Institute of Environmental Engineering

COURSE SYLLABUS

Basics of Circular Economics

Recommended by the Didactic Council for the Education Field for the specialization: 05.04.06 "Ecology and Nature Management"

The course instruction is implemented within the professional education programme of higher education:

«Integrated Solid Waste Management» (Network program with L.N. Gumilyov Eurasian National University)

1. COURSE GOAL(s)

The course is designed to help students to obtain the complex theoretical and applied knowledge about the circular economy, developing skills in the field of economic mechanisms of environmental protection, as well as studying the conditions and possibilities for transforming the technogenic type of economic development into a circular one.

• 2. REQUIREMENTS FOR COURSE OUTCOMES

The course implementation is aimed at the development of the following competences:

Competence	Competence descriptor	Competence formation indicators							
code	Competence descriptor	(within this course)							
GPC-2	Able to use special and	GPC-2.1 Has a systematic understanding of the							
	new sections of	theoretical and methodological foundations of							
	ecology, geoecology	environmental regulation							
	and nature	GPC-2.2 Owns modern methods for obtaining and							
	management in solving	evaluating geochemical information to solve theoretical							
	research and applied	and practical problems of environmental geochemistry in							
	problems of	the field of ecology and nature management in order to							
	professional activity								
		GPC-2.3 Knows the basic knowledge of the							
		fundamental sections of biology to the extent necessary							
		to master the basics in ecology and nature management							
		GPC-2.3 Analyzes the current system of environmental							
		regulation for various areas of nature management							
		GPC-2.4 Analyzes the current system of environmental							
		regulation for various areas of nature management							
		GPC-2.5 Identifies and describes biological diversity,							
		evaluates it using modern methods of quantitative							
		information processing							
PC-6	the ability to diagnose	PC-1.1 Capable of carrying out the necessary							
	problems of nature	calculations for planning, modeling and forecasting the							
	conservation, develop	development of a territorial object							
	practical	PC-1.2 Is able to analyze and evaluate the available							
	recommendations for	resources and conditions necessary for the							
	its protection and	implementation of research							
	sustainable	PC-1.3 Capable of conducting spatial, territorial,							
	development	demographic, sociological, economic research,							
		topographic and geodetic, engineering geological,							
		cartographic surveys							

As a result of course studying, the student must:

Know:

- theoretical foundations of sustainable development and circular economy;
- mechanisms and principles of the circular economy;
- regulatory framework in the field of "green" economy and sustainable development; *Be able to:*
 - develop a strategy for the development of a circular economy in the region;
 - calculate fees for negative environmental impact;
 - calculate the environmental fee;

- assess natural benefits using various methodological approaches;
- calculate environmental damage;
- select best available techniques (BAT) from reference books in accordance with performance criteria;

Own :

- skills in working with design and engineering documentation;
- skills of working with normative legal documentation.

3. COURSE IN HIGHER EDUCATION PROGRAMME STRUCTURE

Discipline *Basics of the Circular Economy* refers to the **Electives** block 1 of the curriculum. Within the higher education programme students also master other disciplines (modules) and / or internships that contribute to the achievement of the expected learning outcomes as results of the course.

Table 3.1

Competence code	Competence descriptor	Previous courses/modules, internships*	Subsequent courses/modules, internships*
GPC-2	Able to use special and new sections of ecology, geoecology and nature management in solving research and applied problems of professional activity	MSW Recycling and Utilization Technics geochemical aspects of waste impact Regional & Municipal MSW Management	Research work in the term including projects / Industrial / pedagogical Internship Research work on thesis State Exam degree Diploma
PC-6	the ability to diagnose problems of nature conservation, develop practical recommendations for its protection and sustainable development	Nature Protection and Accumulated Environmental Damage (AED) Elimination Tools geochemical aspects of waste impact Ecotoxicokinetics of waste National and international aspects of radioactive waste management Regional & Municipal MSW Management Biological and sanitary safety of waste management	Research work in the term including projects / Industrial / pedagogical Internship Research work on thesis State Exam degree Diploma

The list of the higher education programme components that contribute to the achievement of the expected learning outcomes

4. COURSE WORKLOAD AND ACADEMIC ACTIVITIES

The total workload of the discipline is **3** credit units.

Tunes of academic activities		Total	Semester(s)						
Types of academic activities		hours	1	2	3	4			
Contact academic hours									
Lectures		17			17				
Lab works									
Seminars (workshops/tutorials)		17			17				
Self-study		47			47				
Evaluation and assessment (exam; pass/fail)	grading)	27			27				
The total course workload	hours	108			108				
	credits	3			3				

Table 4.1. Types of academic activities during the period of the HE program(me) mastering

5. COURSE CONTENT

Table 5.1. Course Modules and Contents

Title	e of Course Modules	Content	Types of academic activities
1.	Circular economy: conceptual basics	Economic content of green economy and sustainable development. Definition of green economy and sustainable development.	L, S
		Functions, goals and objectives of the green economy. The concept and current trends in the development of the circular economy. Principles and tools of the "green economy" and its contribution to the transition to sustainable development.	L, S
2	Economic mechanisms for environmental	Indicators of sustainable development. OECD indicator systems. UNCSD indicator systems. Economic levers of implementation.	L, S
	protection	Payment for negative impact on the environment. Environmental fee and manufacturer's responsibility. Environmental entrepreneurship. Ecological insurance.	L, S
		State support for economic and (or) other activities carried out for the purpose of environmental protection. Basic legal documents regulating environmental principles.	L, S
3	The economic value of nature and the nature management	The need to determine the economic value of nature. National wealth and its composition. Indicators of national wealth (method of the World Bank).	L, S
	efficiency	Accounting for the environmental factor in the main indicators of economic development.	L, S
		Implementation of the principles of green development: "polluter pays (PP)" and implementation of policy 3 R . The concept of consumer surplus.	L, S
4	Towards circular economy: conditions and opportunities for	The need for a transition to a sustainable type of development and the introduction of elements of a "green" economy.	L, S
	the transformation of the technogenic type	Limitations of technogenic development: environmental (degradation and depletion of natural	L, S

Titl	e of Course Modules	Content	Types of academic activities
	of economic	resources, pollution and waste), economic (investment),	
	development	social (ill health, environmental migrants).	
		Alternative options for solving environmental	L, S
		problems; development of low-waste and resource-	
		saving technologies; technological changes; direct	
		environmental protection measures.	
		Reducing the share of natural resource industries and	L, S
		increasing the share of knowledge-intensive high-tech	
		industries	
5	Legislation in the	Mechanisms for the implementation of environmental	L, S
	field of	and economic policy: direct regulation (state influence),	
	environmental	economic incentives (market mechanisms), mixed	
	protection and the	mechanisms. Formation of environmental legislation.	
	concept of "best available technology (BAT)"	The role of the state in the formation of a circular economy.	L, S

6. CLASSROOM EQUIPMENT AND TECHNOLOGY SUPPORT REQUIREMENTS

Classroom for Academic Activity Type	Classroom equipment	Specialized educational / laboratory equipment, software and materials for mastering the course (if necessary)
Lecture	Classroom, equipped with a set of specialized furniture; whiteboard; a set of devices includes portable multimedia projector, laptop, projection screen, stable wireless	Classroom, equipped with a set of specialized furniture; whiteboard; a set of devices includes portable
Seminars	Classroom, equipped with a set of specialized furniture; whiteboard; a set of devices includes portable multimedia projector, laptop, projection screen, stable wireless	multimedia projector, laptop, projection screen, stable wireless Internet connection. Software: Microsoft Windows, MS Office / Office 365, MS Teams, Chrome (latest stable release), Skype. Microsoft Windows 7 corporate. License No. 5190227, date of issue March 16, 2010 MS Office 2007 Prof , License # 6842818, date of issue 09/07/2009
Computer Lab	Computer Lab for conducting classes, group and individual consultations, current control and intermediate certification, equipped with	INTEGRAL

Table 6.1. Classroom equipment and technology support requirements

Classroom for Academic Activity Type	Classroom equipment	Specialized educational / laboratory equipment, software and materials for mastering the course (if necessary)
	personal computers (in the amount of 12), a	
	board (screen) and technical devices of	
	multimedia presentations.	
	Classroom for self-study (can be used for	
For Self-Study	seminars and consultations), equipped with a	No
	set of devices includes laptop, stable wireless.	

7. RECOMMENDED SOURCES FOR COURSE STUDIES

a) Main reading:

1. Tambovceva T., Titko J. Introduction to circular economy //Ekonomikas un kulturas augstskola. – 2020, materials posted in system TUIS RUDN University

b) Additional reading

 Neugarten, R.A., Langhammer, P.F., Osipova, E., Bagstad, K.J., Bhagabati, N., Butchart, S.H.M., Dudley, N., Elliott, V., Gerber, L.R., Gutierrez Arrellano, C., Ivanić, K.-Z., Kettunen, M., Mandle, L., Merriman, J.C., Mulligan, M., Peh, K.S.-H., Raudsepp-Hearne, C., Semmens, D.J., Stolton, S., Willcock, S. (2018). Tools for measuring, modelling, and valuing ecosystem services: Guidance for Key Biodiversity Areas, natural World Heritage Sites, and protected areas. Gland, Switzerland: IUCN. x + 70pp., materials posted in system TUIS RUDN University
The report of Material Economics. The Circular Economy – a Powerful Force for Climate Mitigation, 2018, 176 pp., materials posted in system TUIS RUDN University
Ecosystem Management: adaptive, community-based conservation / by Gary K. Meffe ... [et al .] Island Press .- 2002.- 333 p ., materials posted in system TUIS RUDN University
The Ellen MacArthur Foundation's report "Towards the circular economy. Economic and business rationale for an accelerated transition", 2013 Vol. 1.- 91 pp., materials posted in system TUIS RUDN University

Internet-based sources

1. ELS of RUDN University and third-party ELS, to which university students have access on the basis of concluded agreements:

- RUDN Electronic Library System - RUDN EBS http://lib.rudn.ru/MegaPro/Web

- ELS "University Library Online" http://www.biblioclub.ru
- EBS Yurayt http://www.biblio-online.ru
- ELS "Student Consultant" www.studentlibrary.ru
- EBS "Lan" <u>http://e.lanbook.com/</u>

- 2. Databases and search engines:
- electronic fund of legal and normative-technical documentation http://docs.cntd.ru/
- Yandex search engine https://www.yandex.ru/
- Google search engine <u>https://www.google.ru/</u>
- abstract database SCOPUS http://www.elsevierscience.ru/products/scopus/

8. MID-TERM ASSESSMENT AND EVALUATION TOOLKIT

Evaluation materials and a point- rating system* for assessing the level of competence formation (part of competences) based on the results of mastering the discipline **Basics of the Circular Economy** are presented in the Appendix to this Work Program of the discipline.

DEVELOPER:

Associate Professor of the ES&PQM Department		Popkova A.V.
Position	Signature	Name, Surname
HEAD OF DEPARTMENT:		
Director of ES&PQM Department		Savenkova E.V.
Position	Signature	Name, Surname
HEAD OF PROGRAMME:		
Associate Professor of the ES&PQM Department		Popkova A.V.
Position	Signature	Name, Surname

Department Environmental Safety and Product Quality Management

educational department to be specified

ASSESSMENT TOOLKIT

for the course

Basics of Circular Economics

05.04.06 "Ecology and nature management" field of studies / speciality code and title

«Integrated Solid Waste Management» (Network program with L.N. Gumilyov Eurasian National

<u>University</u>) higher education programme profile/specialisation title

> <u>Master</u> graduate's qualification (degree)

Passport to Assessment Toolkit for Course Basics of Circular Economics

Field of Studies / Speciality 05.04.06 "Ecology and nature management"/ «Integrated Solid Waste Management» Course: Basics of Circular Economics

			Tools to assess higher education programme mastering level											
s in part) under		Course topic under assessment	Class work						Self-s	tudies		Exam/Pass-fail assessment	Points for topic	Points for module
Competences (competences in part) under assessment	Course module under assessment		Quiz	Test	Work with lecture materials	Work at the seminars	Lab work	Homework	Research essay/ Library research paper	Calculation and graphic work	Group work project			
GPC-2	Module 1. Circular economy: conceptual basics	Economic content of green economy and sustainable development. Definition of green economy and sustainable development.	1	1	1	1					3		7	14
		Functions, goals and objectives of the green economy. The concept and current trends in the development of the circular economy. Principles and	1	1	1	1					3		7	

		tools of the "green economy" and its contribution to the transition to sustainable development.									
GPC-2 PC-6	Module 2. Economic mechanisms for environmental protection	Indicators of sustainable development. OECD indicator systems. UNCSD indicator systems. Economic levers of implementation.	1	1	1	1			2	6	19
		Payment for negative impact on the environment. Environmental fee and manufacturer's responsibility. Environmental entrepreneurship. Ecological insurance.	1	2	1	1			2	7	
		State support for economic and (or) other activities carried out for the purpose of environmental protection. Basic legal documents regulating environmental principles.	1	1	1	1			2	6	
	Module 3. The economic value of nature and the nature management efficiency	The need to determine the economic value of nature. National wealth and its composition. Indicators of national wealth (method of the World Bank).	1	2	1	1			3	8	24
		Accounting for the environmental factor in the	1	2	1	1			3	8	

			1	1	1	r	r	r	r	1	r		
		main indicators of											
		economic development.											
		Implementation of the	1	2	1	1					3	8	
		principles of green											
		development: "polluter											
		pays (PP)" and											
		implementation of policy 3											
		R. The concept of											
		consumer surplus.											
GPC-2	Module 4.	The need for a transition to	1	1	1	1					2	6	19
PC-6	Towards circular	a sustainable type of											
	economy:	development and the											
	conditions and	introduction of elements of											
	opportunities for	a "green" economy.											
	the transformation	Limitations of technogenic	1	1	1	1					2	6	
	of the technogenic	development:											
	type of economic	environmental											
	development	(degradation and depletion											
	1	of natural resources,											
		pollution and waste),											
		economic (investment),											
		social (ill health,											
		environmental migrants).											
		Alternative options for	1	2	1	1					2	7	
		solving environmental										-	
		problems; development of											
		low-waste and resource-											
		saving technologies;											
		technological changes;											
		direct environmental											
		protection measures.											
		Reducing the share of											
		natural resource industries											
		and increasing the share of											
	1	and mercusing the share of				I		1	I		I		

		knowledge-intensive high- tech industries										
GPC-2	Module 5. Legislation in the field of environmental protection and the concept of "best available technology (BAT)"	Mechanisms for the implementation of environmental and economic policy: direct regulation (state influence), economic incentives (market mechanisms), mixed mechanisms. Formation of environmental legislation.	1	1	1	1			2		6	10
		The role of the state in the formation of a circular economy.	1	1		1			1		4	
		TOTAL	13	18	12	13			30	14	86	86

Course Basics of Circular Economics

QUESTION CARD No 1

QUESTION 1 International aspects of the formation of a green economy QUESTION 2 Cultural ecosystem services

3 *

Developer_____(Popkova Anna)

Head of Educational Department____(Savenkova Elena)

day, month, year

Note * Practice case/task inclusion is subject to the teacher's discretion.

The set of exam question cards is complemented by the assessment criteria developed by the teacher and approved at the department meeting.

Assessment criteria:

(in compliance with the legal regulations in force)

EXAM QUESTIONS

- 1. Green economy. Definition. Main features.
- 2. Evolution of green economy ideas.
- 3. International aspects of the formation of a circular economy.
- 4. Resolution of the UN Conference on Sustainable Development "The Future We Want" on the ideas of a green economy. Green economy in the context of sustainable development.
- 5. Capital. Definition. Types of capital within the framework of the green economy concept.
- 6. Human capital. Natural capital. Physical capital.
- 7. Ecosystem services. Definition. Classification.
- 8. Providing ecosystem services.
- 9. Regulating ecosystem services.
- 10. Cultural ecosystem services.
- 11. Supporting ecosystem services.
- 12. Methods for the economic valuation of ecosystem services.
- 13. The potential of remote sensing technologies in ecosystem services assessment
- 14. The application of NDWI for ecosystem services assessment
- 15. The concepts of green economy: it's origins and evolution.
- 16. Closed-loop Economy.
- 17. Diversification and decarbonization of the economy.
- 18. The concept of a low-carbon economy.
- 19. Comparative analysis of traditional and alternative energy chains.
- 20. Cyclical economy. Basic principles and instruments.

21. Framework indicators for sustainable development, developed by the UN Commission on Sustainable Development.

- 22. Linear and circular business models.
- 23. Stages of product life cycle assessment.
- 24. Closed loop and open loop material recycling systems.
- 25. Approaches to the definition of enterprises sustainable development.

- 26. Components of corporate sustainable development of the enterprise.
- 27. Corporate social responsibility and methods of its assessment.
- 28. Indicators of environmental performance of the enterprise.
- 29. Industrial symbiosis.
- 30. The main stages of assessing the life cycle of products.

Tentative list of assessment tools

N 0	Assessment tool	Brief features	Assessment tool representation in the kit			
	Class work					
1	Survey/Quiz	A tool of control, organised as a special conversation between a teacher and students on topics related to the course under study, and designed to clarify the amount of students' knowledge in a particular section, topic, problem, etc.	Questions on the course topics /modules			
2	Test	A system of standardised tasks that allows the teacher to automate the procedure for measuring the student's level of knowledge and skills	Tests bank			
3	Control work	A tool of control organised as a classroom lesson, at which students need to independently demonstrate the acquisition and mastering of the educational material of the course topic, section, or sections.	Questions on the course topics /modules			
4	Round table, discussion, polemic, dispute, debate, (class work)	Evaluation tools that allow the teacher to engage students in the process of discussing controversial issues, problems and assess their ability to argue their own point of view.	List of themes for round tables, discussions, polemics, disputes, debates.			
5	Business game and/or role play	Joint activities of a student group under the teacher's control to solve educational and professionally oriented tasks through the simulation of a real-world problem; this activity allows the teacher to assess the students' ability to analyse and solve typical professional challenges.	Topic (problem), concept, roles and expected results for each game			
6.	Presentation (defence) of project/report/ Library research paper /briefs *	A tool for monitoring the students' ability to present the work results to the audience.	Themes for projects/reports/ Library research paper/ briefs			
7	Pass/Fail assessment	A tool for checking the quality of students' performance of laboratory work, acquisition and mastering of the practice training and seminar educational material, successful completion of the advanced field internship and pre-graduate internship and fulfillment of all training assignments in the course of these internships in accordance with the approved programme.	Tasks examples			
8	Exam	The evaluation of the student's work during the semester (year, the entire period of study, etc.); it is designed to identify the level, soundness and systematic nature of theoretical and practical knowledge gained by the student, formation of independent work skills, development of creative	Examples of tasks/questions/exam question cards			

		thinking ability to synthesise the acquired	
		thinking, ability to synthesise the acquired knowledge and apply it to solve practice tasks.	
0	Casa		A seignments to solve
9	Case	A problem-solving task in which the student is	Assignments to solve
		asked to comprehend the real work-related	the case
		(occupational) situation necessary to solve the problem.	
10	Multi-level tasks	The tasks and assignments differ in terms of the	Set of multi-level tasks
10	and assignments	following levels:	and assignments with
	with varying	a) reproductive level allows the teacher to	varying difficulty
	difficulty	evaluate and diagnose the students' knowledge	, ar i mg arrie arei
	5	of factual material (basic concepts, algorithms,	
		facts) and the students' ability to correctly use	
		special terms and concepts, recognize objects of	
		study within a certain section of the discipline,	
		b) reconstructive level allows the teacher to	
		evaluate and diagnose the students' abilities to	
		synthesise, analyse, generalise factual and	
		theoretical material and formulate specific	
		conclusions, establish cause-and-effect	
		relationships,	
		c) creative level allows to evaluate and	
		diagnose students' skills to integrate knowledge	
		of various fields, argue their own point of view.	
		Self- studies	
1	Calculation and	A tool for checking students' skills in applying	Set of tasks for
	graphic work	the acquired knowledge according to a	calculation and graphic
		predetermined methodology in task solving or	work
		fulfilling assignments for a module or discipline	
2	Course work/project	as a whole. A type of independent written work aimed at the	Course aggignment
2	Course work/project	creative development of general professional and	Course assignment themes
		specialised professional disciplines (modules)	uleffies
		and the development of relevant professional	
		competences	
3	Project	The final "product" that results from planning	Themes for team-based
5	5	and performance of educational and research	or individual projects
		tasks set; it allows the teacher to assess the	1 5
		students' ability to independently shape their	
		knowledge in the course of solving practice tasks	
		and problems, navigate in the information	
		environment and the students' level of	
		analytical, research skills, skills of practical and	
		creative thinking; it can be implemented	
4		individually or by a group of students.	
4	Research essay (Library	The student's independent work in writing that	Themes for research
	research paper)	summarises the results of the theoretical analysis	essay (library research
		of a certain scientific (educational and research) topic, where the author reveals the essence of the	papers)
		problem under study, considers different points	
		of view, as well as argues his/her views on the	
		material under consideration.	
			1

5	Deports briefs	The product of the student's independent work	Thomas for reports
3	Reports, briefs	The product of the student's independent work,	Themes for reports, briefs
		which is a public performance on the	briers
		presentation of the results of solving a specific	
-	F 1.1	educational, practical, research or scientific topic.	
6	Essay and other	A partially regulated assignment that has a non-	Themes for team-based
	creative assignments	standard solution and allows the teacher to	or individual creative
		diagnose students' skills in integrating	assignments
		knowledge from various fields and arguing their	
		own point of view; it can be prepared	
		individually or by a group of students.	
7	Standard calculations	A tool to test skills in applying the acquired	Set of tasks for
		knowledge, according to a predetermined	standard calculations
		methodology, solving tasks or fulfilling	
		assignments for a module or discipline as a	
		whole.	
8	Homework	The tasks and assignments differ in terms of the	Set of multi-level tasks
		following levels:	and assignments with
		a) reproductive level allows the teacher to	varying difficulty
		evaluate and diagnose the students' knowledge	
		of factual material (basic concepts, algorithms,	
		facts) and the students' ability to correctly use	
		special terms and concepts, recognize objects of	
		study within a certain section of the discipline,	
		b) reconstructive level allows the teacher to	
		evaluate and diagnose the students' abilities to	
		synthesise, analyse, generalise factual and	
		theoretical material and formulate specific	
		conclusions, establish cause-and-effect	
		relationships,	
		c) creative level allows the teacher to	
		evaluate and diagnose students' skills to	
		integrate knowledge of various fields, argue	
		their own point of view.	

Department of Environmental Management and Product Quality Management

Business game

for the course Basics of Circular Economics

1 Theme (problem): Towards circular economy: pros and cons

2 Game conception: the establishment of benefits and disadvantages in regards to circular economy tools implementation for different stockholders

3 Roles:

- government;
- society
- non-profit organizations;
- entreasures;

4 Expected outcomes:

- Business game helps students to obtain deep understanding of:
- the main approaches to transition of linear economy into the circular one;
- the basic principles and tools of circular economy;
- the application possibilities of circular economy model

Assessment criteria:

(in compliance with the legal regulations in force)

Developer _____ (Anna Popkova)

day, month, year

Department of Environmental Management and Product Quality Management

Set of assignments for control work

for the course Basics of Circular Economy $_{\rm course\ title}$

1. Establish a correspondence between the type of enterprise and its characteristics

LABOR INTENSIVE ENTERPRISES	High share of labor costs in total production costs
CAPITAL INTENSIVE ENTERPRISES	A significant part of production costs is depreciation
MATERIAL-INTENSIVE ENTERPRISES	A significant part of production costs is the cost of raw materials

2. The main focus of the Millennium Development Goals is on:

- a) ensuring social well-being
- b) solving environmental problems
- c) development of economic development programs
- d) modernization of technologies in the production sector of the economy

3. Choose the correct formulation of the triple sustainability goal for business:

- a) People, Planet, Profit
- b) Profit, People, Planet
- c) Planet, People, Profit
- d) Planning, Production, Profit
- 4. Within the framework of what concept were the first ideas of the circular economy formulated?
- a) "Cradle to Cradle", William McDonough and Michael Brongart
- b) "The Blue Economy", Günther Pauli
- c) "Biomimicry", Jeanine M. Benyu
- d) "The Economics of the Future Spaceship Earth", Connet Boulding

5. Choose the subjects related to the external microenvironment of the enterprise:

- a) suppliers of material and technical resources
- b) consumers of products (services) of the enterprise
- c) competitors
- d) enterprise administration

Assessment criteria:

(in compliance with the legal regulations in force)

Developer _____ (Anna Popkova)

day, month, year

Department of Environmental Management and Product Quality Management

Themes for team-based or individual creative assignments/projects

for the course Basics of Circular Economy

For the successful implementation of the green economy concept, it is necessary to take into account the industries specifics. In the works of UNEP, the following priority green economy industries are highlighted: agriculture, fishing, forestry, industry, transport, waste management, energy. New technologies play a key role in the transformation of certain economy's industries. It should be noted that there is a wide range of related terms in relation to this area: "clean" technologies (clean-tech), "green" technologies, eco-innovations. The abovementioned technologies can reduce emissions, discharges and waste generation, as well as increase energy efficiency.

The purpose of the seminar is to analyze the main directions of the transition to a green economy in various industries.

Topics of reports

1. Analysis of the main directions of the transition to a green economy in agriculture.

2. Analysis of the main directions of the transition to a green economy in the forest industry.

3. Analysis of the main directions of the transition to a green economy in transport.

4. Analysis of the main directions of the transition to a green economy in heavy industry (you can choose a specific industry, for example, ferrous and non-ferrous metallurgy, mechanical engineering, etc.).

5. Analysis of the main directions of the transition to a green economy in the oil and gas complex.

6. Analysis of the main directions of the transition to a green economy in fisheries.

Algorithm

1. Brief description of the selected industry and its contribution to the global economy.

2. Contribution of the selected industry to the economy of the Russian Federation * (share of GDP).

3. The main environmental problems in the selected industry of the Russian economy * (problems of emissions, discharges, waste).

4. Technologies to reduce emissions, discharges and waste generation in the selected industry.

5. Technologies to increase energy efficiency in the selected industry.

6. Successful cases of the implementation of the concept of a green economy in the selected industry.

* For international students - can choose the industry of their country economy.

The presented algorithm is applicable to all topics.

Task defense form – Power Point presentation of the report.

Assessment criteria:

(in compliance with the legal regulations in force)

Developer _____ (Anna Popkova)

day, month, year