МИНИСТЕРСТВО НАУКИ И ВЫСШЕГО ОБРАЗОВАНИЯ РОССИЙСКОЙ ФЕДЕРАЦИИ
**Федеральное государственное бюджетное образовательное учреждение высшего образования
«Пензенский государственный университет архитектуры и строительства»
(ПГУАС)**

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ДЕЛОВОЙ ИНОСТРАННЫЙ ЯЗЫК. АНГЛИЙСКИЙ ЯЗЫК

МЕТОДИЧЕСКИЕ УКАЗАНИЯ К ПРАКТИЧЕСКИМ ЗАНЯТИЯМ ДЛЯ СТУДЕНТОВ, ОБУЧАЮЩИХСЯ ПО НАПРАВЛЕНИЯМ ПОДГОТОВКИ 08.04.01 «СТРОИТЕЛЬСТВО (МАГИСТРАТУРА)»

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Деловой иностранный язык. Английский язык: Методические указания к практическим занятиям для студентов, обучающихся по направлениям подготовки 08.04.01 «Строительство (магистратура)» / О.В.Гринцова, М.В. Пац, Н.В. Солманидина, О.С.Милотаева. Пенза: ПГУАС, 2020. – с.
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Методические указания к практическим занятиям по деловому английскому языку входит в состав учебно-методического комплекса дисциплины «Деловой иностранный язык. Английский язык» для студентов, обучающихся по направлениям подготовки 08.04.01.0201 «Строительство (магистратура)».

Методические указания к практическим занятиям подготовлены на кафедре «Иностранные языки» в соответствии с рабочей программой дисциплины «Деловой иностранный язык. Английский язык».

Методические указания содержат профессионально ориентированные тексты, упражнения для освоения профессиональной терминологии; отработку умений чтения текстов в различных режимах; информационное приложение, включающее словарь-справочник, грамматическую информацию. Акцент сделан на отработку навыков анализа научных текстов по специальности, аннотирования и реферирования.

ISBN

ПРЕДИСЛОВИЕ

Настоящие методические указания к практическим занятиям по деловому иностранному языку (английскому языку) предназначены для студентов, обучающихся по направлениям подготовки 08.04.01 «Строительство (магистратура)».

Методические указания ориентированы на формирование и развитие достаточного уровня иноязычной коммуникативной компетенции в деловой и научной сферах. Это позволит студентам использовать иностранный язык (английский язык) как средство деловой межкультурной коммуникации.

Содержание методических указаний направлено на удовлетворение требований, предъявляемых к результатам освоения дисциплины, и способствует формированию следующей компетенции:

УК-4 - Способен применять современные коммуникативные технологии, в том числе на иностранном(ых) языке(ах), для академического и профессионального взаимодействия

В результате изучения дисциплины (модуля) обучающийся должен:
Знать:

- терминологию на английском языке в изучаемой и смежной областях знаний,
  грамматические конструкции, характерные для профессионально-ориентированных и научных текстов
- основные приемы аналитико-синтетической переработки информации: смысловой анализ текста, вычленение единиц информации и составление плана реферируемого документа в сжатой форме
- традиции межкультурной коммуникации в странах изучаемого языка.
  особенности профессионального этикета западной и отечественной культур.

Уметь:

- -реферировать профессионально-ориентированные тексты и составлять аннотации к ним;
  -отбирать, обрабатывать и оформлять литературу по заданной профессиональной тематике для написания реферата;
  - составлять и представлять техническую и научную информацию, используемую в профессиональной деятельности, в виде презентации;
- правильно пользоваться специальной литературой: словарями, справочниками, электронными ресурсами интернета;
- самостоятельно получать и сообщать информацию на иностранном языке в письменной и устной форме, оформлять профессиональную и деловую корреспонденцию;
- участвовать в обсуждении тем, связанных с культурой, наукой,

техникой;

- самостоятельно работать с иноязычными источниками профессиональной информации;
- организовывать деловые встречи, презентации на иностранном языке.

Владеть:

- -умением применять полученные знания в своей будущей профессиональной деятельности;
  -основами деловых устных и письменных коммуникаций и речевого этикета изучаемого иностранного языка;
- навыками анализа и составления документации на иностранном языке;
- навыками выражения мыслей и собственного мнения в межличностном и деловом общении на иностранном языке;
- навыками обсуждения тем, связанных с направлением подготовки.

Иметь представление:

- -о смысловом анализе текста;
  -о стилистических особенностях сферы профессиональной коммуникации;
- о научной терминологии, классификации, функционировании и способах перевода терминов и фразеологизмов области сферы профессиональной коммуникации.

Методические указания содержат профессионально ориентированные тексты, упражнения для освоения профессиональной терминологии; информационное приложение, включающее словарь-справочник, грамматическую информацию.

Профессионально-направленный характер методических указаний способствует развитию умений активного владения профессиональным иностранным (английским) языком, что необходимо для понимания актуальных проблем строительства и бизнеса, повышения общей языковой компетенции, расширения диапазона навыков и умений.

Оригинальный материал профессионального и страноведческого характера, представленный в данных методических указаниях позволяет использовать последние для развития у студентов словарного запаса на профессиональном иностранном (английском) языке в области научной и профессиональной коммуникации; навыков чтения и анализа научных текстов по специальности, аннотирования и реферирования; совершенствования умений составления презентационных материалов; поддержания ранее приобретенных умений и навыков иноязычного общения и применения их как основы для совершенствования коммуникативной компетенции; изучения особенностей профессионального этикета западной и отечественной культур и развития умений использования этих знаний в профессиональной деятельности.

ВВЕДЕНИЕ

Изучение иностранных языков является необходимой и неотъемлемой составной частью общеобразовательной профессиональной подготовки научных и научно-педагогических кадров. Это обусловлено интернационализацией научного общения, развитием сотрудничества специалистов и ученых на глобальном уровне и расширением сферы научного дискурса в современной коммуникации. Знание иностранного языка облегчает доступ к научной информации, использование ресурсов Интернета, помогает налаживанию международных научных контактов и расширяет возможности повышения профессионального уровня ученого.

В связи с процессами глобализации усиливаются интеграционные тенденции в науке, культуре и образовании, что повышает роль иностранного языка как посредника всех интеграционных процессов. Именно язык воплощает единство процессов общения, познания и становления личности. В этих условиях цели и задачи изучения языка сближаются с целями и задачами профессиональной подготовки и становления студента-магистранта как будущего ученого, т.е. язык постигается одновременно и вместе с наукой как форма, в которую облекается научное знание в соответствии с условиями научного общения. Современное понимание науки как дискурсивной практики требует при изучении языка приоритетного знания структур и стратегий научного дискурса, форм и средств коммуникации, а также умения ими оперировать. Курс изучения иностранного языка носит, таким образом, профессионально-ориентированный и коммуникативный характер. Его целевая разработка обусловлена необходимостью модернизации отечественного образования и конкретизации его содержания на каждом уровне обучения иностранным языкам.

Целью данных методических указаний является обучение английскому языку как средству межкультурного, межличностного и профессионального общения в различных сферах научной деятельности.

В процессе достижения этой цели реализуются коммуникативные, когнитивные и развивающие задачи.

Коммуникативные задачи включают обучение следующим практическим умениям и навыкам:

• свободного чтения оригинальной литературы соответствующей отрасли знаний на иностранном языке;

• оформления извлеченной из иностранных источников информации в виде перевода, реферата, аннотации;

• устного общения в монологической и диалогической форме по специальности и общественно-политическим вопросам (доклад, сообщение, презентация, беседа за круглым столом, дискуссия, подведение итогов и т.п.);

• письменного научного общения на темы, связанные с научной работой аспиранта (научная статья, тезисы, перевод, реферирование и аннотирование);

• различения видов и жанров справочной и научной литературы;

• использования этикетных форм научного общения.

Когнитивные (познавательные) задачи включают приобретение следующих знаний и навыков:

• развития рациональных способов мышления: умения производить различные логические операции (анализ, синтез, установление причинно-следственных связей, аргументирование, обобщение и вывод, комментирование);

• формулирования цели, планирования и достижения результатов в научной деятельности на иностранном языке.

Развивающие задачи включают:

• способность четко и ясно излагать свою точку зрения по проблеме на иностранном языке;

• способность понимать и ценить чужую точку зрения по научной проблеме,

стремиться к сотрудничеству, достижению согласия, выработке общей позиции в условиях различия взглядов и убеждений;

• готовность к различным формам и видам международного сотрудничества (совместный проект, гранд, конференция, конгресс, симпозиум, семинар, совещание и др.), а также к освоению достижений науки в странах изучаемого языка;

• способность выявлять и сопоставлять социокультурные особенности подготовки студентов-бакалавров в стране и за рубежом, достижения и уровень исследований крупных научных центров по избранной специальности.

UNIT I
FOR STUDENTS DOING THEIR MASTER DEGREE (MD)

Due to the increasingly globalized world of international business the demand for business English today is great and it keeps on growing. As a result the learning of business English is playing an increasingly important role in business studies and every day corporate life. For students doing their MD their learning experience must reflect an understanding of business practices and reality. The aim of this textbook is to provide skills, strategies and vocabulary that will enable business English learners to improve basic and academic skills to develop essential business communication skills as efficiently as possible.

A task-based teaching approach enables students to work out techniques to tackle an assignment, introduces the core reading skills that are essential for processing text efficiently, which are then taken up and practiced. Each Unit begins with a business brief, giving the learner a purpose for reading, summarizing information from the reading texts, introducing the key points of the topic discussed in the Unit. This approach encourages learners to work individually and creatively. The follow-up discussion and analyses allowing discovering the most helpful techniques and realize why these ways are effective. This Business English course is based on topics of great interest to everyone involved in international business of the XXI century. It is designed to maintain and develop students' ability to communicate in English in a wide variety of business situations. It also enlarges students' knowledge of the business world.

The basic academic and communications skills, practiced in this course involve:

1. Reading. The reading focus is based on authentic articles from British and American newspapers and books on civil engineering. The emphasis is laid on developing the following techniques: skimming, scanning and follow-up detailed study, including vocabulary development.

2. Summarizing. These skills are aimed at developing students' ability to briefly state the main points of a written text, summarizing information of the reading texts, case studies and presentations.

3. Discussion. Discussion activities are based on issues raised in Business Briefs, articles, and related topics. The discussion focus is aimed at improving fluency and developing an ability to express opinions and exchange views, using an appropriate style. Proficiency in spoken English is developed using different interrelated stages which combine role-play and group discussions as well as problem-solving in case studies. A set of practical tasks encourages students to provide creative solutions to authentic business problems.

4. Making a presentation. This skill is aimed at developing essential business communication competence providing the basics the students will need to effectively operate in a business environment.

5. Vocabulary development. Mastering vocabulary and achieving fluency is an integral part and basis for improving academic and communication skills. The practiced vocabulary consists of compulsory items of basic and specialist vocabulary (terminology and business jargon). All compulsory materials (Business Briefs and articles) are supplemented by a list of active vocabulary. The words and phrases are practiced in the vocabulary exercised and the activities mentioned above.

The activities aimed at practicing the skills mentioned above comprise:

Reading

1. Skim-reading, i.e. getting an overall idea of what the article is about.
2. Scanning, i.e. extracting some specific information.
3. Further comprehension check by asking questions and paraphrasing some sentences, idioms, phrases, etc.
4. Follow-up activities: exchanging opinions/agreement or disagreement/; sharing experiences or additional information, discussing related issues.

Summarizing

1. Formulating a gist of the article.
2. Formulating the main idea of each paragraph.
3. Devising a plan of the summary with key-words in writing.
4. Presenting an article in summary orally or in writing.

Vocabulary development

1. Studying the highlighted Key Words in the business brief and the article, which are needed to understand and discuss the topic.
2. Supplying definitions, synonyms, opposites for basic and special vocabulary.
3. Learning the useful vocabulary/active vocabulary in a specific situation by heart.
4. Developing vocabulary in follow-up exercises, based on the Key Words.
5. Creating individual private vocabulary list devoted to the topic of the Unit.
6. Speaking or writing a paragraph on a related topic using Active Vocabulary.

Transfer activities

1. Summarizing the information from the texts in each Unit with the use of the active vocabulary.
2. Making a presentation. This activity frequently includes an opportunity to use ideas based on students' own studies, work and experience.

3.Follow-up activities: exchanging opinions, sharing additional information.
4.

RECOMMENDATION FOR STUDENTS 1: READING AND VOCABULARY DEVELOPMENT

In the recommendations below we describe in more detail the above-mentioned skills and the techniques used to develop them.

Skimming and scanning are useful tools when reading any type of texts: articles, business briefs, business documents, letters, reports, etc. Learners all too frequently read a foreign language text with a painstaking dedication to deciphering every word in a linear fashion, frequently spending more time looking up words in a dictionary than reading the text. The result is either an imperfect translation or incomprehension. However, if the learners follow the techniques suggested and do not read in more detail then the instructions recommend, they should cope well with the tasks and texts. Each article in this textbook has a number of tasks or exercises with it. The tasks are based on reading techniques or vocabulary study. Follow the instructions carefully: do not read the text in more detail than the instructions tell you to. Use the dictionary only:

a) if you decide a word is especially important;

b) if you cannot guess its meaning from the context.

There is never enough time to read everything. Reading techniques will help you to read better. This does not mean simply reading more quickly. It means spending a minimum of time getting maximum understanding from what you read.

Input	Output
Reading time	Understanding
(minimum)	(maximum)

Skimming

When we have a text to read it is often helpful and time-saving to skim-read it first. Skimming is reading quickly without attention to detail, with no special attention to unknown words. The objective of skimming is to identify quickly the main points in each paragraph. It is often not necessary to understand everything in a paragraph to understand the main points. The aim is getting an overall idea of what the text is about. We advise the following procedure for skimming (allow 1—2 minutes for the task).

Step 1: Look at an article quickly and formulate in your own words what the article is about.

Step 2: Specify which parts of the text you have used to skim-read after checking the results.

Step 3: Read the title, read the lead and the bold introductory text, the headings or just the first lines of the paragraphs if the lead and the headings are missing.

This will help you to understand what is and what is not in the article. This is important because by understanding the title we can began to think about what information we will find in the text and where we will find it. You also learn what you will not find in the article. Look at the length and any pictures or graphic materials, e.g.

diagrams, tables, figures etc. Then try to predict: 'What will the article tell me?' or 'What information is probably in the article?'. Skimming technique is time-saving and it enables to sort out documents, letters, etc.

Scanning

Most articles of the course are followed or preceded by tasks on scanning that is scanning for specific information, e.g. true-false statements or sentences which are missing from some paragraphs of the text, multiple choice or others. Note that these assignments should be done without a dictionary and new unfamiliar words must be either ignored or guessed. When you scan a page or an article, it is not necessary to read everything to find what is of special interest to you. Look for words, pictures, figures, etc., which indicate what you need to know. This is scanning. The aim is extracting specific relevant information. We advise the following procedure for scanning (allow 5-7 minutes for this activity):

Step 1. Find proof for or against the statements in the text or read the complete version of the paragraph.

Step 2. Tackle the task and find ways of doing it within a time-limit.

Step 3. After checking on the results analyze how you did the assignment and what you should have done to perform more effectively.

A follow-up technique for skimming and scanning is identification of the main points in a text. It is particularly important if you have long articles where you may see the words Introduction, Summary or Conclusion. One way of identifying the main points in a text is to read only the first one or two paragraphs and the last one or two. Read only the Introduction or the first paragraph carefully. Then read the final part of the text or the last two paragraphs. The beginning and the end of long texts often have the most important information.

After skimming and scanning the article, look at specific words or a particular phrase which can help you to predict what is coming next. They signal what is coming. Examples are phrases like ‘The first thing to do is...’, ‘Secondly…’, ‘The last step is…’ Recognizing and understanding signaling words and phrases can help you to read more efficiently and to understand the structure of the text.

Detailed reading (with vocabulary development)

When reading a text, try first to predict the meaning of the unknown word from the context. Using a dictionary to find the meaning of every word you don't know reduces the efficiency of your reading. It is important first to attempt to guess the meaning of words you do not know. Usually the context/the rest of the text and especially words and sentences close to the unfamiliar words will help you to decide on a possible meaning for them. Only look up a word if you have no idea what it means and you are confident that it is necessary to understand the word to get the information you need. Tasks on detailed reading include: answering questions on the articles, analyzing small details and paying attention to highlighted vocabulary.

This textbook offers a number of follow-up exercises aimed at vocabulary development. The assignments in the exercises include:

• Finding the words which mean...
• Matching the words with their definitions
• Paraphrasing
• Finding a synonym/ an opposite for/of...
• Translating sentences into Russian

While working individually on your home assignment find definitions of the words in an English-English dictionary, learn the words in the specific context or sentences, sum up the topic, using the active vocabulary, prepare a presentation on a topic related to the issues of the article or the business brief.

RECOMMENDATION FOR STUDENTS 2: SUMMARIZING

When you are referring to a book or other source, you can either quote directly from it, or summarize what it says. A summary is a brief restatement of the main idea and the most important supporting points of a written text, lecture or a presentation, etc. The ability to write a clear and accurate summary is a valuable skill, useful not only when referring to a text produced by someone else, but when you have to reduce the length of your own writing.

In order to communicate information effectively you have to develop the ability to present ideas in brief, in a logical form and in clear and simple terms. Your summary should be

1. Clear, i.e. presented in a logical form, in simple terms
2. Concise, i.e. brief, free from unnecessary details and repetition
3. Complete, i.e. covering all most important points which support the main idea
4. Correct, i.e. free from mistakes and wrong information

There are no specific rules about the length of a summary. An effective summary is just long enough to present the main ideas and too short to include any unnecessary details.

Overall, the recommended proportion of a close summary may be 1 to 3 of the original.

Here are some suggestions regarding the procedure of summarizing which could be useful in making a summary of an article or any other written text.

Task 1: Understanding the main idea of the article.

Procedure: read the article fairly quickly to get a general understanding of the topic and issues (ideas) it deals with.

Task 2: Highlight the important points and key words in the text.

Procedure: Read the article more carefully to get a better understanding of the points each paragraph deals with.

Read paragraph by paragraph and mark in the margin what is relevant information which develops the topic, i.e. important points and what is irrelevant information which illustrates or enlarges on the topic, i.e. unnecessary details, specific examples.

Go through the paragraphs again to understand how the main points are connected, highlighting essential phrases /key words/ related to the important points.

Task 3: Writing one sentence of each paragraph of the summary.

Procedure: Use your marks in the text and formulate the main idea of each paragraph in your own words, i.e. write in simple terms what you have learnt from each paragraph in one sentence. You may use some of the key-words from the text, if they are effective.

Task 4: Choosing the most important points from the notes.

Procedure: Look through the list of the main ideas or points you have made/ your notes. Mark the points which go together, i.e. related to the same issue.

Cross out the points which give unnecessary detail (repetitions, deviations, specific examples). Check with the original to make sure you have included all the important information.

Task 5: Organizing the most important points in a logical order.

Procedure:

a) Organize your notes.

a) Combine the points which go together and decide the best order to put the points in.

b) Make a plan of your summary to organize your most important points in a logical order.

For example:

1. Cause and results.
2. Advantages and disadvantages.
3. Keys to success.

The order of presenting the most important points may be different from the order in which they appear in the article.

Task: Writing a gist.

Procedure: Formulate the gist of the article, i.e. the main idea it deals with in writing in one sentence. You may start with: 'The article deals with/ reports on/ outlines, etc.

When you present an article in a summary try to follow the rules below:

1. State the title, the author's name, the source from which the article is taken.
2. Start with the gist covering the main idea of the article.
3. Present the most important points in a logical order (on the basis of your plan), in simple and clear terms.

Try to avoid typical mistakes:

Don't:

make an introduction or a conclusion;
express your personal opinion or attitude;
give additional information to support the important points;
include all the names, figures and some examples from the article;
analyze the facts or opinions from the article;
make it too general;
retell from beginning to end.

The rule of thumb for summarizing: accurately state the main idea and the most important points of the original.

RECOMMENDATION FOR STUDENTS 3: MAKING A PRESENTATION

Presentation is a talk delivered to a group of people. Making a presentation is one of essential business skills. The aim of this activity is developing an ability to deliver a talk to a group of people within an accepted standard format (5 stages below) and learning to use effective techniques of communicating with the audience, i.e. structuring and signposting the talk in other words, making it clear and easy to understand.

What are the characteristics of a good presentation in terms of content and the way the speaker presents the information, that is, appearance and style? One of the key points is Planning and Preparation. Special attention should be paid to Organization, Visual support, Voice, Content, Physical aspects (appearance, gesture, eye contact, etc.) Preparation steps include the following:

Decide on the objectives - what you want the talk to achieve. What is the purpose of your presentation: informative, persuasive, educational, etc.? Find out about the audience: their technical level, interests, experience, age, responsibilities, required knowledge, size of audience and what they want to know, their expectations.

Content. Collect a number of key ideas, not to overload the audience, sort out information and organize it.

Structure of the presentation**.** The information should be clearly presented and easy to follow.

Practice the presentation - memorize it by heart, visit the room where the presentation will take place, check the equipment.

The key questions that a presenter can ask himself while planning and preparing a presentation are:

a) Will your talk be formal or informal?

b) What are the audience's expectations in terms of technical detail, expertise, etc.?

c) What is your audience's probable level of specialist knowledge? Are they experts or non-experts?

d) How long will your talk be: five minutes, 20 minutes, half a day, or longer?

e) What is your policy on questions? Will the audience interrupt or will they ask questions afterwards? Will there be any discussion?

f) How will you help the audience to remember what you tell them?

The main points to be considered while planning can be grouped as follows:

Audience - expectations, technical knowledge, size, questions and / or discussion.

Speakers' competence - knowledge, presentation technique.

Content - what to include, length/depth (technical detail), number of key ideas.

Structure - sequence: beginning, middle, end, repetition, summarizing.

Delivery - style: formal/informal, enthusiasm/confidence, voice: variety/speed, pauses, body language: eye contact, gesture/movement, posture.

Visual aids - Power Point, type/design/clarity, relevance.

Practice - PC, script or notes.

Room - size/seating, equipment (does it work?), sound quality.

Language - simple/ clear, spelling, sentence length, structure signals.

Any presentation requires a strategy to help you reach your objectives. The aim is to deliver a message that is worth hearing to an audience who want to hear it. It is important to use various signals to help hold the audience's attention and make the information clear. One type of a signal is to introduce the topic with special phrases, such as: ‘I'd like to outline...’, ‘There are two things to consider...’ etc. Another signaling technique is to give a link between parts of a presentation. Say where one part finishes and another starts. Useful phrases are: ‘That's all I have to say about...’ or ‘Let’s move on to...’ etc.

Next comes sequencing of the information, e.g.: the background, present situation and the future. Useful words are: first, next, then, later, finally.

Another technique which helps to emphasize key points is careful repetition, e.g. ‘As I have already said’, ‘I’d like to emphasize...’

The final point concerns timing and quantity of information. Every speaker needs to think about exactly how much information of a particular type a specific audience is likely to absorb, usually not more than three things in a five-minute speech.

Needless to say, that a successful presentation should be well-structured. Your presentation should have a clear, coherent structure and cover the points you wish to make in a logical order.

First of all, special attention should be paid to the beginning of a presentation, because in any presentation it is crucial. You should get the full attention of your audience during the first stage of your talk that is during the first moments that can make or break the presentation. Most presentations start with a brief introduction and end with a brief conclusion. Use the introduction to welcome your audience, introduce your topic/subject, outline the structure of your talk and provide guidelines on questions. Use the conclusion to summarize the main points of your presentation, thank the audience for their attention and invite questions. A good rule of thumb is 'to tell your audience what you are going to say, say it, then tell the audience what you have said'.

Now a few words about visual aids. Visual aids can make a presentation more interesting and easier to understand, but make sure they are appropriate and clear. Do not try to put too much information on each one, allow your audience time to absorb information.

Next goes voice quality and language. You must be clearly audible at all times. If you vary your intonation, your voice will be more interesting to listen to and you will be able to make your points more effectively. Pay attention to simplicity of the language. You must be sure that your audience understands you. Try to use simple constructions.

CONCLUSION

The recommendations given above are broad and general in nature. Depending on the level of your overall knowledge of English and your communication skills some activities may need to be practiced more often than others. Ask your instructor for more recommendations on the development of the specific skills that you need to improve.

UNIT II
CIVIL ENGINEERING

Civil engineering is a professional engineering discipline that deals with the design, construction, and maintenance of the physical and naturally built environment, including works like roads, bridges, canals, dams, and buildings. Civil engineering is the oldest engineering discipline after military engineering, and it was defined to distinguish non-military engineering from military engineering. It is traditionally broken into several sub-disciplines including environmental engineering, geotechnical engineering, structural engineering, transportation engineering, municipal or urban engineering, water resources engineering, materials engineering, coastal engineering, surveying, and construction engineering. Civil engineering takes place on all levels: in the public sector from municipal through to national governments, and in the private sector from individual homeowners through to international companies.

1.1. History of the civil engineering profession

Engineering has been an aspect of life since the beginnings of human existence. The earliest practice of civil engineering may have commenced between 4000 and 2000 BC in Ancient Egypt and Mesopotamia (Ancient Iraq) when humans started to abandon a nomadic existence, creating a need for the construction of shelter. During this time, transportation became increasingly important leading to the development of the wheel and sailing.

Until modern times there was no clear distinction between civil engineering and architecture, and the term engineer and architect were mainly geographical variations referring to the same person, often used interchangeably. The construction of Pyramids in Egypt (circa 2700–2500 BC) might be considered the first instances of large structure constructions. Other ancient historic civil engineering constructions include the Qanat water management system (older than 3000 years and longer than 71 km,) the Parthenon by Iktinos in Ancient Greece (447–438 BC), the Appian Way by Roman engineers (312 BC), the Great Wall of China (220 BC) and the stupas constructed in ancient Sri Lanka like the Jetavanaramaya and the extensive irrigation works in Anuradhapura. The Romans developed civil structures throughout their empire, including especially aqueducts, insular, harbors, bridges, dams and roads.

In the 18th century, the term civil engineering was coined to incorporate all things civilian as opposed to military engineering. The first self-proclaimed civil engineer was John Smeaton who constructed the Eddy stone lighthouse. In 1771 Smeaton and some of his colleagues formed the Smeatonian Society of Civil Engineers, a group of leaders of the profession who met informally over dinner. Though there was evidence of some technical meetings, it was little more than a social society.

In 1818 the Institution of Civil Engineers was founded in London, and in 1820 the eminent engineer Thomas Telford became its first president. The institution received a Royal Charter in 1828, formally recognizing civil engineering as a profession. Its charter defined civil engineering as the art of directing the great sources of power in nature for the use and convenience of man, as the means of production and of traffic in states, both for external and internal trade, as applied in the construction of roads, bridges, aqueducts, canals, river navigation and docks for internal intercourse and exchange, and in the construction of ports, harbors, moles, breakwaters and lighthouses, and in the art of navigation by artificial power for the purposes of commerce, and in the construction and application of machinery, and in the drainage of cities and towns.

The first private college to teach Civil Engineering in the United States was Norwich University founded in 1819 by Captain Alden Partridge. The first degree in Civil Engineering in the United States was awarded by Rensselaer Polytechnic Institute in 1835. The first such degree to be awarded to a woman was granted by Cornell University to Nora Stanton Blatch in 1905.

1.2. History of civil engineering

Civil engineering is the application of physical and scientific principles, and its history is intricately linked to advances in understanding of physics and mathematics throughout history. Because civil engineering is a wide ranging profession, including several separate specialized sub-disciplines, its history is linked to knowledge of structures, materials science, geography, geology, soils, hydrology, environment, mechanics and other fields.

Throughout ancient and medieval history most architectural design and construction was carried out by artisans, such as stonemasons and carpenters, rising to the role of master builder. Knowledge was retained in guilds and seldom supplanted by advances. Structures, roads and infrastructure that existed were repetitive, and increases in scale were incremental.

One of the earliest examples of a scientific approach to physical and mathematical problems applicable to civil engineering is the work of Archimedes in the 3rd century BC, including Archimedes Principle, which underpins our understanding of buoyancy, and practical solutions such as Archimedes' screw. Brahmagupta, an Indian mathematician, used arithmetic in the 7th century AD, based on Hindu-Arabic numerals, for excavation (volume) computations.

1.3. The civil engineer

Civil engineers typically possess an academic degree with a major in civil engineering. The length of study for such a degree is usually three to five years and the completed degree is usually designated as a Bachelor of Engineering, though some universities designate the degree as a Bachelor of Science. The degree generally includes units covering physics, mathematics, project management, design and specific topics in civil engineering. Initially such topics cover most, if not all, of the sub-disciplines of civil engineering. Students then choose to specialize in one or more sub-disciplines towards the end of the degree. While an Undergraduate (BEng / BSc) Degree will normally provide successful students with industry accredited qualification, some universities offer postgraduate engineering awards (MEng / MSc) which allow students to further specialize in their particular area of interest within engineering.

In most countries, a Bachelor's degree in engineering represents the first step towards professional certification and the degree program itself is certified by a professional body. After completing a certified degree program the engineer must satisfy a range of requirements (including work experience and exam requirements) before being certified. Once certified, the engineer is designated the title of Professional Engineer (in the United States, Canada and South Africa), Chartered Engineer (in most Commonwealth countries), Chartered Professional Engineer (in Australia and New Zealand), or European Engineer (in much of the European Union). There are international engineering agreements between relevant professional bodies which are designed to allow engineers to practice across international borders.

The advantages of certification vary depending upon location. For example, in the United States and Canada only a licensed engineer may prepare, sign and seal, and submit engineering plans and drawings to a public authority for approval, or seal engineering work for public and private clients. This requirement is enforced by state and provincial legislation such as Quebec's Engineers Act. In other countries, no such legislation exists. In Australia, state licensing of engineers is limited to the state of Queensland. Practically all certifying bodies maintain a code of ethics that they expect all members to abide by or risk expulsion. In this way, these organizations play an important role in maintaining ethical standards for the profession. Even in jurisdictions where certification has little or no legal bearing on work, engineers are subject to contract law. In cases where an engineer's work fails he or she may be subject to the tort of negligence and, in extreme cases, the charge of criminal negligence. An engineer's work must also comply with numerous other rules and regulations such as building codes and legislation pertaining to environmental law.

1.4. Careers

There is no one typical career path for civil engineers. Most people who graduate with civil engineering degrees start with jobs that require a low level of responsibility, and as the new engineers prove their competence, they are trusted with tasks that have larger consequences and require a higher level of responsibility. However, within each branch of civil engineering career path options vary. In some fields and firms, entry-level engineers are put to work primarily monitoring construction in the field, serving as the "eyes and ears" of senior design engineers; while in other areas, entry-level engineers perform the more routine tasks of analysis or design and interpretation. Experienced engineers generally do more complex analysis or design work, or management of more complex design projects, or management of other engineers, or into specialized consulting, including forensic engineering.

1.5. Sub-disciplines

In general, civil engineering is concerned with the overall interface of human created fixed projects with the greater world. General civil engineers work closely with surveyors and specialized civil engineers to fit and serve fixed projects within their given site, community and terrain by designing grading, drainage, pavement, water supply, sewer service, electric and communications supply, and land divisions. General engineers spend much of their time visiting project sites, developing community consensus, and preparing construction plans. General civil engineering is also referred to as site engineering, a branch of civil engineering that primarily focuses on converting a tract of land from one usage to another. Civil engineers typically apply the principles of geotechnical engineering, structural engineering, environmental engineering, transportation engineering and construction engineering to residential, commercial, industrial, and public works projects of all sizes and levels of construction.

1.6. Coastal engineering

Coastal engineering is concerned with managing coastal areas. In some jurisdictions the terms sea defense and coastal protection are used to mean, respectively, defense against flooding and erosion. The term coastal defense is the more traditional term, but coastal management has become more popular as the field has expanded to include techniques that allow erosion to claim land.

1.7. Construction engineering

Construction engineering involves planning and execution of the designs from transportation, site development, hydraulic, environmental, structural and geotechnical engineers. As construction firms tend to have higher business risk than other types of civil engineering firms, many construction engineers tend to take on a role that is more business-like in nature: drafting and reviewing contracts, evaluating logistical operations, and closely monitoring prices of necessary supplies.

1.8. Earthquake engineering

Earthquake engineering covers ability of various structures to withstand hazardous earthquake exposures at the sites of their particular location.

Earthquake engineering is a sub discipline of the broader category of structural engineering. The main objectives of earthquake engineering are:

Understand interaction of structures with the shaky ground.

Foresee the consequences of possible earthquakes.

Design, construct and maintain structures to perform at earthquake exposure up to the expectations and in compliance with building codes.

1.9. Environmental engineering

Environmental engineering deals with the treatment of chemical, biological, and/or thermal waste, the purification of water and air, and the remediation of contaminated sites, due to prior waste disposal or accidental contamination. Among the topics covered by environmental engineering are pollutant transport, water purification, waste water treatment, air pollution, solid waste treatment and hazardous waste management. Environmental engineers can be involved with pollution reduction, green engineering, and industrial ecology. Environmental engineering also deals with the gathering of information on the environmental consequences of proposed actions and the assessment of effects of proposed actions for the purpose of assisting society and policy makers in the decision making process.

Environmental engineering is the contemporary term for sanitary engineering, though sanitary engineering traditionally had not included much of the hazardous waste management and environmental remediation work covered by the term environmental engineering. Some other terms in use are public health engineering and environmental health engineering.

1.10. Geotechnical engineering

Geotechnical engineering is an area of civil engineering concerned with the rock and soil that civil engineering systems are supported by. Knowledge from the fields of geology, material science and testing, mechanics, and hydraulics are applied by geotechnical engineers to safely and economically design foundations, retaining walls, and similar structures. Environmental concerns in relation to groundwater and waste disposal have spawned a new area of study called geo environmental engineering where biology and chemistry are important.

Some of the unique difficulties of geotechnical engineering are the result of the variability and properties of soil. Boundary conditions are often well defined in other branches of civil engineering, but with soil, clearly defining these conditions can be impossible. The material properties and behavior of soil are also difficult to predict due to the variability of soil and limited investigation. This contrasts with the relatively well defined material properties of steel and concrete used in other areas of civil engineering. Soil mechanics, which describes the behavior of soil, is also complicated because soils exhibit nonlinear (stress-dependent) strength, stiffness, and dilatancy (volume change associated with application of shear stress).

1.11. Water resources engineering

Water resources engineering is concerned with the collection and management of water (as a natural resource). As a discipline it therefore combines hydrology, environmental science, meteorology, geology, conservation, and resource management. This area of civil engineering relates to the prediction and management of both the quality and the quantity of water in both underground (aquifers) and above ground (lakes, rivers, and streams) resources. Water resource engineers analyze and model very small to very large areas of the earth to predict the amount and content of water as it flows into, through, or out of a facility. Although the actual design of the facility may be left to other engineers. Hydraulic engineering is concerned with the flow and conveyance of fluids, principally water. This area of civil engineering is intimately related to the design of pipelines, water supply network, drainage facilities (including bridges, dams, channels, culverts, levees, storm sewers), and canals. Hydraulic engineers design these facilities using the concepts of fluid pressure, fluid statics, fluid dynamics, and hydraulics, among others.

1.12. Materials engineering

Another aspect of civil engineering is materials science. Material engineering deals with ceramics such as concrete, mix asphalt concrete, metals Focus around increased strength, metals such as aluminum and steel, and polymers such as polymethylmethacrylate (PMMA) and carbon fibers.

Materials engineering also consists of protection and prevention like paints and finishes. Alloying is another aspect of material engineering, combining two different types of metals to produce a stronger metal.

1.13. Structural engineering

Structural engineering is concerned with the structural design and structural analysis of buildings, bridges, towers, flyovers, tunnels, off shore structures like oil and gas fields in the sea, and other structures. This involves identifying the loads which act upon a structure and the forces and stresses which arise within that structure due to those loads, and then designing the structure to successfully support and resist those loads. The loads can be self weight of the structures, other dead load, live loads, moving (wheel) load, wind load, earthquake load, load from temperature change etc. The structural engineer must design structures to be safe for their users and to successfully fulfill the function they are designed for (to be serviceable). Due to the nature of some loading conditions, sub-disciplines within structural engineering have emerged, including wind engineering and earthquake engineering.

Design considerations will include strength, stiffness, and stability of the structure when subjected to loads which may be static, such as furniture or self-weight, or dynamic, such as wind, seismic, crowd or vehicle loads, or transitory, such as temporary construction loads or impact. Other considerations include cost, constructability, safety, aesthetics and sustainability.

1.14. Surveying

Surveying is the process by which a surveyor measures certain dimensions that generally occur on the surface of the Earth. Surveying equipment, such as levels and theodolites, are used for accurate measurement of angular deviation, horizontal, vertical and slope distances. With computerization, electronic distance measurement (EDM), total stations, GPS surveying and laser scanning have supplemented (and to a large extent supplanted) the traditional optical instruments. This information is crucial to convert the data into a graphical representation of the Earth's surface, in the form of a map. This information is then used by civil engineers, contractors and even realtors to design from, build on, and trade, respectively. Elements of a building or structure must be correctly sized and positioned in relation to each other and to site boundaries and adjacent structures. Although surveying is a distinct profession with separate qualifications and licensing arrangements, civil engineers are trained in the basics of surveying and mapping, as well as geographic information systems. Surveyors may also lay out the routes of railways, tramway tracks, highways, roads, pipelines and streets as well as position other infrastructures, such as harbors, before construction.

1.14.1. Land surveying

In the United States, Canada, the United Kingdom and most Commonwealth countries land surveying is considered to be a distinct profession. Land surveyors are not considered to be engineers, and have their own professional associations and licensing requirements. The services of a licensed land surveyor are generally required for boundary surveys (to establish the boundaries of a parcel using its legal description) and subdivision plans (a plot or map based on a survey of a parcel of land, with boundary lines drawn inside the larger parcel to indicate the creation of new boundary lines and roads), both of which are generally referred to as cadastral surveying.

1.14.2. Construction surveying

Construction surveying is generally performed by specialized technicians. Unlike land surveyors, the resulting plan does not have legal status. Construction surveyors perform the following tasks:

Survey existing conditions of the future work site, including topography, existing buildings and infrastructure, and even including underground infrastructure whenever possible;

Construction surveying (otherwise ‘lay-out’ or ‘setting-out’): to stake out reference points and markers that will guide the construction of new structures such as roads or buildings for subsequent construction;

Verify the location of structures during construction;

As-Built surveying: a survey conducted at the end of the construction project to verify that the work authorized was completed to the specifications set on plans.

1.15. Transportation engineering

Transportation engineering is concerned with moving people and goods efficiently, safely, and in a manner conducive to a vibrant community. This involves specifying, designing, constructing, and maintaining transportation infrastructure which includes streets, canals, highways, rail systems, airports, ports, and mass transit. It includes areas such as transportation design, transportation planning, traffic engineering, and some aspects of urban engineering, queuing theory, pavement engineering, Intelligent Transportation System (ITS), and infrastructure management.

1.16. Municipal or urban engineering

Municipal engineering is concerned with municipal infrastructure. This involves specifying, designing, constructing, and maintaining streets, sidewalks, water supply networks, sewers, street lighting, municipal solid waste management and disposal, storage depots for various bulk materials used for maintenance and public works (salt, sand, etc.), public parks and bicycle paths. In the case of underground utility networks, it may also include the civil portion (conduits and access chambers) of the local distribution networks of electrical and telecommunications services. It can also include the optimizing of waste collection and bus service networks. Some of these disciplines overlap with other civil engineering specialties, however municipal engineering focuses on the coordination of these infrastructure networks and services, as they are often built simultaneously, and managed by the same municipal authority.

COMPREHENSION

1. Read the text; as your read, note the topic dealt with in each paragraph, underline the topic sentence, key words, and important facts as your go along.
2. Analyze how the facts are connected, how the topic of a paragraph is connected with that of a preceding paragraph.
3. Make a list of all points you are going to mention in your précis .Write them down using the necessary key terms. These notes must contain all the essential facts.
4. Write a précis of the text.
5. Sum up the main points presented in the text. Write the plan of the text in the form of statements.
6. Develop your plan into summary.
7. Make your summary coherent by a sparing use of connectors.
8. Look through your summary. Find the least important sentences and delete them out the remaining ones to produce a well-written, clear and concise summary.
9. Prepare and deliver a 10-minute presentation about civil engineering.

UNIT III
CIVIL ENGINEER

While all civil engineers tend to spend at least some time working "on site", much of the modern civil engineering work is done in offices, working with plans or computers.
A civil engineer is a person who practices civil engineering; the application of planning, designing, constructing, maintaining, and operating infrastructures while protecting the public and environmental health, as well as improving existing infrastructures that have been neglected.
Originally, a civil engineer worked on public works projects and was contrasted with the military engineer, who worked on armaments and defenses. Over time, various branches of engineering have become recognized as distinct from civil engineering, including chemical engineering, mechanical engineering, and electrical engineering, while much of military engineering has been absorbed by civil engineering.
In some places, a civil engineer may perform land surveying; in others, surveying is limited to construction surveying, unless an additional qualification is obtained. On some U.S. military bases, the personnel responsible for building and grounds maintenance, such as grass mowing, are called civil engineers and are not required to meet any minimum educational requirements
2.1. Specialization

Civil engineers usually practice in a particular specialty, such as construction engineering, geotechnical engineering, structural engineering, land development, transportation engineering, hydraulic engineering, and environmental engineering.
Some civil engineers, particularly those working for government agencies, may practice across multiple specializations, particularly when involved in critical infrastructure development or maintenance.

2.2. Education and licensing

In most countries, a civil engineer will have graduated from a post-secondary school with a degree in civil engineering, which requires a strong background in mathematics and the physical sciences; this degree is typically a bachelor's degree, though many civil engineers study further to obtain masters, engineer, doctoral and post doctoral degrees. In many countries, civil engineers are subject to licensure. In jurisdictions with mandatory licensing, people who do not obtain a license may not call themselves civil engineers.

In Belgium, a civil engineer is a legally protected title applicable to graduates of the five-year engineering course of one of the six universities and the Royal Military Academy. Their specialty can be all fields of engineering: civil, structural, electrical, mechanical, chemical, physics and even computer science. This use of the title may cause confusion to the English speaker as the Belgian civil engineer can have a specialty other than civil engineering. In fact, Belgians use the adjective civil as an opposition to military engineers.

The formation of the civil engineer has a strong mathematical and scientific base and is more theoretical in approach than the practical oriented industrial engineer educated in a five-year program at a polytechnic. Traditionally, students were required to pass an entrance exam on mathematics to start civil engineering studies. This exam was abolished in 2004 for the Flemish Community, but is still organized in the French Community.

In Scandinavian countries, civil engineer is a first professional degree, approximately equivalent to Master of Science in Engineering, and a protected title granted to students by selected institutes of technology. As in English the word has its origin in the distinction between civilian and military engineers, as in before the start of the 19th century only military engineers existed and the prefix civil was a way to separate those who had studied engineering in a regular University from their military counterparts. Today the degree spans over all fields within engineering, like civil engineering, computer science, electronics engineering, etc.

There is generally a slight difference between a Master of Science in Engineering degree and the Scandinavian civil engineer degree, the latter's program having closer ties with the industry's demands. A civil engineer is more well-known of the two; still the area of expertise remains obfuscated for most of the public. A noteworthy difference is the mandatory courses in mathematics and physics, regardless of the equivalent master degree, e.g. computer science.

Although a college engineer is roughly equivalent to a Bachelor of Science in Scandinavia, to become a civil engineer one often has had to do up to one extra year of overlapping studies compared to attaining a BSc / MSc combination. This

is because the higher educational system is not fully adapted to the international standard graduation system, since it is treated as a professional degree. Today this is starting to change due to the Bologna process.
A Scandinavian civil engineer will in international contexts commonly call himself Master of Science in Engineering and will occasionally wear an engineering class ring. At the Norwegian Institute of Technology (now the Norwegian University of Science and Technology), the tradition with a NTH Ring goes back to 1914, before the Canadian iron ring.
In Norway the title ‘Sivilingeniør’ will no longer be issued after 2007, and have been replaced with ‘Master i teknologi’. In the English translation of the diploma, the title will be ‘Master of Science’, since ‘Master of Technology’ is not an established title in the English-speaking world. The extra overlapping year of studies has also been abolished with this change to make Norwegian degrees more equal to their international counterparts.
In Spain, a civil engineering degree can be obtained after four years of study in the various branches of mathematics, physics, mechanics, etc. The earned degree is called Grado en Ingeniería Civil. Further studies at a Graduate school include Master's and doctoral degrees.
Before the current situation, that is, before the implementation of Bologna Process in 2010, a Civil Engineering degree in Spain could be obtained after three or five years of study. In the first case, the earned degree was called Ingeniero Técnico de Obras Públicas (ITOP), literally translated as ‘Public Works Engineer’; at the second case, the academic earned degree was called Ingeniero de Caminos, Canales y Puertos (often shortened to Ingeniero de Caminos or ICCP), that literally means ‘Roads, Canals and Harbors Engineer’, though civil engineers in Spain practice in the same fields as civil engineers do elsewhere.
The first Spanish Civil Engineering School was the Escuela Especial de Ingenieros de Caminos y Canales (now called Escuela Técnica Superior de Ingenieros de Caminos, Canales y Puertos), established in 1802 in Madrid, followed by the Escuela Especial de Ayudantes de Obras Públicas (now called Escuela Universitaria de Ingeniería Técnica de Obras Públicas de la Universidad Politécnica de Madrid), founded in 1854 in Madrid. Both schools now belong to the Technical University of Madrid.
In Spain, a Civil Engineer has the technical and legal ability to design projects of any branch, so any Spanish Civil Engineer can oversee projects about structures, buildings (except residential structures which are reserved for architects), foundations, hydraulics, the environment, transportation, urbanism, etc.
In Spain, Mechanical and Electrical engineering tasks are included under the Industrial engineering degree.
In the United Kingdom a chartered civil engineer (known as certified or professional engineer in other countries) is a member of the Institution of Civil Engineers, and has also passed charter ship exams. However a non-chartered civil engineer may be a member of the Institution of Civil Engineers or the Institution of Civil Engineering Surveyors. The description ‘Civil Engineer’ is not restricted to

members of any particular professional organization although ‘Chartered Civil Engineer’ is.

In the United States, civil engineers are typically employed by municipalities, construction firms, consulting engineering firms, architect/engineer firms, state governments, and the federal government. Each State requires engineers who offer their services to the public to be licensed by the State. Licensure is obtained by meeting specified education, examination, and work experience requirements. Specific requirements vary by State. Typically licensed engineers must graduate from an ABET-accredited University or College engineering program, pass the Fundamentals of Engineering exam, obtain several years of engineering experience under the supervision of a licensed engineer, then pass the Principles and Practice of Engineering Exam. After completing these steps and the granting of licensure by a State Board, engineers may use the title ‘Professional Engineer’ or PE in advertising and documents.

2.3. Professional associations

The ASCE (American Society of Civil Engineers) represents more than 140,000 members of the civil engineering profession worldwide. Official members of the ASCE must hold a bachelor's degree from an accredited civil engineering program and be a licensed professional engineer or have five years responsible charge of engineering experience. Most civil engineers join this organization to be updated of current news, projects, and methods (such as sustainability) related to civil engineering; as well as contribute their expertise and knowledge to other civil engineers and students obtaining their civil engineering degree.

The ICE (Institution of Civil Engineers) founded in 1818, represents more than 80,000 members of the civil engineering profession worldwide. Its commercial arm, Thomas Telford Ltd, provides training, recruitment, publishing and contract services.

COMPREHENSION

1. Read the text; as your read, note the topic dealt with in each paragraph, underline the topic sentence, key words, and important facts as your go along.
2. Analyze how the facts are connected, how the topic of a paragraph is connected with that of a preceding paragraph.
3. Make a list of all points you are going to mention in your précis .Write them down using the necessary key terms. These notes must contain all the essential facts.
4. Write a précis of the text.
5. Sum up the main points presented in the text. Write the plan of the text in the form of statements.
6. Develop your plan into summary.
7. Make your summary coherent by a sparing use of connectors.
8. Look through your summary. Find the least important sentences and delete them out the remaining ones to produce a well-written, clear and concise summary.

9. Prepare and deliver a 10-minute presentation about civil engineers in different countries.

UNIT IV
BUILDING MATERIALS

A building material is any material which is used for a construction purpose. Many naturally occurring substances, such as clay, sand, wood and rocks, even twigs and leaves have been used to construct buildings. Apart from naturally occurring materials, many man-made products are in use, some more and some less synthetic. The manufacture of building materials is an established industry in many countries and the use of these materials is typically segmented into specific specialty trades, such as carpentry, plumbing, roofing and insulation work. They provide the make-up of habitats and structures including homes.

The tent is the home of choice among nomadic groups all over the world. Two well known types include the conical teepee and the circular yurt. It has been revived as a major construction technique with the development of tensile architecture and synthetic fabrics. Modern buildings can be made of flexible material such as fabric membranes, and supported by a system of steel cables; rigid or internal (air pressure).

3.1. Mud and clay

The amount of each material used leads to different styles of buildings. The deciding factor is usually connected with the quality of the soil being used. Larger amounts of clay usually mean using the cob/adobe style, while low clay soil is usually associated with sod building. The other main ingredients include more or less sand/gravel and straw/grasses. Rammed earth is both an old and newer take on creating walls, once made by compacting clay soils between planks by hand; now forms and mechanical pneumatic compressors are used.

Soil and especially clay is good thermal mass; it is very good at keeping temperatures at a constant level. Homes built with earth tend to be naturally cool in the summer heat and warm in cold weather. Clay holds heat or cold, releasing it over a period of time like stone. Earthen walls change temperature slowly, so artificially raising or lowering the temperature can use more resources than in say a wood built house, but the heat/coolness stays longer.

Peoples building with mostly dirt and clay, such as cob, sod, and adobe, resulted in homes that have been built for centuries in western and northern Europe as well as the rest of the world, and continue to be built, though on a smaller scale. Some of these buildings have remained habitable for hundreds of years.

3.2. Wood

A natural material for building dwellings for thousands of years, wood was also used to make Churches in the past. The main problems with wood structures are fire risk and durability. Wood is an aesthetically pleasing material that never goes out of trend completely, though the current popularity of plastic is taking its place in many construction sites.

3.3. Rock

Rock structures have existed for as long as history can recall. It is the longest lasting building material available, and is usually readily available. There are many types of rock throughout the world all with differing attributes that make them better or worse for particular uses. Rock is a very dense material so it gives a lot of protection too, its main draw-back as a material is its weight and awkwardness. Its energy density is also considered a big draw-back, as stone is hard to keep warm without using large amounts of heating resources.

Dry stone walls have been built for as long as humans have put one stone on top of another. Eventually different forms of mortar were used to hold the stones together, cement being the most commonplace now.

The granite-strewn uplands of Dart moor National Park, United Kingdom, for example, provided ample resources for early settlers. Circular huts were constructed from loose granite rocks throughout the Neolithic and early Bronze Age, and the remains of an estimated 5,000 can still be seen today. Granite continued to be used throughout the medieval period (see Dart moor longhouse) and into modern times. Slate is another stone type, commonly used as roofing material in the United Kingdom and other parts of the world where it is found.

Mostly stone buildings can be seen in most major cities, some civilizations built entirely with stone such as the Pyramids in Egypt, the Aztec pyramids and the remains of the Inca civilization.

3.4. Thatch

Thatch is one of the oldest of building materials known; grass is a good insulator and easily harvested. Many African tribes have lived in homes made completely of grasses year round. In Europe, thatch roofs on homes were once prevalent but the material fell out of favor as industrialization and improved transport increased the availability of other materials. Today, though, the practice is undergoing a revival. In the Netherlands, for instance, many new buildings have thatched roofs with special ridge tiles on top.

3.5. Brush

Brush structures are built entirely from plant parts and are generally found in tropical and sub-tropical areas, such as rainforests, where very large leaves can be used in the building. Native Americans use them for resting and living in, too. These are built mostly with branches, twigs and leaves, and bark, similar to a beaver's lodge. These were variously named wiki ups, lean tos, and so forth.

3.6. Ice

Ice was used by the Inuit for igloos, but has also been used for ice hotels as a tourist attraction in northern areas that might not otherwise see many winter tourists.

3.7. Sand

Sand is used with cement and sometimes lime to make mortar for masonry work and plaster. Sand is used as a part of the concrete mix.

3.8. Concrete

Concrete is a composite building material made from the combination of aggregate and a binder such as cement. The most common form of concrete is Portland cement concrete, which consists of mineral aggregate (generally gravel and sand), Portland cement and water. After mixing, the cement hydrates and eventually hardens into a stone-like material. When used in the generic sense, this is the material referred to by the term concrete.

For a concrete construction of any size, as concrete has a rather low tensile strength, it is generally strengthened using steel rods or bars (known as rebar). This strengthened concrete is then referred to as reinforced concrete. In order to minimize any air bubbles that would weaken the structure, a vibrator is used to eliminate any air that has been entrained when the liquid concrete mix is poured around the ironwork. Concrete has been the predominant building material in this modern age due to its longevity, formability, and ease of transport. Recent advancements, such as Insulating concrete forms, combine the concrete forming and other construction steps (installation of insulation). All materials must be taken in required proportions as described in standards.

3.9. Metal

Metal is used as structural framework for larger buildings such as skyscrapers, or as an external surface covering. There are many types of metals used for building. Steel is a metal alloy whose major component is iron, and is the usual choice for metal structural building materials. It is strong, flexible, and if refined well and/or treated lasts a long time. Corrosion is metal's prime enemy when it comes to longevity.

The lower density and better corrosion resistance of aluminum alloys and tin sometimes overcome their greater cost. Brass was more common in the past, but is usually restricted to specific uses or specialty items today.

Metal figures quite prominently in prefabricated structures such as the Quonset hut, and can be seen used in most cosmopolitan cities. It requires a great deal of human labor to produce metal, especially in the large amounts needed for the building industries.

Other metals used include titanium, chrome, gold, and silver. Titanium can be used for structural purposes, but it is much more expensive than steel. Chrome, gold, and silver are used as decoration, because these materials are expensive and lack structural qualities such as tensile strength or hardness.

3.10. Glass

Glassmaking is considered an art form as well as an industrial process or material.

Clear windows have been used since the invention of glass to cover small openings in a building. They provided humans with the ability to both let light into rooms while at the same time keeping inclement weather outside. Glass is generally made from mixtures of sand and silicate, in a very hot fire stove called a kiln and is very brittle. Very often additives are added to the mixture when making to produce glass with shades of colors or various characteristics (such as bulletproof glass, or light emittance).

The use of glass in architectural buildings has become very popular in the modern culture. Glass ‘curtain walls’ can be used to cover the entire facade of a building.

They can also be used to span over a wide roof structure in a 'space frame'. These uses though require some sort of frame to hold sections of glass together, as glass by itself is too brittle and would require an overly large kiln to be used to span such large areas.

3.11. Plastic

The term 'plastics' covers a range of synthetic or semi-synthetic organic condensation or polymerization products that can be molded or extruded into objects or films or fibers. Their name is derived from the fact that in their semi-liquid state they are malleable, or have the property of plasticity. Plastics vary immensely in heat tolerance, hardness, and resiliency. Combined with this adaptability, the general uniformity of composition and lightness of plastics ensures their use in almost all industrial applications today.

3.12. Foam

More recently synthetic polystyrene or polyurethane foam has been used in combination with structural materials, such as concrete. It is light weight, easily shaped and an excellent insulator. It is usually used as part of a structural insulated panel where the foam is sandwiched between wood and cement or insulating concrete forms, where concrete is sandwiched between two layers of foam.

3.13. Cement composites

Cement bonded composites are made of hydrated cement paste that binds wood or alike particles or fibers to make pre-cast building components. Various fibrous materials including paper and fiberglass have been used as binders.

Wood and natural fibers are composed of various soluble organic compounds like carbohydrates, glycosides and phenolics. These compounds are known to retard cement setting. Therefore, before using a wood in making cement boned composites, its compatibility with cement is assessed.

Wood-cement compatibility is the ratio of a parameter related to the property of a wood-cement composite to that of a neat cement paste. The compatibility is often expressed as a percentage value. To determine wood-cement compatibility, methods based on different properties are used, such as, hydration characteristics, strength, interfacial bond and morphology. Various methods are used by researchers such as the measurement of hydration characteristics of a cement aggregate mix; the comparison of the mechanical properties of cement aggregate mixes and the visual assessment of micro structural properties of the wood cement mixes. It has been found that the hydration test by measuring the change in hydration temperature with time is the most convenient method. Recently, Karade et al have reviewed these methods of compatibility assessment and suggested a method based on the 'maturity concept' i.e. taking in consideration both time and temperature of cement hydration reaction.

3.14. Modern industry

Modern building is a multibillion dollar industry, and the production and harvesting of raw materials for building purposes is on a world wide scale. Often being a primary governmental and trade key point between nations. Environmental concerns are also becoming a major world topic concerning the availability and sustainability of certain materials, and the extraction of such large quantities needed for the human habitat.

3.15. Building products

In the market place the term building products often refers to the ready-made particles/sections, made from various materials that are fitted in architectural hardware and decorative hardware parts of a building. The list of building products exclusively exclude the building materials, which are used to construct the building architecture and supporting fixtures like windows, doors, cabinets, etc. Building products do not make any part of a bajingo rather they support and make them working in a modular fashion.

It also can refer to items used to put such hardware together such as glues, caulking, paint, and anything else bought for the purpose of constructing a building.

COMPREHENSION

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4. Write a précis of the text.
5. Sum up the main points presented in the text. Write the plan of the text in the form of statements.
6. Develop your plan into summary.
7. Make your summary coherent by a sparing use of connectors.
8. Look through your summary. Find the least important sentences and delete them out the remaining ones to produce a well-written, clear and concise summary.
9. Prepare and deliver a 10-minute presentation about various types of building materials.

UNIT V
AUTOMATIVE ENGINEERING

Modern automotive engineering, along with aerospace engineering and marine engineering, is a branch of vehicle engineering, incorporating elements of mechanical, electrical, electronic, software and safety engineering as applied to the design, manufacture and operation of motorcycles, automobiles, buses and trucks and their respective engineering subsystems.

4.1. Product Engineering.

Some of the engineering attributes/disciplines that are of importance to the automotive engineer:

Safety Engineering: Safety Engineering is the assessment of various crash scenarios and their impact on the vehicle occupants. These are tested against very stringent governmental regulations. Some of these requirements include: Seat belt and air bag functionality, front and side impact testing, and resistance to rollover. Assessments are done with various methods and tools: Computer crash simulation (typically Finite element analysis), crash test dummies, partial system sled and full vehicle crashes.

Visualization of how a car deforms in an asymmetrical crash using finite element analysis.

Fuel Economy/Emissions: Fuel economy is the measured fuel efficiency of the vehicle in miles per gallon or liters per 100 km. Emissions testing the measurement of the vehicles emissions: hydrocarbons, nitrogen oxides (NO), carbon monoxide (CO), carbon dioxide (CO2), and evaporative emissions.

Vehicle Dynamics: Vehicle dynamics is the vehicle's response of the following attributes: ride, handling, steering, braking, and traction. Design of the chassis systems of suspension, steering, braking, structure (frame), wheels and tires, and traction control are highly leveraged by the Vehicle Dynamics engineer to deliver the Vehicle Dynamics qualities desired.

NVH Engineering (Noise, Vibration, and Harshness): NVH is the customer's feedback (both tactile (feel) and audible (hear)) from the vehicle. While sound can be interpreted as a rattle, squeal, or hoot; a tactile response can be seat vibration, or a buzz in the steering wheel. This feedback is generated by components either rubbing, vibrating or rotating. NVH response can be classified in various ways: power train NVH, road noise, wind noise, component noise, and squeak and rattle. Note, there are both good and bad NVH qualities. The NVH engineer works to either eliminate bad NVH, or change the ‘bad NVH’ to good (i.e. exhaust tones).

Performance: Performance is a measurable and testable value of a vehicles ability to perform in various conditions. Performance can be considered in a wide variety of tasks, but it's generally associated with how quickly a car can accelerate (i.e. 0-60 mph, 1/4 mile, trap speed, top speed, etc), how short and quickly a car can come to a complete stop from a set distance (i.e. 70-0 mph), how much g-force a car can generate without losing grip, recorded trap lap times, cornering speed, brake fade, etc. Performance can also reflect the amount of control in inclement weather (snow, ice, rain).

Shift Quality: Shift Quality is the driver’s perception of the vehicle to an automatic transmission shift event. This is influenced by the power train (engine, transmission), and the vehicle (driveline, suspension, engine and power train mounts, etc). Shift feel is both a tactile (feel) and audible (hear) response of the vehicle. Shift Quality is experienced as various events: Transmission shifts are felt as an upshift at acceleration (1-2), or a downshift maneuver in passing (4-2). Shift engagements of the vehicle are also evaluated, as in Park to Reverse, etc.

Durability/Corrosion engineering: Durability and Corrosion engineering is the evaluation testing of a vehicle for its useful life. This includes mileage accumulation, severe driving conditions, and corrosive salt baths.

Package/Ergonomics Engineering: Package Engineering is a discipline that designs/analyzes the occupant accommodations (seat roominess), ingress/egress to the vehicle, and the driver’s field of vision (gauges and windows). The Package Engineer is also responsible for other areas of the vehicle like the engine compartment, and the component to component placement. Ergonomics is the discipline that assesses the occupant's access to the steering wheel, pedals, and other driver/passenger controls.

Climate Control: Climate Control is the customer’s impression of the cabin environment and level of comfort related to the temperature and humidity. From the windshield defrosting, to the heating and cooling capacity, all vehicle seating positions are evaluated to a certain level of comfort.

Drivability: Drivability is the vehicle’s response to general driving conditions. Cold starts and stalls, RPM dips, idle response, launch hesitations and stumbles, and performance levels.

Cost: The cost of a vehicle program is typically split into the effect on the variable cost of the vehicle, and the up-front tooling and fixed costs associated with developing the vehicle. There are also costs associated with warranty reductions, and marketing.

Program timing: To some extent programs are timed with respect to the market, and also to the production schedules of the assembly plants. Any new part in the design must support the development and manufacturing schedule of the model.

Assembly Feasibility: It is easy to design a module that is hard to assemble, either resulting in damaged units, or poor tolerances. The skilled product development engineer works with the assembly/manufacturing engineers so that the resulting design is easy and cheap to make and assemble, as well as delivering appropriate functionality and appearance.

4.2. Development Engineer.

A development engineer is a job function within automotive engineering, in which the development engineer has the responsibility for coordinating delivery of the engineering attributes of a complete automobile (bus, car, truck, van, SUV, etc.) as dictated by the automobile manufacturer, governmental regulations and the customer who buys the product.

Much like the systems engineer, the development engineer is concerned with the interactions of all systems in the complete automobile. While there are multiple components and systems in an automobile that have to function as designed, they must also work in harmony with the complete automobile. As an example, the brake system's main function is to provide braking functionality to the automobile. Along with this, it must also provide an acceptable level of: pedal feel (spongy, stiff), brake system ‘noise’ (squeal, shudder, etc), and interaction with the ABS (anti-lock braking system)

Another aspect of the development engineer's job is a trade-off process required to deliver all the automobile attributes at a certain acceptable level. An example of this is the trade-off between engine performance and fuel economy. While some customers are looking for maximum power from their engine, the automobile is still required to deliver an acceptable level of fuel economy. From the engine's perspective, these are opposing requirements. Engine performance is looking for maximum displacement (bigger, more power), while fuel economy is looking for a smaller displacement engine (e.g.1.4L vs. 5.4L). The engine size, though is not the only contributing factor to fuel economy and automobile performance. Other attributes include: automobile weight, aerodynamic drag, transmission gearing, emission control devices, and tires.

The development engineer is also responsible for organizing automobile level testing, validation, and certification. Components and systems are designed and tested individually by the product engineer. The final evaluation though, has to be conducted at the automobile level to evaluate system to system interactions. As an example, the audio system (radio) needs to be evaluated at the automobile level. Interaction with other electronic components can cause interference. Heat dissipation of the system and ergonomic placement of the controls need to be evaluated. Sound quality in all seating positions needs to be provided at acceptable levels.

There are also other automotive engineers:

The aerodynamics engineers will often give guidance to the styling studio so that the shapes they design are aerodynamic, as well as attractive.

Body engineers will also let the studio know if it is feasible to make the panels for their designs.

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8. Look through your summary. Find the least important sentences and delete them out the remaining ones to produce a well-written, clear and concise summary.
9. Prepare and deliver a 10-minute presentation about automotive engineering.

UNIT VI
WATER RESOURCES

Water resources are sources of water that are useful or potentially useful. Uses of water include agricultural, industrial, household, recreational and environmental activities. Virtually all of these human uses require fresh water.

97% of the water on the Earth is salt water. Only three percent is fresh water; slightly over two thirds of this is frozen in glaciers and polar ice caps. The remaining unfrozen fresh water is found mainly as groundwater, with only a small fraction present above ground or in the air.

Fresh water is a renewable resource, yet the world's supply of clean, fresh water is steadily decreasing. Water demand already exceeds supply in many parts of the world and as the world population continues to rise, so too does the water demand. Awareness of the global importance of preserving water for ecosystem services has only recently emerged as, during the 20th century, more than half the world’s wetlands have been lost along with their valuable environmental services for Water Education. The framework for allocating water resources to water users (where such a framework exists) is known as water rights

5.1. Sources of fresh water

Surface water is water in a river, lake or fresh water wetland. Surface water is naturally replenished by precipitation and naturally lost through discharge to the oceans, evaporation, vapor transpiration and sub-surface seepage.

Although the only natural input to any surface water system is precipitation within its watershed, the total quantity of water in that system at any given time is also dependent on many other factors. These factors include storage capacity in lakes, wetlands and artificial reservoirs, the permeability of the soil beneath these storage bodies, the runoff characteristics of the land in the watershed, the timing of the precipitation and local evaporation rates. All of these factors also affect the proportions of water lost.

Human activities can have a large and sometimes devastating impact on these factors. Humans often increase storage capacity by constructing reservoirs and decrease it by draining wetlands. Humans often increase runoff quantities and velocities by paving areas and channelizing stream flow.

The total quantity of water available at any given time is an important consideration. Some human water users have an intermittent need for water. For example, many farms require large quantities of water in the spring, and no water at all in the winter. To supply such a farm with water, a surface water system may require a large storage capacity to collect water throughout the year and release it in a short period of time. Other users have a continuous need for water, such as a power plant that requires water for cooling. To supply such a power plant with water, a surface water system only needs enough storage capacity to fill in when average stream flow is below the power plant's need.

Nevertheless, over the long term the average rate of precipitation within a watershed is the upper bound for average consumption of natural surface water from that watershed.

Natural surface water can be augmented by importing surface water from another watershed through a canal or pipeline. It can also be artificially augmented from any of the other sources listed here; however, in practice the quantities are negligible. Humans can also cause surface water to be ‘lost’ (i.e. become unusable) through pollution.

Brazil is the country estimated to have the largest supply of fresh water in the world, followed by Russia and Canada.

5.2. Under river flow

Throughout the course of a river, the total volume of water transported downstream will often be a combination of the visible free water flow together with a substantial contribution flowing through sub-surface rocks and gravels that underlie the river and its floodplain called the hyporheic zone. For many rivers in large valleys, this unseen component of flow may greatly exceed the visible flow. The hyporheic zone often forms a dynamic interface between surface water and true ground-water receiving water from the ground water when aquifers are fully charged and contributing water to ground-water when ground waters are depleted. This is especially significant in karsts areas where pot-holes and underground rivers are common.

5.3. Ground water

Sub-surface water, or groundwater, is fresh water located in the pore space of soil and rocks. It is also water that is flowing within aquifers below the water table. Sometimes it is useful to make a distinction between sub-surface water that is closely associated with surface water and deep sub-surface water in an aquifer (sometimes called ‘fossil water’).

Sub-surface water can be thought of in the same terms as surface water: inputs, outputs and storage. The critical difference is that due to its slow rate of turnover, sub-surface water storage is generally much larger compared to inputs than it is for surface water. This difference makes it easy for humans to use sub-surface water unsustainably for a long time without severe consequences. Nevertheless, over the long term the average rate of seepage above a sub-surface water source is the upper bound for average consumption of water from that source.

The natural input to sub-surface water is seepage from surface water. The natural outputs from sub-surface water are springs and seepage to the oceans.

If the surface water source is also subject to substantial evaporation, a sub-surface water source may become saline. This situation can occur naturally under endorheic bodies of water, or artificially under irrigated farmland. In coastal areas, human use of a sub-surface water source may cause the direction of seepage to ocean to reverse which can also cause soil salinization. Humans can also cause sub-surface water to be ‘lost’ (i.e. become unusable) through pollution. Humans can increase the input to a sub-surface water source by building reservoirs or detention ponds.

5.4. Desalination

Desalination is an artificial process by which saline water (generally sea water) is converted to fresh water. The most common desalination processes are distillation and reverse osmosis. Desalination is currently expensive compared to most alternative sources of water, and only a very small fraction of total human use is satisfied by desalination. It is only economically practical for high-valued uses (such as household and industrial uses) in arid areas. The most extensive use is in the Persian Gulf.

5.4. Frozen water

Several schemes have been proposed to make use of icebergs as a water source, however to date this has only been done for novelty purposes. Glacier runoff is considered to be surface water.

The Himalayas, which are often called "The Roof of the World", contain some of the most extensive and rough high altitude areas on Earth as well as the greatest area of glaciers and permafrost outside of the poles. Ten of Asia’s largest rivers flow from there and more than a billion people’s livelihoods depend on them. To complicate matters, temperatures are rising more rapidly here than the global average. In Nepal the temperature has risen with 0.6 degree over the last decade, whereas the global warming has been around 0.7 over the last hundred years.

5.5. Uses of fresh water

Uses of fresh water can be categorized as consumptive and non-consumptive (sometimes called ‘renewable’). A use of water is consumptive if that water is not immediately available for another use. Losses to sub-surface seepage and evaporation are considered consumptive, as is water incorporated into a product (such as farm produce). Water that can be treated and returned as surface water, such as sewage, is generally considered non-consumptive if that water can be put to additional use. Water use in power generation and industry is generally described using an alternate terminology, focusing on separate measurements of withdrawal and consumption. Withdrawal describes the removal of water from the environment, while consumption describes the conversion of fresh water into some other form, such as atmospheric water vapor or contaminated waste water.

5.6. Agricultural water use

It is estimated that 69% of worldwide water use is for irrigation, with 15-35% of irrigation withdrawals being unsustainable.[5] It takes around 3,000 liters of water, converted from liquid to vapor, to produce enough food to satisfy one person's daily dietary need. This is a considerable amount, when compared to that required for drinking, which is between two and five liters. To produce food for the now over 7 billion people who inhabit the planet today requires the water that would fill a canal ten meters deep, 100 meters wide and 7.1 million kilometers long – that's enough to circle the globe 180 times.

Fifty years ago, the common perception was that water was an infinite resource. At this time, there was fewer than half the current number of people on the planet. People were not as wealthy as today, consumed fewer calories and ate less meat, so less water was needed to produce their food. They required a third of the volume of water we presently take from rivers. Today, the competition for water resources is much more intense. This is because there are now seven billion people on the planet, their consumption of water-thirsty meat and vegetables is rising, and there is increasing competition for water from industry, urbanization bio fuel crops, and water reliant food items. In future, even more water will be needed to produce food because the Earth's population is forecast to rise to 9 billion by 2050. An additional

2.5 or 3 billion people, choosing to eat fewer cereals and more meat and vegetables could add an additional five million kilometers to the virtual canal mentioned above.
An assessment of water management in agriculture was conducted in 2007 by the International Water Management Institute in Sri Lanka to see if the world had sufficient water to provide food for its growing population. It assessed the current availability of water for agriculture on a global scale and mapped out locations suffering from water scarcity. It found that a fifth of the world's people, more than 1.2 billion, live in areas of physical water scarcity, where there is not enough water to meet all demands. One third of the world’s population does not have access to clean drinking water, which is more than 2.3 billion people. A further 1.6 billion people live in areas experiencing economic water scarcity, where the lack of investment in water or insufficient human capacity makes it impossible for authorities to satisfy the demand for water. The report found that it would be possible to produce the food required in future, but that continuation of today's food production and environmental trends would lead to crises in many parts of the world. To avoid a global water crisis, farmers will have to strive to increase productivity to meet growing demands for food, while industry and cities find ways to use water more efficiently.
In some areas of the world irrigation is necessary to grow any crop at all, in other areas it permits more profitable crops to be grown or enhances crop yield. Various irrigation methods involve different trade-offs between crop yield, water consumption and capital cost of equipment and structures. Irrigation methods such as furrow and overhead sprinkler irrigation are usually less expensive but are also typically less efficient, because much of the water evaporates, runs off or drains below the root zone. Other irrigation methods considered to be more efficient include drip or trickle irrigation, surge irrigation, and some types of sprinkler systems where the sprinklers are operated near ground level. These types of systems, while more expensive, usually offer greater potential to minimize runoff, drainage and evaporation. Any system that is improperly managed can be wasteful all methods have the potential for high efficiencies under suitable conditions, appropriate irrigation timing and management. Some issues that are often insufficiently considered are saltinization of sub-surface water and contaminant accumulation leading to water quality declines.
As global populations grow, and as demand for food increases in a world with a fixed water supply, there are efforts under way to learn how to produce more food with less water, through improvements in irrigation[9] methods[10] and technologies, agricultural water management, crop types, and water monitoring. Aquaculture is a small but growing agricultural use of water. Freshwater commercial fisheries may also be considered as agricultural uses of water, but have generally been assigned a lower priority than irrigation (e.g. the Aral Sea and the Pyramid Lake).
5.7. Industrial water use
It is estimated that 22% of worldwide water use is industrial. Major industrial users

include hydroelectric dams, thermoelectric power plants, which use water for cooling, ore and oil refineries, which use water in chemical processes, and manufacturing plants, which use water as a solvent. Water withdrawal can be very high for certain industries, but consumption is generally much lower than that of agriculture.

Water is used in renewable power generation. Hydroelectric power derives energy from the force of water flowing downhill, driving a turbine connected to a generator. This hydroelectricity is a low-cost, non-polluting, renewable energy source. Significantly, hydroelectric power can also be used for load following unlike most renewable energy sources which are intermittent. Ultimately, the energy in a hydroelectric power plant is supplied by the sun. Heat from the sun evaporates water, which condenses as rain in higher altitudes and flows downhill. Pumped-storage hydroelectric plants also exist, which use grid electricity to pump water uphill when demand is low, and use the stored water to produce electricity when demand is high.

Hydroelectric power plants generally require the creation of a large artificial lake. Evaporation from this lake is higher than evaporation from a river due to the larger surface area exposed to the elements, resulting in much higher water consumption. The process of driving water through the turbine and tunnels or pipes also briefly removes this water from the natural environment, creating water withdrawal. The impact of this withdrawal on wildlife varies greatly depending on the design of the power plant.

Pressurized water is used in water blasting and water jet cutters. Also, very high pressure water guns are used for precise cutting. It works very well, is relatively safe, and is not harmful to the environment. It is also used in the cooling of machinery to prevent overheating, or prevent saw blades from overheating. This is generally a very small source of water consumption relative to other uses.

Water is also used in many large scale industrial processes, such as thermoelectric power production, oil refining and fertilizer production and other chemical plant use and natural gas extraction from shale rock. Discharge of untreated water from industrial uses is pollution. Pollution includes discharged solutes (chemical pollution) and increased water temperature (thermal pollution). Industry requires pure water for many applications and utilizes a variety of purification techniques both in water supply and discharge. Most of this pure water is generated on site, either from natural freshwater or from municipal grey water. Industrial consumption of water is generally much lower than withdrawal, due to laws requiring industrial grey water to be treated and returned to the environment. Thermoelectric power plants using cooling towers have high consumption, nearly equal to their withdrawal, as most of the withdrawn water is evaporated as part of the cooling process. The withdrawal, however, is lower than in once-through cooling systems.

5.8. Drinking water

It is estimated that 8% of worldwide water use is for household purposes. These include drinking water, bathing, cooking, sanitation, and gardening. Basic household water requirements have been estimated by Peter Gleick at around 50 liters per person per day, excluding water for gardens. Drinking water is water that is of sufficiently high quality so that it can be consumed or used without risk of immediate or long term harm. Such water is commonly called potable water. In most developed countries, the water supplied to households, commerce and industry is all of drinking water standard even though only a very small proportion is actually consumed or used in food preparation.

5.9. Recreation water use

Recreational water use is usually a very small but growing percentage of total water use. Recreational water use is mostly tied to reservoirs. If a reservoir is kept fuller than it would otherwise be for recreation, then the water retained could be categorized as recreational usage. Release of water from a few reservoirs is also timed to enhance whitewater boating, which also could be considered a recreational usage. Other examples are anglers, water skiers, nature enthusiasts and swimmers.

Recreational usage is usually non-consumptive. Golf courses are often targeted as using excessive amounts of water, especially in drier regions. It is, however, unclear whether recreational irrigation (which would include private gardens) has a noticeable effect on water resources. This is largely due to the unavailability of reliable data. Additionally, many golf courses utilize either primarily or exclusively treated effluent water, which has little impact on potable water availability.

Some governments, including the Californian Government, have labeled golf course usage as agricultural in order to deflect environmentalists' charges of wasting water. However, using the above figures as a basis, the actual statistical effect of this reassignment is close to zero. In Arizona, an organized lobby has been established in the form of the Golf Industry Association, a group focused on educating the public on how golf impacts the environment.

Recreational usage may reduce the availability of water for other users at specific times and places. For example, water retained in a reservoir to allow boating in the late summer is not available to farmers during the spring planting season. Water released for whitewater rafting may not be available for hydroelectric generation during the time of peak electrical demand.

5.10. Environmental water use

Explicit environmental water use is also a very small but growing percentage of total water use. Environmental water may include water stored in impoundments and released for environmental purposes (held environmental water), but more often is water retained in waterways through regulatory limits of abstraction. Environmental water usage includes watering of natural or artificial wetlands, artificial lakes intended to create wildlife habitat, fish ladders, and water releases from reservoirs timed to help fish spawn, or to restore more natural flow regimes

Like recreational usage, environmental usage is non-consumptive but may reduce the availability of water for other users at specific times and places. For example, water release from a reservoir to help fish spawn may not be available to farms upstream, and water retained in a river to maintain waterway health would not be available to water abstractors downstream.

5.11. Water crisis and water stress.

The concept of water stress is relatively simple. According to the World Business Council for Sustainable Development, it applies to situations where there is not enough water for all uses, whether agricultural, industrial or domestic. Defining thresholds for stress in terms of available water per capita is more complex, however, entailing assumptions about water use and its efficiency. Nevertheless, it has been proposed that when annual per capita renewable freshwater availability is less than 1,700 cubic meters, countries begin to experience periodic or regular water stress. Below 1,000 cubic meters, water scarcity begins to hamper economic development and human health and well-being.

In 2000, the world population was 6.2 billion. The UN estimates that by 2050 there will be an additional 3.5 billion people with most of the growth in developing countries that already suffer water stress. Thus, water demand will increase unless there are corresponding increases in water conservation and recycling of this vital resource. In building on the data presented here by the UN, the World Bank goes on to explain that access to water for producing food will be one of the main challenges in the decades to come. Access to water will need to be balanced with the importance of managing water itself in a sustainable way while taking into account the impact of climate change, and other environmental and social variables.

Business activity ranging from industrialization to services such as tourism and entertainment continues to expand rapidly. This expansion requires increased water services including both supply and sanitation, which can lead to more pressure on water resources and natural ecosystems.

The trend towards urbanization is accelerating. Small private wells and septic tanks that work well in low-density communities are not feasible within high-density urban areas. Urbanization requires significant investment in water infrastructure in order to deliver water to individuals and to process the concentrations of wastewater - both from individuals and from business. These polluted and contaminated waters must be treated or they pose unacceptable public health risks.

In 60% of European cities with more than 100,000 people, groundwater is being used at a faster rate than it can be replenished. Even if some water remains available, it costs more and more to capture it.

Climate change could have significant impacts on water resources around the world because of the close connections between the climate and hydrological cycle. Rising temperatures will increase evaporation and lead to increases in precipitation, though there will be regional variations in rainfall. Overall, the global supply of freshwater will increase. Both droughts and floods may become more frequent in different regions at different times, and dramatic changes in snowfall and snow melt are expected in mountainous areas. Higher temperatures will also affect water quality in ways that are not well understood. Possible impacts include increased eutrophication. Climate change could also mean an increase in demand for farm irrigation, garden sprinklers, and perhaps even swimming pools. There is now ample evidence that increased hydrologic variability and change in climate has and will continue have a profound impact on the water sector through the hydrologic cycle, water availability, water demand, and water allocation at the global, regional, basin, and local levels.

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Due to the expanding human population, competition for water is growing such that many of the world major aquifers are becoming depleted. This is due both for direct human consumption as well as agricultural irrigation by groundwater. Millions of pumps of all sizes are currently extracting groundwater throughout the world. Irrigation in dry areas such as northern China and India is supplied by groundwater, and is being extracted at an unsustainable rate. Cities that have experienced aquifer drops between 10 to 50 meters include Mexico City, Bangkok, Manila, Beijing, Madras and Shanghai.

5.12. Pollution and water protection

Water pollution is one of the main concerns of the world today. The governments of numerous countries have striven to find solutions to reduce this problem. Many pollutants threaten water supplies, but the most widespread, especially in developing countries, is the discharge of raw sewage into natural waters; this method of sewage disposal is the most common method in underdeveloped countries, but also is prevalent in quasi-developed countries such as China, India and Iran. Sewage, sludge, garbage, and even toxic pollutants are all dumped into the water. Even if sewage is treated, problems still arise. Treated sewage forms sludge, which may be placed in landfills, spread out on land, incinerated or dumped at sea. In addition to sewage, nonpoint source pollution such as agricultural runoff is a significant source of pollution in some parts of the world, along with urban storm water runoff and chemical wastes dumped by industries and governments.

Over the past 25 years, politicians, academics and journalists have frequently predicted that disputes over water would be a source of future wars. Commonly cited quotes include: that of former Egyptian Foreign Minister and former Secretary-General of the United Nations Boutrous Ghali, who forecast, “The next war in the Middle East will be fought over water, not politics”; his successor at the UN, Kofi Annan, who in 2001 said, “Fierce competition for fresh water may well become a source of conflict and wars in the future,” and the former Vice President of the World Bank, Ismail Serageldin, who said the wars of the next century will be over water unless significant changes in governance occurred. The water wars hypothesis had its roots in earlier research carried out on a small number of trans boundary rivers such as the Indus, Jordan and Nile. These particular rivers became the focus because they had experienced water-related disputes. Specific events cited as evidence include Israel’s bombing of Syria’s attempts to divert the

Jordan's headwaters, and military threats by Egypt against any country building dams in the upstream waters of the Nile. However, while some links made between conflict and water were valid, they did not necessarily represent the norm.

The only known example of an actual inter-state conflict over water took place between 2500 and 2350 BC between the Sumerian states of Lagash and Umma. Water stress has most often led to conflicts at local and regional levels. Tensions arise most often within national borders, in the downstream areas of distressed river basins. Areas such as the lower regions of China's Yellow River or the Chao Phraya River in Thailand, for example, have already been experiencing water stress for several years. Water stress can also exacerbate conflicts and political tensions which are not directly caused by water. Gradual reductions over time in the quality and/or quantity of fresh water can add to the instability of a region by depleting the health of a population, obstructing economic development, and exacerbating larger conflicts.

Water resources that span international boundaries are more likely to be a source of collaboration and cooperation, than war. Scientists working at the International Water Management Institute, in partnership with Aaron Wolf at Oregon State University, have been investigating the evidence behind water war predictions. Their findings show that, while it is true there has been conflict related to water in a handful of international basins, in the rest of the world's approximately 300 shared basins the record has been largely positive. This is exemplified by the hundreds of treaties in place guiding equitable water use between nations sharing water resources. The institutions created by these agreements can, in fact, be one of the most important factors in ensuring cooperation rather than conflict.

The International Union for the Conservation of Nature (IUCN) published the book Share: Managing water across boundaries. One chapter covers the functions of trans-boundary institutions and how they can be designed to promote cooperation, overcome initial disputes and find ways of coping with the uncertainty created by climate change. It also covers how the effectiveness of such institutions can be monitored.

5.13. World water supply and distribution

Food and water are two basic human needs. However, global coverage figures from 2002 indicate that, of every 10 people: roughly 5 have a connection to a piped water supply at home (in their dwelling, plot or yard); 3 make use of some other sort of improved water supply, such as a protected well or public standpipe; 2 are unserved. In addition, 4 out of every 10 people live without improved sanitation.

At Earth Summit 2002 governments approved a Plan of Action to:

Halve by 2015 the proportion of people unable to reach or afford safe drinking water. The Global Water Supply and Sanitation Assessment 2000 Report (GWSSAR) defines 'Reasonable access' to water as at least 20 liters per person per day from a source within one kilometer of the user's home.

Halve the proportion of people without access to basic sanitation. The GWSSR defines 'Basic sanitation' as private or shared but not public disposal systems that separate waste from human contact.

In 2025, water shortages will be more prevalent among poorer countries where resources are limited and population growth is rapid, such as the Middle East, Africa, and parts of Asia. By 2025, large urban and perurban areas will require new infrastructure to provide safe water and adequate sanitation. This suggests growing conflicts with agricultural water users, who currently consume the majority of the water used by humans.

Generally speaking the more developed countries of North America, Europe and Russia will not see a serious threat to water supply by the year 2025 not only because of their relative wealth, but more importantly their populations will be better aligned with available water resources. North Africa, the Middle East, South Africa and northern China will face very severe water shortages due to physical scarcity and a condition of overpopulation relative to their carrying capacity with respect to water supply. Most of South America, Sub-Saharan Africa, Southern China and India will face water supply shortages by 2025; for these latter regions the causes of scarcity will be economic constraints to developing safe drinking water, as well as excessive population growth.

1.6 billion people have gained access to a safe water source since 1990. The proportion of people in developing countries with access to safe water is calculated to have improved from 30 percent in 1970 to 71 percent in 1990, 79 percent in 2000 and 84 percent in 2004. This trend is projected to continue.

Water supply and sanitation require a huge amount of capital investment in infrastructure such as pipe networks, pumping stations and water treatment works. It is estimated that Organization for Economic Cooperation and Development (OECD) nations need to invest at least USD 200 billion per year to replace aging water infrastructure to guarantee supply, reduce leakage rates and protect water quality.

International attention has focused upon the needs of the developing countries. To meet the Millennium Development Goals targets of halving the proportion of the population lacking access to safe drinking water and basic sanitation by 2015, current annual investment on the order of USD 10 to USD 15 billion would need to be roughly doubled. This does not include investments required for the maintenance of existing infrastructure.

Once infrastructure is in place, operating water supply and sanitation systems entails significant ongoing costs to cover personnel, energy, chemicals, maintenance and other expenses. The sources of money to meet these capital and operational costs are essentially either user fees, public funds or some combination of the two.

But this is where the economics of water management start to become extremely complex as they intersect with social and broader economic policy. Such policy questions are beyond the scope of this article, which has concentrated on basic information about water availability and water use. They are, nevertheless, highly relevant to understanding how critical water issues will affect business and industry in terms of both risks and opportunities.

The World Business Council for Sustainable Development in its H2OScenarios

engaged in a scenario building process to:
Clarify and enhance understanding by business of the key issues and drivers of change related to water.
Promote mutual understanding between the business community and non-business stakeholders on water management issues.
Support effective business action as part of the solution to sustainable water management.
It concludes that:
Business cannot survive in a society that thirsts.
One does not have to be in the water business to have a water crisis.
Business is part of the solution, and its potential is driven by its engagement.
Growing water issues and complexity will drive up costs.

COMPREHENSION

1. Read the text; as your read, note the topic dealt with in each paragraph, underline the topic sentence, key words, and important facts as your go along.
2. Analyze how the facts are connected, how the topic of a paragraph is connected with that of a preceding paragraph.
3. Make a list of all points you are going to mention in your précis .Write them down using the necessary key terms. These notes must contain all the essential facts.
4. Write a précis of the text.
5. Sum up the main points presented in the text. Write the plan of the text in the form of statements.
6. Develop your plan into summary.
7. Make your summary coherent by a sparing use of connectors.
8. Look through your summary. Find the least important sentences and delete them out the remaining ones to produce a well-written, clear and concise summary.
9. Prepare and deliver a 10-minute presentation about water resources.

UNIT VII
WATER SUPPLY

Water supply is the provision of water by public utilities, commercial organizations, community endeavours or by individuals, usually via a system of pumps and pipes. Irrigation is covered separately.
In 2010 about 84% of the global population (6.74 billion people) had access to piped water supply through house connections or to an improved water source through other means than house, including standpipes, "water kiosks", protected springs and protected wells. However, about 14% (884 million people) did not have access to an improved water source and had to use unprotected wells or springs, canals, lakes or rivers for their water needs.
A clean water supply, especially so with regard to sewage, is the single most

important determinant of public health. Destruction of water supply and/or sewage disposal infrastructure after major catastrophes (earthquakes, floods, war, etc.) poses the immediate threat of severe epidemics of waterborne diseases, several of which can be life-threatening.

6.1. Technical overview

Water supply systems get water from a variety of locations, including groundwater (aquifers), surface water (lakes and rivers), conservation and the sea through desalination. The water is then, in most cases, purified, disinfected through chlorination and sometimes fluoridated. Treated water then either flows by gravity or is pumped to reservoirs, which can be elevated such as water towers or on the ground (for indicators related to the efficiency of drinking water distribution see non-revenue water). Once water is used, wastewater is typically discharged in a sewer system and treated in a wastewater treatment plant before being discharged into a river, lake or the sea or reused for landscaping, irrigation or industrial use

6.2. Service quality

Many of the 3.5 billion people having access to piped water receive a poor or very poor quality of service, especially in developing countries where about 80% of the world population lives. Water supply service quality has many dimensions: continuity; water quality; pressure; and the degree of responsiveness of service providers to customer complaints

Continuity of water supply is taken for granted in most developed countries, but is a severe problem in many developing countries, where sometimes water is only provided for a few hours every day or a few days a week. It is estimated that about half of the population of developing countries receives water on an intermittent basis.

6.3. Water quality and water pressure

Drinking water quality has a micro-biological and a physic-chemical dimension. There are thousands of parameters of water quality. In public water supply systems water should, at a minimum, be disinfected - most commonly through the use of chlorination or the use of ultra violet light - or it may need to undergo treatment, especially in the case of surface water. For more details, please see the separate entries on water quality, water treatment and drinking water.

Water pressures vary in different locations of a distribution system. Water mains below the street may operate at higher pressures, with a pressure reducer located at each point where the water enters a building or a house. In poorly managed systems, water pressure can be so low as to result only in a trickle of water or so high that it leads to damage to plumbing fixtures and waste of water. Pressure in an urban water system is typically maintained either by a pressurized water tank serving an urban area, by pumping the water up into a tower and relying on gravity to maintain a constant pressure in the system or solely by pumps at the water treatment plant and repeater pumping stations.

Typical UK pressures are 4–5 bars for an urban supply. However, some people can get over eight bars or below one bar. A single iron main pipe may cross a deep valley, it will have the same nominal pressure and, however, each consumer will get a bit more or less because of the hydrostatic pressure (about 1 bar/10 m height). So people at the bottom of a 100-foot (30 m) hill will get about 3 bars more than those at the top.

The effective pressure also varies because of the supply resistance even for the same static pressure. An urban consumer may have 5 meters of ½-inch lead pipe running from the iron main, so the kitchen tap flow will be fairly unrestricted, so high flow. A rural consumer may have a kilometer of rusted and limed ¾ iron pipe, so their kitchen tap flow will be small.

For this reason the UK domestic water system has traditionally (prior to 1989) employed a 'cistern feed' system, where the incoming supply is connected to the kitchen sink and also a header/storage tank in the attic. Water can dribble into this tank through a ½ lead pipe, plus ball valve, and then supply the house on 22 or 28 mm pipes. Gravity water has a small pressure (say ¼ bar in the bathroom) but needs wide pipes allow higher flows. This is fine for baths and toilets but is frequently inadequate for showers. People install shower booster pumps to increase the pressure. For this reason urban houses are increasingly using mains pressure boilers (combies) which take a long time to fill a bath but suit the high back pressure of a shower.

6.4. Comparing the performance of water and sanitation service providers

Comparing the performance of water and sanitation service providers (utilities) is needed, because the sector offers limited scope for direct competition (natural monopoly). Firms operating in competitive markets are under constant pressure to outperform each other. Water utilities are often sheltered from this pressure, and it frequently shows: some utilities are on a sustained improvement track, but many others keep falling further behind best practice. Benchmarking the performance of utilities allows simulating competition, establishing realistic targets for improvement and creating pressure to catch up with better utilities. Information on benchmarks for water and sanitation utilities is provided by the International Benchmarking Network for Water and Sanitation Utilities.

A great variety of institutions have responsibilities in water supply. A basic distinction is between institutions responsible for policy and regulation on the one hand; and institutions in charge of providing services on the other hand.

6.5. Policy and regulation

Water supply policies and regulation are usually defined by one or several Ministries, in consultation with the legislative branch. In the United States the United States Environmental Protection Agency, whose administrator reports directly to the President, is responsible for water and sanitation policy and standard setting within the executive branch. In other countries responsibility for sector policy is entrusted to a Ministry of Environment (such as in Mexico and Colombia), to a Ministry of Health (such as in Panama, Honduras and Uruguay), a Ministry of Public Works (such as in Ecuador and Haiti), a Ministry of Economy (such as in German states) or a Ministry of Energy (such as in Iran). A few countries, such as Jordan and Bolivia, even have a Ministry of Water. Often several Ministries share responsibilities for water supply. In the European Union, important policy functions have been entrusted to the supranational level. Policy and regulatory functions include the setting of tariff rules and the approval of tariff increases; setting, monitoring and enforcing norms for quality of service and environmental protection; benchmarking the performance of service providers; and reforms in the structure of institutions responsible for service provision. The distinction between policy functions and regulatory functions is not always clear-cut. In some countries they are both entrusted to Ministries, but in others regulatory functions are entrusted to agencies that are separate from Ministries.

6.6. Regulatory agencies

Dozens of countries around the world have established regulatory agencies for infrastructure services, including often water supply and sanitation, in order to better protect consumers and to improve efficiency. Regulatory agencies can be entrusted with a variety of responsibilities, including in particular the approval of tariff increases and the management of sector information systems, including benchmarking systems. Sometimes they also have a mandate to settle complaints by consumers that have not been dealt with satisfactorily by service providers. These specialized entities are expected to be more competent and objective in regulating service providers than departments of government Ministries. Regulatory agencies are supposed to be autonomous from the executive branch of government, but in many countries have often not been able to exercise a great degree of autonomy. In the United States regulatory agencies for utilities have existed for almost a century at the level of states, and in Canada at the level of provinces. In both countries they cover several infrastructure sectors. In many US states they are called Public Utility Commissions. For England and Wales, a regulatory agency for water (OFWAT) was created as part of the privatization of the water industry in 1989. In many developing countries, water regulatory agencies were created during the 1990s in parallel with efforts at increasing private sector participation.

Many countries do not have regulatory agencies for water. In these countries service providers are regulated directly by local government, or the national government. This is, for example, the case in the countries of continental Europe, in China and India.

6.7. Service provision

Water supply service providers, which are often utilities, differ from each other in terms of their geographical coverage relative to administrative boundaries; their sectored coverage; their ownership structure; and their governance arrangements.

Many water utilities provide services in a single city, town or municipality. However, in many countries municipalities have associated in regional or inter-municipal or multi-jurisdictional utilities to benefit from economies of scale. In the United States these can take the form of special-purpose districts which may have independent taxing authority. An example of a multi-jurisdictional water utility in the United States is WASA, a utility serving Washington, DC and various localities in the state of Maryland. Multi-jurisdictional utilities are also common in Germany, where they are known as ‘Zweckverbaende’, in France and in Italy.

In some federal countries there are water service providers covering most or all cities and towns in an entire state, such as in all states of Brazil and some states in Mexico (see Water supply and sanitation in Mexico). In England and Wales, water supply and sewerage is supplied almost entirely through ten regional companies. Some smaller countries, especially developed countries, have established service providers that cover the entire country or at least most of its cities and major towns. Such national service providers are especially prevalent in West Africa and Central America, but also exist, for example, in Tunisia, Jordan and Uruguay (see also water supply and sanitation in Uruguay). In rural areas, where about half the world population lives, water services are often not provided by utilities, but by community-based organizations which usually cover one or sometimes several villages.

6.8. Sector coverage

Some water utilities provide only water supply services, while sewerage is under the responsibility of a different entity. This is for example the case in Tunisia. However, in most cases water utilities also provide sewer and wastewater treatment services. In some cities or countries utilities also distribute electricity. In a few cases such multi-utilities also collect solid waste and provide local telephone services. An example of such an integrated utility can be found in the Colombian city of Medellín. Utilities that provide water, sanitation and electricity can be found in Frankfurt, Germany (Mainova), in Casablanca, Morocco and in Gabon in West Africa. Multi-utilities provide certain benefits such as common billing and the option to cross-subsidize water services with revenues from electricity sales, if permitted by law.

6.9. Ownership and governance arrangements

Water supply providers can be either public private mixed or cooperative. Most urban water supply services around the world are provided by public entities. As Willem-Alexander, Prince of Orange (2002) stated, "The water crisis that is affecting so many people is mainly a crisis of governance — not of water scarcity." The introduction of cost-reflective tariffs together with cross-subsidization between richer and poorer consumers is an essential governance reform in order to reduce the high levels of Unaccounted or Water (UAW) and to provide the finance needed to extend the network to those poorest households who remain unconnected. Partnership arrangements between the public and private sector can play an important role in order to achieve this objective

6.10. Private sector participation

An estimated 10 percent of urban water supply is provided by private or mixed public-private companies, usually under concessions, leases or management contracts. Under these arrangements the public entity that is legally responsible for service provision delegates certain or all aspects of service provision to the private service provider for a period typically ranging from 4 to 30 years. The public entity continues to own the assets. These arrangements are common in France and in Spain. Only in few parts of the world water supply systems have been completely sold to the private sector (privatization), such as in England and Wales as well as in Chile. The largest private water companies in the world are Suez and Veolia Environment from France; Aqua de Barcelona from Spain; and Thames Water from the UK, all of which are engaged internationally.

6.11. Public water service provision

90% of urban water supply and sanitation services are currently in the public sector. They are owned by the state or local authorities, or also by collectives or cooperatives. They run without an aim for profit but are based on the ethos of providing a common good considered to be of public interest. In most middle and low-income countries, these publicly-owned and managed water providers can be inefficient as a result of political interference, leading to over-staffing and low labor productivity. Ironically, the main losers from this institutional arrangement are the urban poor in these countries. Because they are not connected to the network, they end up paying far more per liter of water than do more well-off households connected to the network who benefit from the implicit subsidies that they receive from loss-making utilities. We are still so far from achieving universal access to clean water and sanitation shows that public water authorities, in their current state, are not working well enough. Yet some are being very successful and are modeling the best forms of public management. As Ryutaro Hashimoto, former Japanese Prime Minister, notes: ‘Public water services currently provide more than 90 per cent of water supply in the world. Modest improvement in public water operators will have immense impact on global provision of services.’

6.12. Governance arrangements

Governance arrangements for both public and private utilities can take many forms. Governance arrangements define the relationship between the service provider, its owners, its customers and regulatory entities. They determine the financial autonomy of the service provider and thus its ability to maintain its assets, expand services, attract and retain qualified staff, and ultimately to provide high-quality services. Key aspects of governance arrangements are the extent to which the entity in charge of providing services is insulated from arbitrary political intervention; and whether there is an explicit mandate and political will to allow the service provider to recover all or at least most of its costs through tariffs and retain these revenues. If water supply is the responsibility of a department that is integrated in the administration of a city, town or municipality, there is a risk that tariff revenues are diverted for other purposes. In some cases, there is also a risk that staff are appointed mainly on political grounds rather than based on their professional credentials.

6.13. Tariffs

Almost all service providers in the world charge tariffs to recover part of their costs. According to estimates by the World Bank the average (mean) global water tariff is US$ 0.53 per cubic meter. In developed countries the average tariff is US$ 1.04, while it is only U$ 0.11 in the poorest developing countries. The lowest tariffs in developing countries are found in South Asia (mean of US$ 0.09/m3), while the highest are found in Latin America (US$ 0.41/m3) Data for 132 cities were assessed. The tariff is estimate for a consumption level of 15 cubic meters per month. Few utilities do recover all their costs. According to the same World Bank study only 30% of utilities globally, and only 50% of utilities in developed countries generate sufficient revenue to cover operation, maintenance and partial capital costs.

According to another study undertaken in 2006 by NUS Consulting, the average water and sewerage tariff in 14 mainly OECD countries excluding VAT varied between US$ 0.66 per cubic meter in the United States and the equivalent of US$ 2.25 per cubic meter in Denmark. However, water consumption is much higher in the US than in Europe. Therefore, residential water bills may be very similar, even if the tariff per unit of consumption tends to be higher in Europe than in the US.

A typical family on the US East Coast paid between US$30 and US$70 per month for water and sewer services in 2005.

In developing countries, tariffs are usually much further from covering costs. Residential water bills for a typical consumption of 15 cubic meters per month vary between less than US$ 1 and US$ 12 per month.

Water and sanitation tariffs, which are almost always billed together, can take many different forms. Where meters are installed, tariffs are typically volumetric (per usage), sometimes combined with a small monthly fixed charge. In the absence of meters, flat or fixed rates - which are independent of actual consumption - are being charged. In developed countries, tariffs are usually the same for different categories of users and for different levels of consumption.

In developing countries, the situation is often characterized by cross-subsidies with the intent to make water more affordable for residential low-volume users that are assumed to be poor. For example, industrial and commercial users are often charged higher tariffs than public or residential users. Also, metered users are often charged higher tariffs for higher levels of consumption (increasing-block tariffs). However, cross-subsidies between residential users do not always reach their objective. Given the overall low level of water tariffs in developing countries even at higher levels of consumption, most consumption subsidies benefit the wealthier segments of society. Also, high industrial and commercial tariffs can provide an incentive for these users to supply water from other sources than the utility (own wells, water tankers) and thus actually erode the utility's revenue base.

6.14. Water metering and water meter

Metering of water supply is usually motivated by one or several of four objectives: First, it provides an incentive to conserve water which protects water resources (environmental objective). Second, it can postpone costly system expansion and saves energy and chemical costs (economic objective). Third, it allows a utility to better locate distribution losses (technical objective). Fourth, it allows to charge for water based on use, which is perceived by many as the fairest way to allocate the costs of water supply to users. Metering is considered good practice in water supply and is widespread in developed countries, except for the United Kingdom. In developing countries it is estimated that half of all urban water supply systems are metered and the tendency is increasing.

Water meters are read by one of several methods:

a water customer writes down the meter reading and mails in a postcard with this info to the water department;
a water customer writes down the meter reading and uses a phone dial-in system to transfer this info to the water department;
a water customer logs in to the website of the water supply company, enters the address, meter ID and meter readings
a meter reader comes to the premise and enters the meter reading into a handheld computer;
meter reading is echoed on a display unit mounted to the outside of the premise, where a meter reader records them;
a small radio is hooked up to the meter to automatically transmit readings to corresponding receivers in handheld computers, utility vehicles or distributed collectors;
a small computer is hooked up to the meter that can either dial out or receive automated phone calls that give the reading to a central computer system.
Most cities are increasingly installing Automatic Meter Reading (AMR) systems to prevent fraud, to lower ever-increasing labor and liability costs and to improve customer service and satisfaction.

6.15. Costs and financing

The cost of supplying water consists to a very large extent of fixed costs (capital costs and personnel costs) and only to a small extent of variable costs that depend on the amount of water consumed (mainly energy and chemicals). The full cost of supplying water in urban areas in developed countries is about US$1–2 per cubic meter depending on local costs and local water consumption levels. The cost of sanitation (sewerage and wastewater treatment) is another US$1–2 per cubic meter. These costs are somewhat lower in developing countries. Throughout the world, only part of these costs is usually billed to consumers, the remainder being financed through direct or indirect subsidies from local, regional or national governments.
Besides subsidies water supply investments are financed through internally generated revenues as well as through debt. Debt financing can take the form of credits from commercial Banks, credits from international financial institutions such as the World Bank and regional development banks (in the case of developing countries), and bonds (in the case of some developed countries and some upper middle-income countries).

6.16 History of water supply

Throughout history people have devised systems to make getting and using water more convenient. Early Rome had indoor plumbing, meaning a system of aqueducts and pipes that terminated in homes and at public wells and fountains for people to use. London water supply infrastructure developed over many centuries from early mediaeval conduits, through major 19th century treatment works built in response to cholera threats, to modern large scale reservoirs.
Water towers appeared around the late 19th century, as building height rose, and steam, electric and diesel-powered water pumps became available. As skyscrapers

appeared, they needed rooftop water towers.
The technique of purification of drinking water by use of compressed liquefied chlorine gas was developed in 1910 by U.S. Army Major (later Brig. Gen.) Carl Rogers Darnall (1867–1941), Professor of Chemistry at the Army Medical School. Shortly thereafter, Major (later Col.) William J. Lyster (1869–1947) of the Army Medical Department used a solution of calcium hypochlorite in a linen bag to treat water. For many decades, Lyster's method remained the standard for U.S. ground forces in the field and in camps, implemented in the form of the familiar Lyster Bag (also spelled Lister Bag). Darnall's work became the basis for present day systems of municipal water 'purification'.
Desalination appeared during the late 20th century, and is still limited to a few areas.
During the beginning of the 21st Century, especially in areas of urban and suburban population centers, traditional centralized infrastructure have not been able to supply sufficient quantities of water to keep up with growing demand. Among several options that have been managed are the extensive use of desalination technology, this is especially prevalent in coastal areas and in "dry" countries like Australia. Decentralization of water infrastructure has grown extensively as a viable solution including Rainwater harvesting and Stormwater harvesting where policies are eventually tending towards a more rational use and sourcing of water incorporation concepts such as "Fit for Purpose". This section requires expansion.
6.17. Standardization
International standards for water supply system are covered by International Classification of Standards (ICS) 91.140.60.
Outbreaks of diseases due to contaminated water supply:
In 1854 a cholera outbreak in London's Soho district was identified by Dr. John Snow as originating from contaminated water from the Broad street pump. This can be regarded as a founding event of the science of epidemiology.
In 1980 a hepatitis A surge due to the consumption of water from a feces-contaminated well, in Pennsylvania.
In 1987 a cryptosporidiosis outbreak is caused by the public water supply of which the filtration was contaminated, in western Georgia.
Fluoride intoxication in a long-term hem dialysis unit of university hospital due to the failure of a water deionization system.
In 1988 many people were poisoned in Camelford, when a worker put 20 tonnes of aluminum sulphate in the wrong tank..
In 1993 a fluoride poisoning outbreak resulting from overfeeding of fluoride in the Mississippi.
In 1993 Milwaukee Cryptosporidium outbreak.
An outbreak of typhoid fever in northern Israel which was associated with the contaminated municipal water supply.
In 1997 369 cases of cryptosporidiosis occurred caused by a contaminated fountain in the Minnesota zoo. Most of the sufferers were children.

In 1998 a non-chlorinated municipal water supply was blamed for a campylobacteriosis outbreak in northern Finland.

In 2000 a gastroenteritis outbreak that was brought by a non-chlorinated community water supply, in southern Finland.

In 2000 an E. coli outbreak occurred in Walkerton Ontario Canada. Seven people died from drinking contaminated water. Hundreds suffered from the symptoms of the disease not knowing if they too would die.

In 2004 contamination of the community water supply, serving the Bergen city centre of Norway, was later reported after the outbreak of waterborne giardiasis]

In 2007 contaminated drinking water was pinpointed which had led to the outbreak of gastroenteritis with multiple etiologies in Denmark.

6.18 Water supply network

A water supply system or water supply network is a system of engineered hydrologic and hydraulic components which provide water supply. A water supply system typically includes:

A drainage basin (see water purification - sources of drinking water);

A raw (untreated) water collection point (above or below ground) where the water accumulates, such as a lake, a river, or groundwater from an underground aquifer. Untreated drinking water (usually water being transferred to the water purification facilities) may be transferred using uncovered ground-level aqueducts, covered tunnels or underground water pipes.

Water purification facilities. Treated water is transferred using water pipes (usually underground).

Water storage facilities such as reservoirs, water tanks, or watertowers. Smaller water systems may store the water in cisterns or pressure vessels. (Tall buildings may also need to store water locally in pressure vessels in order for the water to reach the upper floors.)

Additional water pressurizing components such as pumping stations may need to be situated at the outlet of underground or above ground reservoirs or cisterns (if gravity flow is impractical)

A pipe network for distribution of water to the consumers (which may be private houses or industrial, commercial or institution establishments) and other usage points (such as fire hydrants)

Connections to the sewers (underground pipes, or aboveground ditches in some developing countries) are generally found downstream of the water consumers, but the sewer system is considered to be a separate system, rather than part of the water supply system.

6.19 Water abstraction and raw water transfer

Raw water (untreated) is collected from a surface water source (such as an intake on a lake or a river) or from a groundwater source (such as a water well drawing from an underground aquifer) within the watershed that provides the water resource.

Shallow dams and reservoirs are susceptible to outbreaks of toxic algae, especially if the water is warmed by a hot sun. The bacteria grow from stormwater runoff carrying fertilizer into the river where it acts as a nutrient for the algae. Such outbreaks render the water unfit for human consumption.

The raw water is transferred to the water purification facilities using uncovered aqueducts, covered tunnels or underground water pipes.

6.20 Water treatment

Virtually all large systems must treat the water; a fact that is tightly regulated by global, state and federal agencies, such as the World Health Organization (WHO) or the United States Environmental Protection Agency (EPA). Water treatment must occur before the product reaches the consumer and afterwards (when it is discharged again). Water purification usually occurs close to the final delivery points to reduce pumping costs and the chances of the water becoming contaminated after treatment.

Traditional surface water treatment plants generally consist of three steps: clarification, filtration and disinfection. Clarification refers to the separation of particles (dirt, organic matter, etc.) from the water stream. Chemical addition (i.e. alum, ferric chloride) destabilizes the particle charges and prepares them for clarification either by settling or floating out of the water stream. Sand, anthracite or activated carbon filters refine the water stream, removing smaller particulate matter. While other methods of disinfection exist, the preferred method is via chlorine addition. Chlorine effectively kills bacteria and most viruses and maintains a residual to protect the water supply through the supply network.

6.21. Water distribution network

Most (treated) water distribution happens through underground pipes. Pressurizing the water is required between the small water reserve and the end-user.

The product, delivered to the point of consumption, is called fresh water if it receives little or no treatment or drinking water if the treatment achieves the water quality standards required for human consumption.

Once treated, chlorine is added to the water and it is distributed by the local supply network. Today, water supply systems are typically constructed of plastic, ferrous, or concrete circular pipe. However, other "pipe" shapes and material may be used, such as square or rectangular concrete boxes, arched brick pipe, or wood. Near the end point, the network of pipes through which the water is delivered is often referred to as the water mains.

The energy that the system needs to deliver the water is called pressure. That energy is transferred to the water, therefore becoming water pressure, in a number of ways: by a pump, by gravity feed from a water source (such as a water tower) at a higher elevation, or by compressed air.

The water is often transferred from a water reserve such as a large communal reservoir before being transported to a more pressured reserve such as a water tower.

In small domestic systems, the water may be pressured by a pressure vessel or even by an underground cistern (the latter however does need additional pressurizing). This eliminates the need of a water-tower or any other heightened water reserve to supply the water pressure.

These systems are usually owned and maintained by local governments, such as cities, or other public entities, but are occasionally operated by a commercial enterprise (see water privatization). Water supply networks are part of the master planning of communities, counties, and municipalities. Their planning and design requires the expertise of city planners and civil engineers, who must consider many factors, such as location, current demand, future growth, leakage, pressure, pipe size, pressure loss, fire fighting flows, etc. using pipe network analysis and other tools. Construction comparable sewage systems, was one of the great engineering advances that made urbanization possible. Improvement in the quality of the water has been one of the great advances in public health.

As water passes through the distribution system, the water quality can degrade by chemical reactions and biological processes. Corrosion of metal pipe materials in the distribution system can cause the release of metals into the water with undesirable aesthetic and health effects. Release of iron from unlined iron pipes can result in customer reports of ‘red water’ at the tap. Release of copper from copper pipes can result in customer reports of ‘blue water’ and/or a metallic taste. Release of lead can occur from the solder used to join copper pipe together or from brass fixtures. Copper and lead levels at the consumer's tap are regulated to protect consumer health.

Utilities will often adjust the chemistry of the water before distribution to minimize its corrosiveness. The simplest adjustment involves control of pH and alkalinity to produce water that tends to pass corrosion by depositing a layer of calcium carbonate. Corrosion inhibitors are often added to reduce release of metals into the water. Common corrosion inhibitors added to the water are phosphates and silicates.

Maintenance of a biologically safe drinking water is another goal in water distribution. Typically, a chlorine based disinfectant, such as sodium hypochlorite or monochloramine is added to the water as it leaves the treatment plant. Booster stations can be placed within the distribution system to ensure that all areas of the distribution system have adequate sustained levels of disinfection.

6.22. Topologies of water distribution networks

Like electric power lines, roads, and microwave radio networks, water systems may have a loop or branch network topology, or a combination of both. The piping networks are circular or rectangular. If any one section of water distribution main fails or needs repair, that section can be isolated without disrupting all users on the network.

Most systems are divided into zones. Factors determining the extent or size of a zone can include hydraulics, telemetry systems, history, and population density. Sometimes systems are designed for a specific area then are modified to accommodate development. Terrain affects hydraulics and some forms of telemetry. While each zone may operate as a stand-alone system, there is usually some arrangement to interconnect zones in order to manage equipment failures or system failures.

Water supply networks usually represent the majority of assets of a water utility.

Systematic documentation of maintenance works using a Computerized Maintenance Management System is a key to a successful operation of a water utility.

COMPREHENSION

1. Read the text; as your read, note the topic dealt with in each paragraph, underline the topic sentence, key words, and important facts as your go along.
2. Analyze how the facts are connected, how the topic of a paragraph is connected with that of a preceding paragraph.
3. Make a list of all points you are going to mention in your précis .Write them down using the necessary key terms. These notes must contain all the essential facts.
4. Write a précis of the text.
5. Sum up the main points presented in the text. Write the plan of the text in the form of statements.
6. Develop your plan into summary.
7. Make your summary coherent by a sparing use of connectors.
8. Look through your summary. Find the least important sentences and delete them out the remaining ones to produce a well-written, clear and concise summary.
9. Prepare and deliver a 10-minute presentation about water supply

ЗАКЛЮЧЕНИЕ

В контексте общемировых процессов и расширения мобильности повышается востребованность иностранного языка в рамках государственной службы, предприятий и организаций, научно-исследовательских институтов. Знание иностранного языка способствует увеличению карьерных перспектив выпускников вузов, изменению их социального статуса.

Сегодня подготовка квалифицированного специалиста предполагает овладение профессиональным иностранным языком, навыками профессиональной коммуникации и саморазвития.

Лексические и грамматические материалы, представленные в данном учебном пособии, включают в себя, помимо текстов, задания, предназначенные для корректировки и контроля, разработанные в соответствии с содержанием образовательного стандарта по английскому языку для студентов строительных специальностей неязыковых вузов в соответствии со следующими требованиями:

- соответствие лингвистической информации необходимому и достаточному уровню профессиональной коммуникации (грамматические структуры, лексика по специальности);
- отражение специфики специальности (профессиональный контекст как доминанта содержания обучения);
- соответствие содержания пособия принципу проблемности;

- опора на принцип коммуникативно-ситуативного обучения;
- соответствие критериям методической аутентичности.

Настоящие методические указания к практическим занятиям по деловому английскому языку предназначены для студентов, обучающихся по направлениям подготовки 08.04.01 «Строительство (магистратура)».

Методические указания ориентированы на формирование, развитие и совершенствование достаточного уровня иноязычной коммуникативной компетенции в деловой и научной сфере, позволяющей студентам использовать иностранный язык как средство деловой межкультурной коммуникации.

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