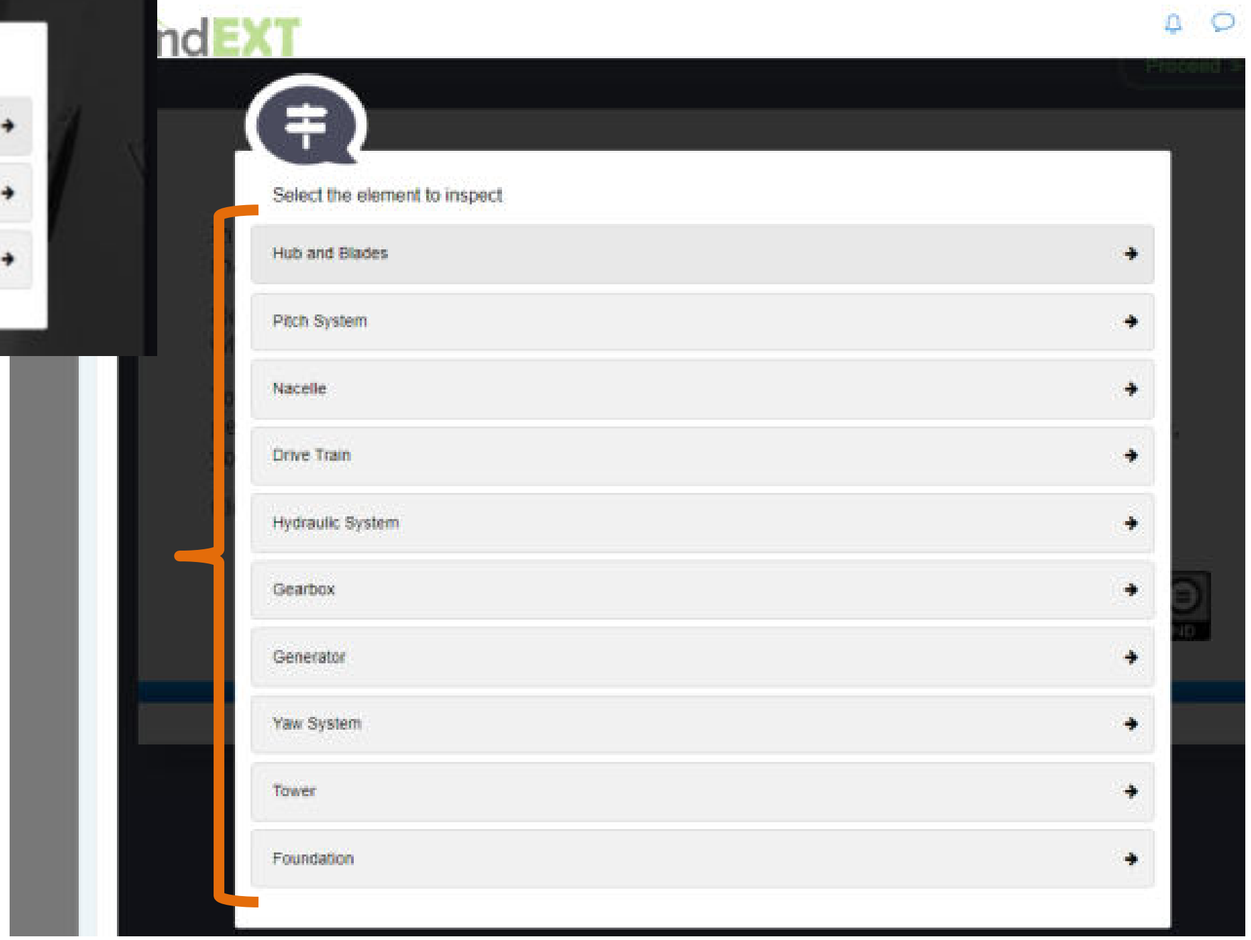

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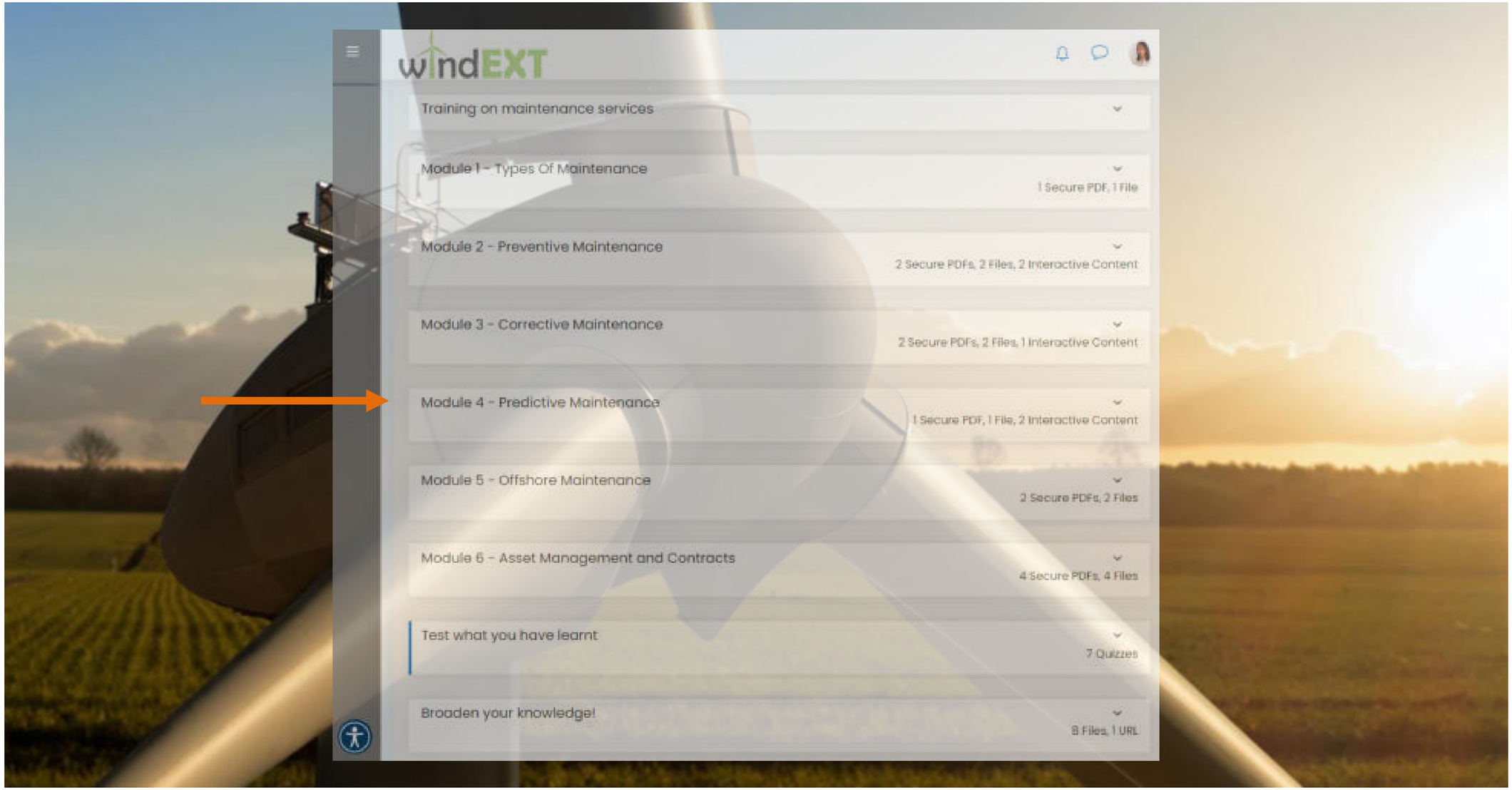
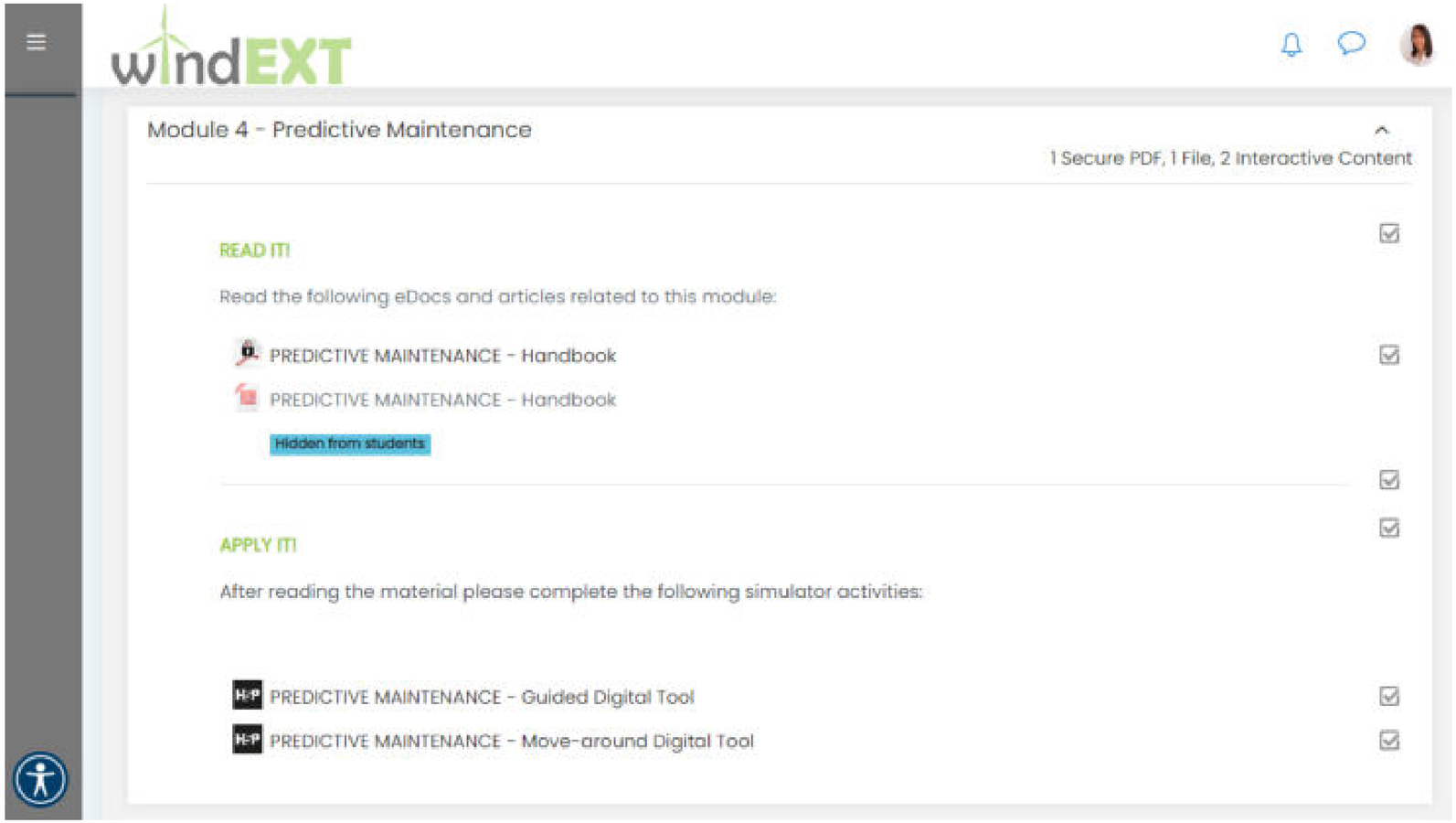
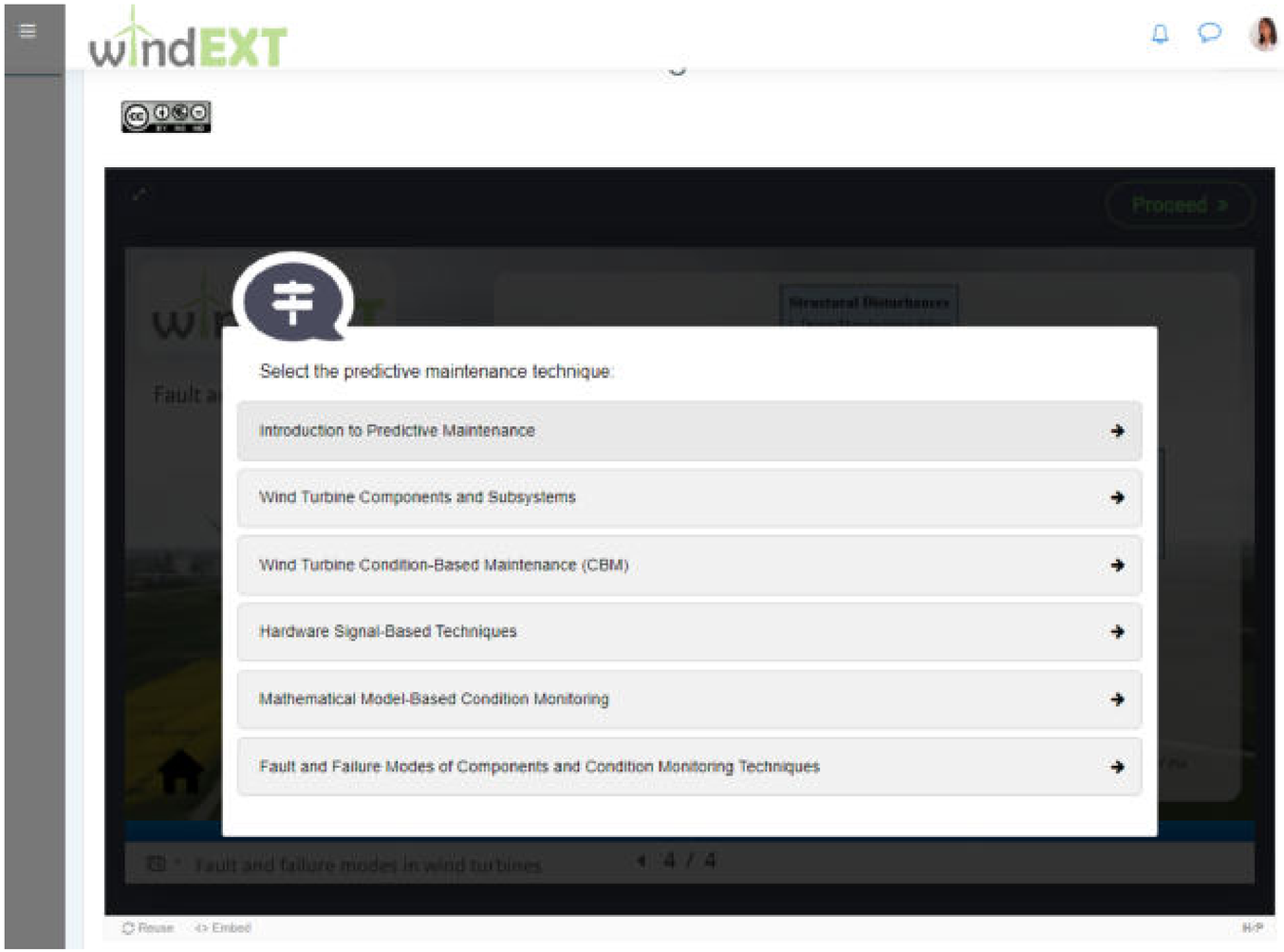
SECTION CONTENTS




windEXT
Module 4 - Predictive Maintenance
1 Secure PDF, 1 File, 2 Interactive Content
READ IT!
Read the following eDocs and articles related to this module:
PREDICTIVE MAINTENANCE - Handbook
PREDICTIVE MAINTENANCE - Handbook
Hidden from students
APPLY IT!
After reading the material please complete the following simulator activities:
PREDICTIVE MAINTENANCE - Guided Digital Tool
PREDICTIVE MAINTENANCE - Move-around Digital Tool

HANDBOOK



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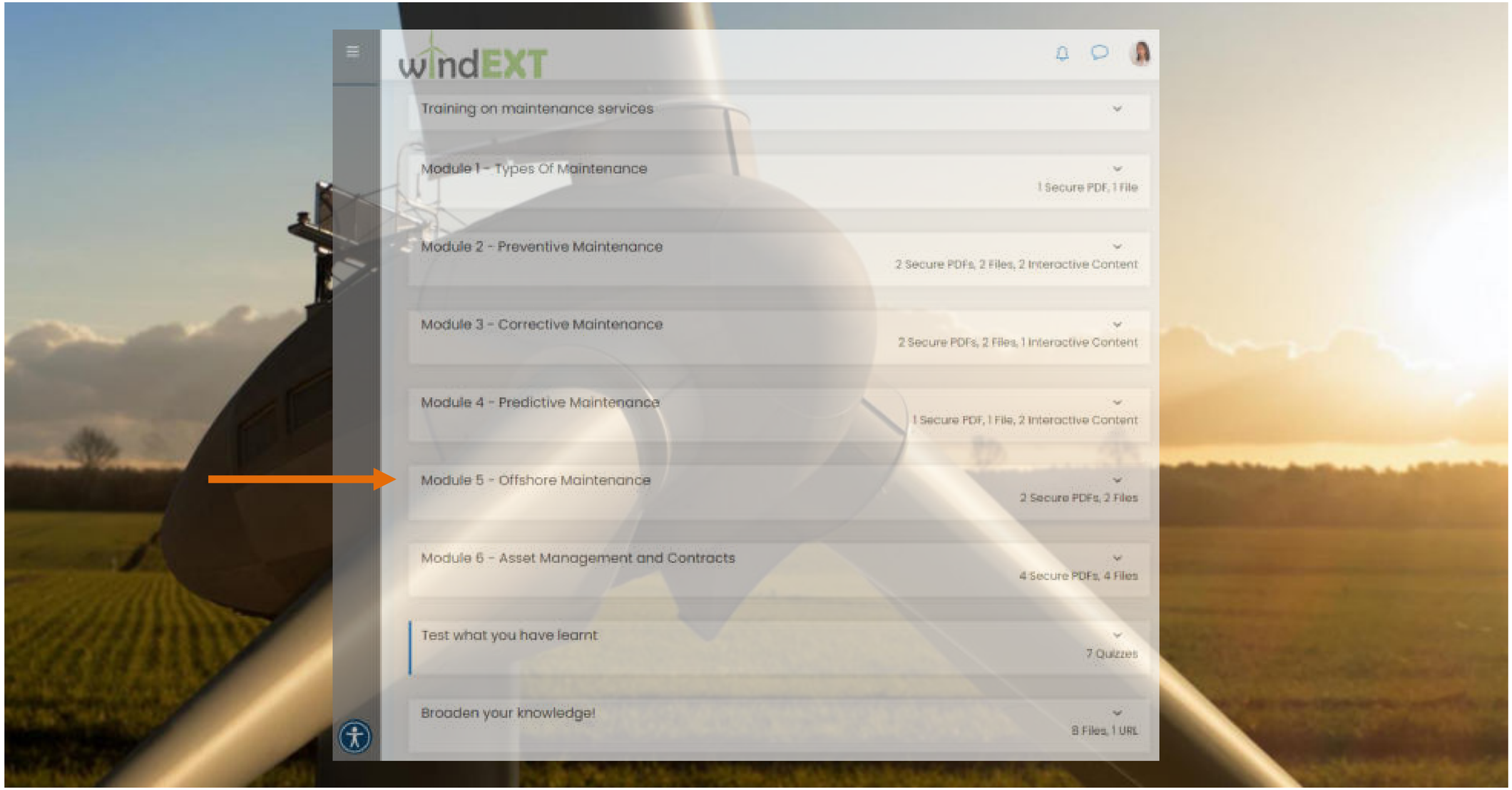
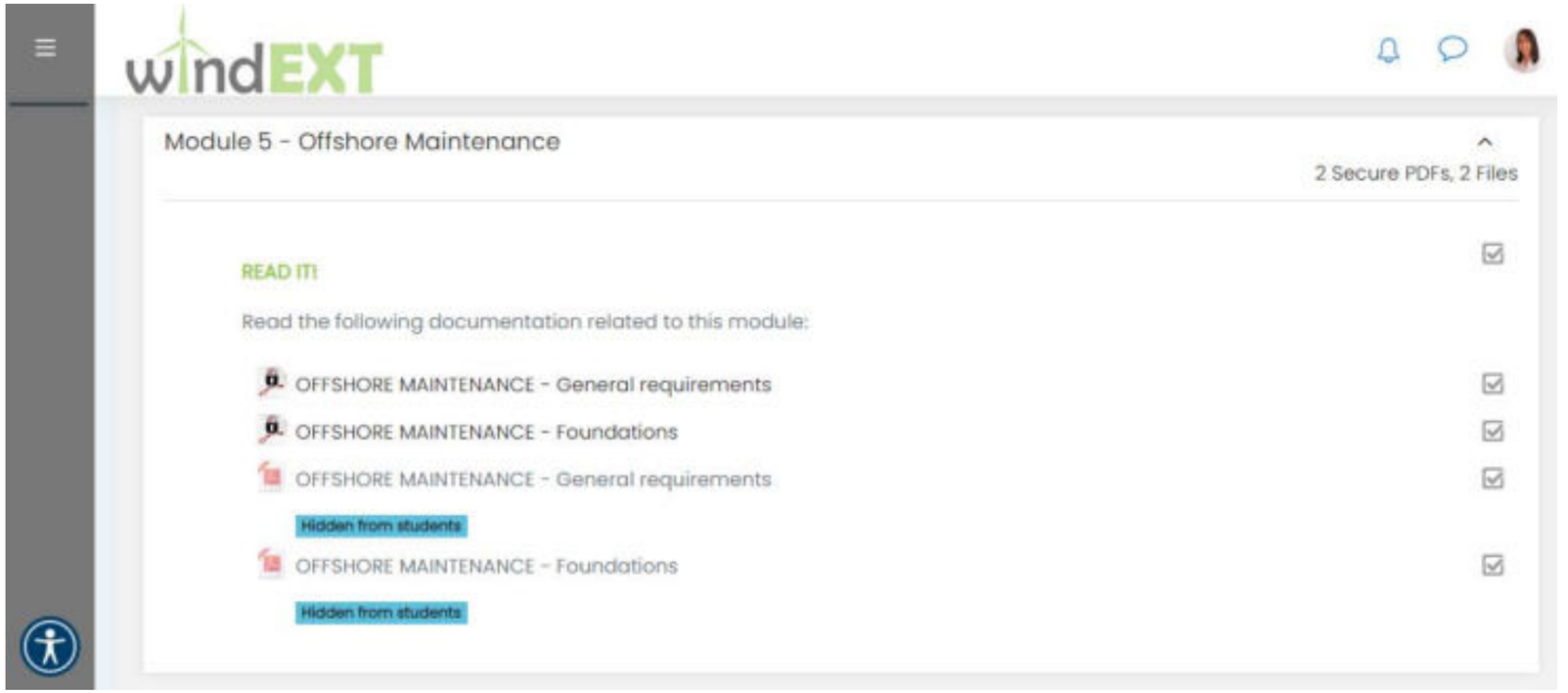
SECTION CONTENTS

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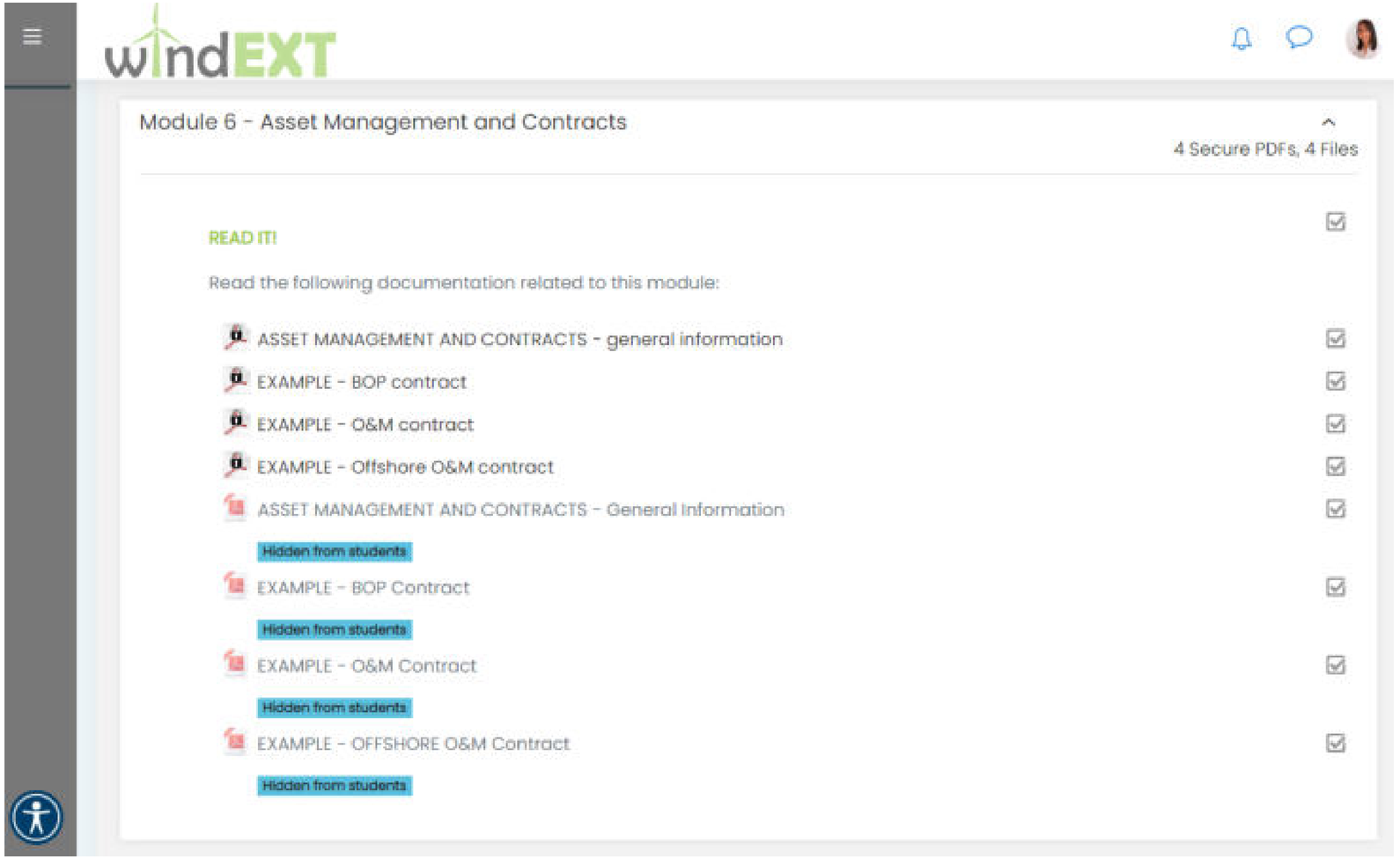
Module 5 - Offshore Maintenance
2 Secure PDFs, 2 Files
READ IT!
Read the following documentation related to this module:
OFFSHORE MAINTENANCE - General requirements
OFFSHORE MAINTENANCE - Foundations
OFFSHORE MAINTENANCE - General requirements
Hidden from students
OFFSHORE MAINTENANCE - Foundations
Hidden from students


windEXT
Module 6 - Asset Management and Contracts
4 Secure PDFs, 4 Files
READ IT!
Read the following documentation related to this module:
ASSET MANAGEMENT AND CONTRACTS - general information
EXAMPLE - BOP contract
EXAMPLE - O&M contract
EXAMPLE - Offshore O&M contract
ASSET MANAGEMENT AND CONTRACTS - General Information
Hidden from students
EXAMPLE - BOP Contract
Hidden from students
EXAMPLE - O&M Contract
Hidden from students
EXAMPLE - OFFSHORE O&M Contract
Hidden from students

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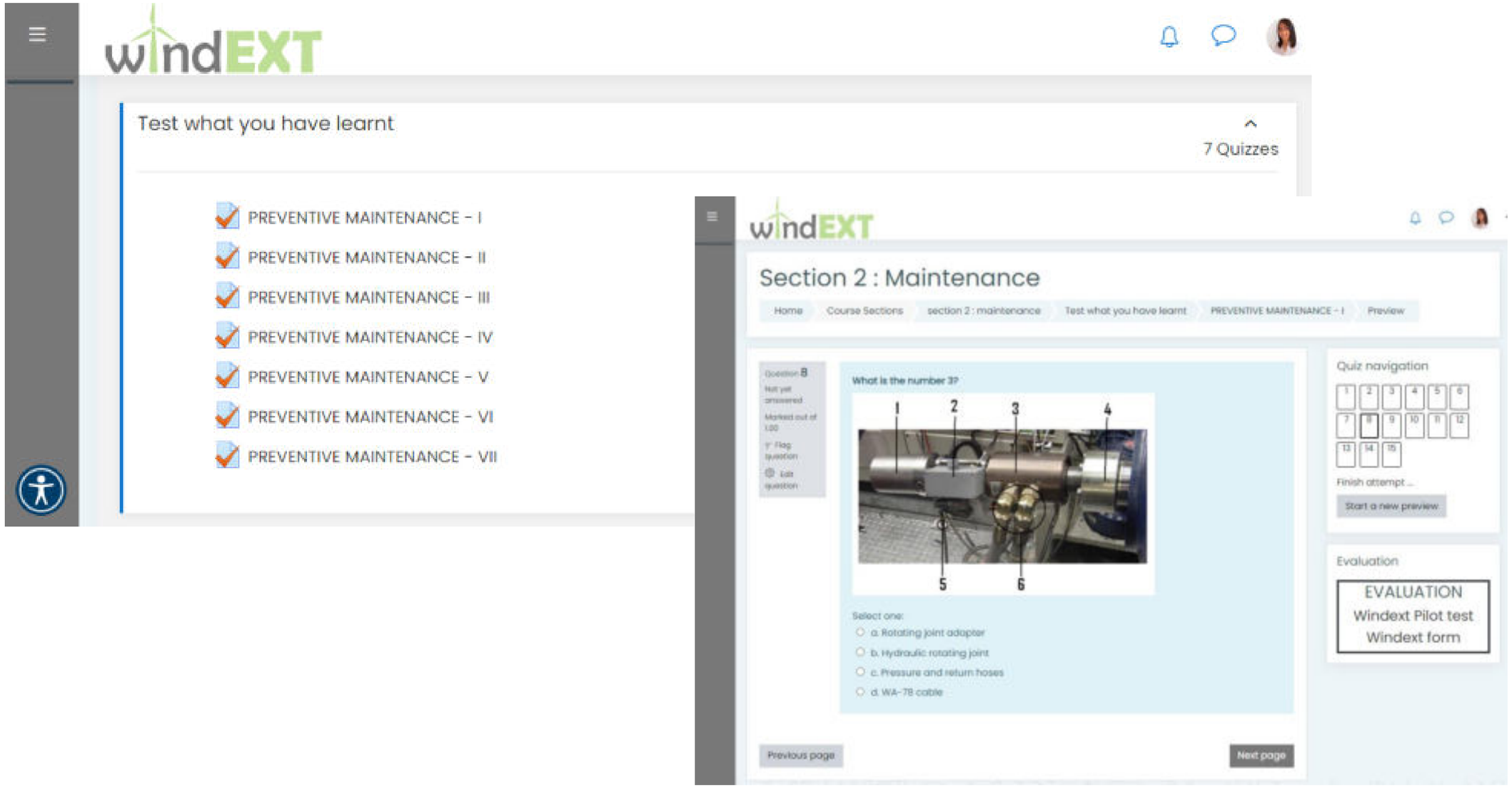
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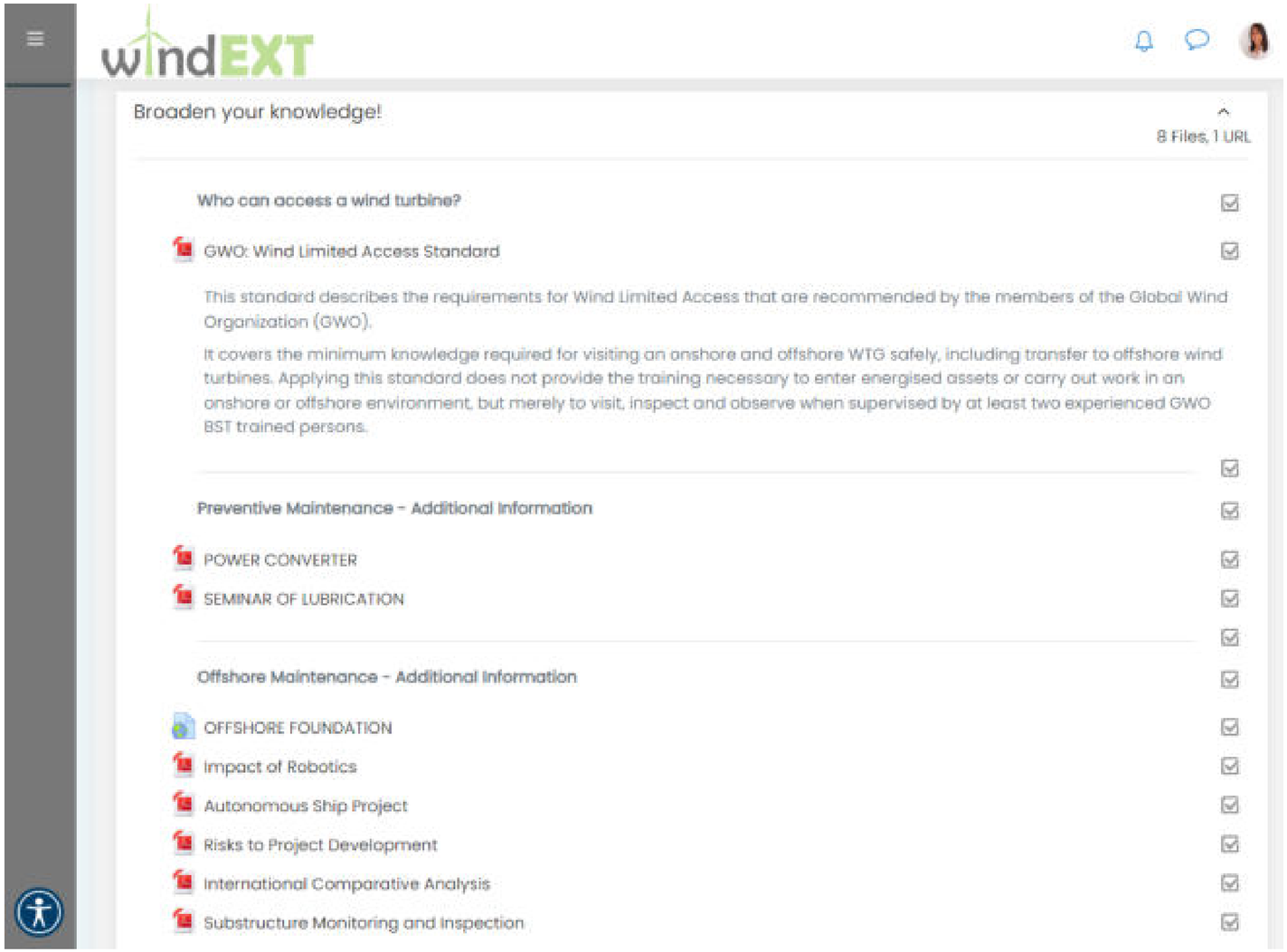
Test what you have learnt
7 Quizzes
PREVENTIVE MAINTENANCE - I
PREVENTIVE MAINTENANCE - II
PREVENTIVE MAINTENANCE - III
PREVENTIVE MAINTENANCE - IV
PREVENTIVE MAINTENANCE - V
PREVENTIVE MAINTENANCE - VI
PREVENTIVE MAINTENANCE - VII
windEXT
Section 2 : Maintenance
Home
Course Sections
section 2 : maintenance
Test what you have learnt
PREVENTIVE MAINTENANCE - I
Preview
What is the number 3?
1
2
3
4
5
6
Select one:
a. Rotating joint adapter
b. Hydraulic rotating joint
c. Pressure and return hoses
d. WA-78 cable
Previous page
Next page
Quiz navigation
Finish attempt ...
Start a new preview
Evaluation
EVALUATION
Windext Pilot test
Windext form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Broaden your knowledge!
8 Files, 1 URL
Who can access a wind turbine?
GWO: Wind Limited Access Standard
This standard describes the requirements for Wind Limited Access that are recommended by the members of the Global Wind Organization (GWO).
It covers the minimum knowledge required for visiting an onshore and offshore WTG safely, including transfer to offshore wind turbines. Applying this standard does not provide the training necessary to enter energised assets or carry out work in an onshore or offshore environment, but merely to visit, inspect and observe when supervised by at least two experienced GWO BST trained persons.
Preventive Maintenance - Additional Information
POWER CONVERTER
SEMINAR OF LUBRICATION
Offshore Maintenance - Additional Information
OFFSHORE FOUNDATION
Impact of Robotics
Autonomous Ship Project
Risks to Project Development
International Comparative Analysis
Substructure Monitoring and Inspection

THANK YOU!

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ADVANCED MAINTENANCE, LIFETIME EXTENSION & REPOWERING OF WIND FARMS SUPPORTED BY ADVANCED DIGITAL

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