



Promotion of Renewable Energy for Water production through
Desalination

www.prodes-project.org


Report on the e-learning course

WP3 – Task 3.6

July 2010

ProDes is co-financed by the Intelligent Energy for Europe programme
(Contract number IEE/07/781/SI2.499059)



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This report is the deliverable 3.5 of the ProDes project (www.prodes-project.org) It was developed by the responsible partner ITC after the completion of the first round of e-learning courses in July 2010. The ProDes project partners are indicated below:



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1. Presentation

The e-learning course is part of the training activities of the ProDes project. This on-line course, implemented in the Moodle (**M**odular **O**bject **O**riented **D**ynamic **L**earning **E**nvironment) Platform, focuses on the introduction of desalination by renewable energies resources.

This training initiative is addressed to people interested in this field of knowledge: professionals related with water or energy, technical students, major water users, water managers. This e-learning action is based on an interactive and user-friendly philosophy; the purpose is that the on-line student is the main leader of his/her own training process.

The course has also a flexible structure, allowing the students with high time restrictions to complete it with a minimum dedication of ten hours; on the other hand, the course offers several complementary training options for the students with more time or specific interest.

The Water Department of the ITC is the partner that proposed and developed the idea of including an e-learning action within the WP3 of the PRODES project. The three involved people, Baltasar Peñate, Juan Antonio de la Fuente and Vicente J. Subiela are the main authors of the course and have been assuming the role of teachers for the different editions. Nevertheless, this initiative is a collective outcome, and has been possible thanks to the strong implication of the coordinator (WIP), the WP leader (UNIPA) and the contributions of the rest of partners for designing the chapters of the course.

2. Contents

The course (<http://agora.cognosfera.org/>) is developed into **10 chapters** (9 theoretical + 1 practical case) with several intermediate questionnaires for the evaluation.

The screenshot shows the Moodle course interface for 'Intelligent Energy Europe'. The page is titled 'Intelligent Energy Europe' and features a navigation menu on the left with sections like 'Section Links', 'About MOODLE', and 'Technical Support'. The main content area displays the course title, a description of the course, and a 'Topic outline' section. The 'Topic outline' includes links for 'READ ME FIRST!!!', 'FAQ (Technical Support)', 'News forum', 'General Questions (Contents of the course)', and 'What is Prodes?'. A video player is visible on the right side of the page, showing a film titled 'Africa Water Week 2009'. The page also includes a 'Tag Cloud' with various keywords like 'energy', 'europe', 'renewable', and 'solar'.

1. Basic concepts on Desalination and Renewable Energies.
2. Desalination I. Membrane Processes (EDR, RO).
3. Desalination II. Distillation Processes (MED, MSF, H/D, MD).
4. Solar thermal energy and MED.
5. Solar thermal energy coupled with H/D or MD.
6. Solar photovoltaic energy powered RO systems.
7. Wind energy powered RO systems.
8. Other technologies.
9. Non-technical aspects.
10. Practical case (four different cases but only one is mandatory):
 - Case 1. PV - RO system
 - Case 2. Solar - MEH system
 - Case 3. Solar – MD system
 - Case 4. WIND – RO system

The **Quiz** tool is used as on-line tests, which can consist of various questions types. Each Chapter (1 to 9) has one Quiz.

The **Forums** are the interactive part of the course; it is what makes this e-learning course a real course, not just an online book. Participation is key.

There are two main forums in CHAPTER 0; the one called **FAQ** is only for those doubts or problems relative to the use of the Moodle platform, and the **General Questions** forum for all those doubts about the course contents. The news forum is only for information about relevant events. One additional forum is activated in each Chapter.

The mandatory parts that all students must complete are: the 9 chapters with their quizzes, the practical case of chapter 10 and the participation in the forum of each chapter (at least one participation is required).

If students do not understand a word of a lesson, they can consult the **glossaries** for definitions of the main concepts of each chapter.

For **complementary training** students can go to the sections of **videos**, **podcasts**, **news**, visit the **suggested links** and **games**; 4 games with words related to desalination are available in order to learn in a constructivism form.

In the case that the evaluators and other staff of EC are interested in visiting the e-learning platform, the administrator will prepare a free access to visit the course in reading mode; this is a very easy process, just the contact name and e-mail are required. This option will make possible to know more deeply the contents and complementary elements of the course.

3. Development of the course

3.1. Draft material

A carefully selected material has been elaborated from specific documents of the partners to be offered in a friendly use format. The preliminary material was formed by the lessons made by UNIPA for their course for students, plus the contributing from other partners.

3.2. Preparation of lessons

With all the material collected from the rest of the partners, together with the ITCs own teaching material a draft version of the 9 theoretical chapters was made. After three revisions, the teaching material contents and appearance were improved; and finally, a testing edition of the e-learning course took place in February which allowed improving lessons, quizzes and general aspects thanks to the recommendations from the testing students (ISE / Solar Spring, UNIPA, HELLAS, WIP, Aquamarine Power, CIEMAT and ITC). With all the recommendations, the material of the course was finally closed to start the first edition on the last 01/03/2010.

3.3. Preparation of evaluation elements

The course includes four elements to check the knowledge of the students:

- A multiple choice question after each lesson; required to pass to the next lesson of the same chapter.
- A quiz with 10 different questions after each chapter, required to go to the next chapter
- The participation in the forums, one per chapter
- The practical case, an XLS file with a basic model of an autonomous desalination system (four options available)

From the elaborated theoretical content, the questions for the lessons questions and quizzes were selected, with a particular preference to the most relevant information given in the chapters.

Similarly, a set of open questions or topics were identified for the forums, with the aim of motivating the participation of the students.

The practical case was made from the elemental describing equations of the systems by simple calculations

3.4. Complementary material

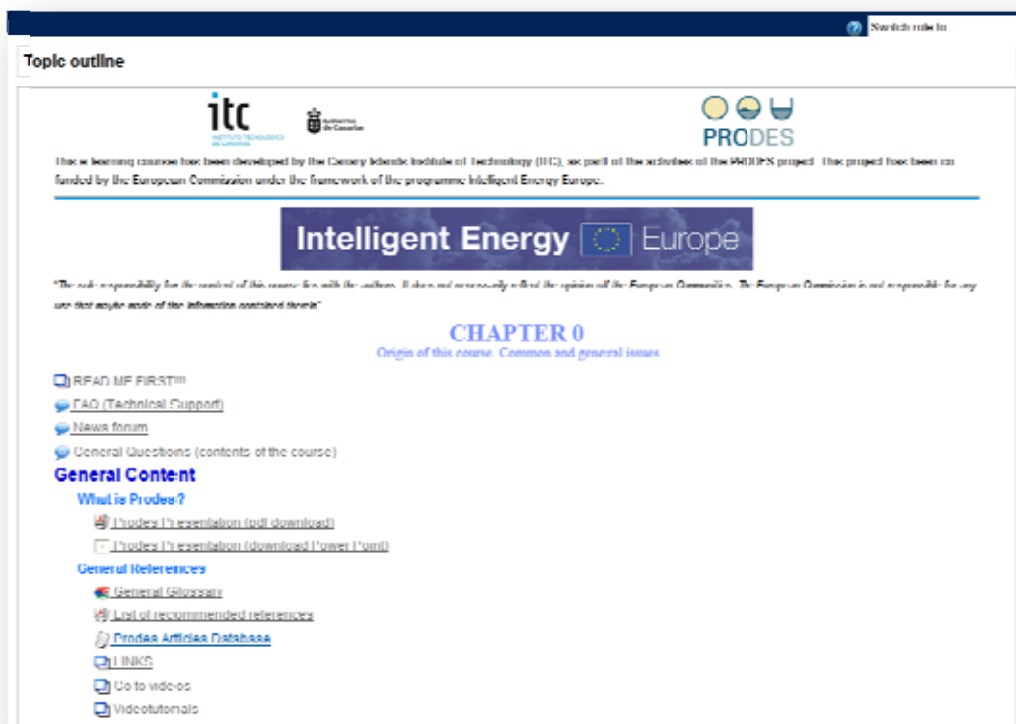
The course includes non mandatory material as downloadable podcasts, videos, news or recommended links, which were mostly developed by the subcontracting company from the indications of ITC.

4. Learning methodology

The learning methodology includes a set of steps to complete the different elements of the course. As a complementary reference, the user guide for students is enclosed as Annex I. Here is a summary of each one.

4.1. Basic info: chapter 0

Students will find the origin and general issues of the e-learning course in Chapter 0. They can read the main instructions of the course by clicking on “README FIRST”.



4.2. Reading lessons + reply intermediate questions

The Lesson is an interactive method of delivering content. The lessons included in each of the 9 chapters are formed by a series of pages presented in a linear fashion, like a slide show. The lessons are scored with the use of intermediate questions for a grade. Students have to read the entire lesson and answer the different questions. If they don't have the correct answer the lesson starts again. This is the best way to assure the reading comprehension of the chapter by the student.

4.3. Quiz

The Quiz tool is used to make on-line tests, which can consist of various question types. Each Chapter (1 to 9) has one quiz, that students must answer

correctly. At the end of each quiz students will find two buttons. One, “Save without submitting”, is meant as a safety feature to save the students answers from time to time, while they are working on the quiz. If something happens, like a power failure or something, their answers remain saved. The second button, “Submit all and finish”, is to submit the quiz when they have answered all the questions.

Students will only have one opportunity to do the quiz (a second chance will be given for those who failed in their first attempt). Once they have submitted and finished a quiz, a result page is shown. Students will be able to review the quiz and see feedback and/or correct answers displayed. Learning from their mistakes is one of the most efficient ways of learning .The result of the quiz will be displayed on their Grades page.

4.4. Forum

The Forums are the interactive part of the course; it's what makes this a real course, not just an online book. Participation is key. Students can enter a forum by clicking on one in the index page of each Chapter. On the grey panel they find the forum topic, to focus the discussion. Students can add their own posting, with a new topic, by clicking on the button that says “Add a new discussion topic”. If they only want to follow the discussion, they can reply to other students postings, by reading their posting, and clicking Reply in the right hand side of their message. It's important to reply the posting of the tutor.

4.5. Practical case

Chapter 10 is formed by 4 different practical cases developed in spread sheets files. The students must choose one of them and upload the results obtained, answering some questions made and giving their comments about the results. The four practical cases are:

- *Case 1. Photovoltaic energy coupled to reverse osmosis (PV-RO).*
- *Case 2. Solar thermal energy coupled to MEH (multi effect humidification)*
- *Case 3. Solar thermal energy coupled to MD (membrane distillation) system.*
- *Case 4. Wind energy coupled to reverse osmosis (Wind-RO).*

The file of each practical case includes four pages:

- Instructions of use
- Input data
- Output data
- Questions to be replied by the students by modifying certain input data and running the XLS file.

A selection of the main displays of the practical case is presented in the Annex II.

4.6. Use of complementary elements

There are several complementary training options for those students with more time or specific interest. These optional activities include: podcasts, videos, games, glossaries, visit to links, and other elements in the platform.


In order to learn in a constructivism form, different games with words related to desalination have been created. Students can play the time they want because there is no score. The games are the following:

- Hang Man
- Crosswords
- Snakes and Ladders
- Sudoku

The enclosed figures present two examples of the appearance of the games:

Hang Man:

A process that uses electrical current (DC), applied to permeable membranes, to remove minerals from water.



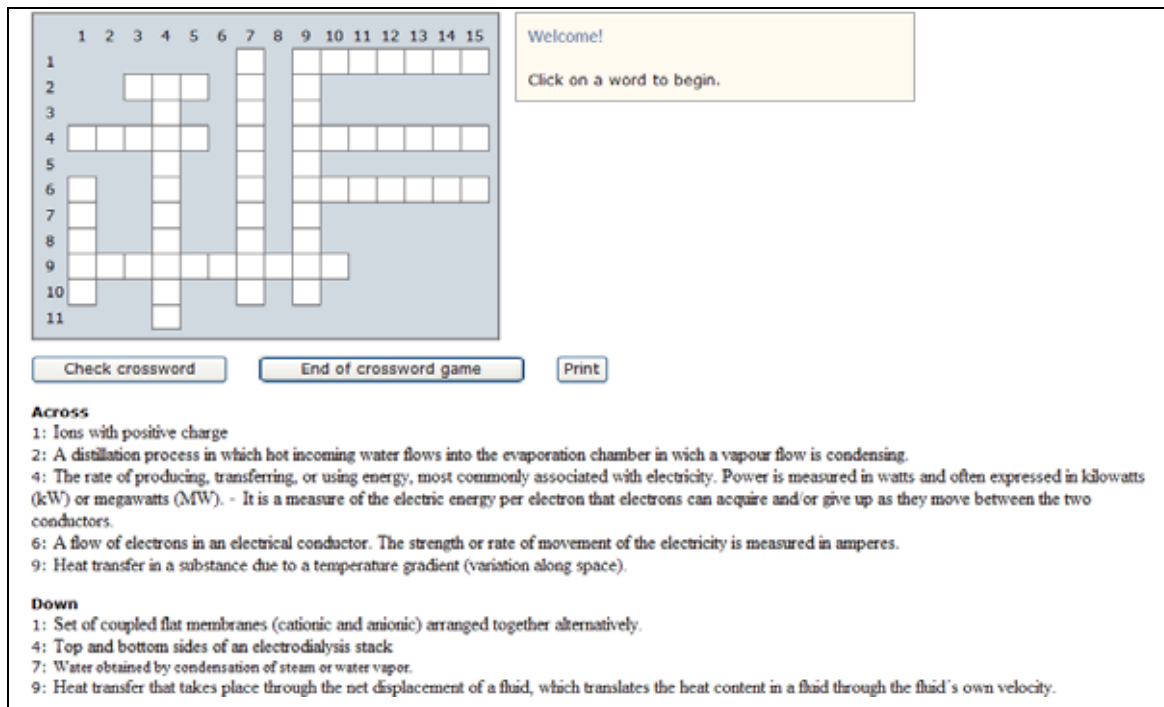
You have **6** tries

E _ E _ _ _ _ _ _ _ _ _

Letters: A B C D **E** F G H I J K L M N O P Q R S T U V W X Y Z

Grade : 7 %

Crossword:



Welcome!
Click on a word to begin.

Check crossword End of crossword game Print

Across

1: Ions with positive charge
2: A distillation process in which hot incoming water flows into the evaporation chamber in which a vapour flow is condensing.
4: The rate of producing, transferring, or using energy, most commonly associated with electricity. Power is measured in watts and often expressed in kilowatts (kW) or megawatts (MW). - It is a measure of the electric energy per electron that electrons can acquire and/or give up as they move between the two conductors.
6: A flow of electrons in an electrical conductor. The strength or rate of movement of the electricity is measured in amperes.
9: Heat transfer in a substance due to a temperature gradient (variation along space).

Down

1: Set of coupled flat membranes (cationic and anionic) arranged together alternatively.
4: Top and bottom sides of an electro dialysis stack
7: Water obtained by condensation of steam or water vapor.
9: Heat transfer that takes place through the net displacement of a fluid, which translates the heat content in a fluid through the fluid's own velocity.

4.7. Role of teachers and evaluation

This e-learning course is a tutor supported course. A teacher evaluates part of the students training process, particularly the intervention in the chapter's forums, replying the student's comments and answering the questions made. The teachers also give a mark to the practical case and could give an additional mark (up to 1 extra point) according to the participation of the student in the optional activities.

The grade obtained in the course is calculated according to the following:

- Lessons of the chapter: 30%
- Quizzes: 30%
- Practical case of chapter 10: 20%
- Participation in the forums: 20%
- Complementary elements: +10% evaluates the implication, participation and use of elements 2.0 (games, glossary, videos, podcasts).

Qualification: after completing all the mandatory elements of the course students will be able to download an attendance certificate, with their name, final grade and date.

5. Results of the five editions

Within the ProDes e-learning course, five editions have been done with a total students registered of 190.

- 1st edition (from the 1st to the 14th March), 3 groups with 61 students.
- 2nd edition (from the 5th to the 18th April), 2 groups with 32 students.
- 3rd edition (from the 3rd to the 16th May), 2 groups with 24 students.
- 4th edition (from the 31st May to the 13th June), 2 groups with 37 students.
- 5th edition (from the 28th June to the 11th July), 2 groups with 36 students.

5.1. Introduction to the available data of the platform

The teacher, by means of the “Activity reports”, is able to know at any moment the student’s progress and their participation in each one of the e-learning course activities. The table below shows the marks obtained by the student in each activity of the course and the final mark.

Grade item	Grade	Range	Percentage	Feedback
PRODES				
Chapter				
Chapter 1	10.00	0.00–10.00	100.00 %	
Chapter 2	10.00	0.00–10.00	100.00 %	
Chapter 3	10.00	0.00–10.00	100.00 %	
Chapter 4	10.00	0.00–10.00	100.00 %	
Chapter 5	10.00	0.00–10.00	100.00 %	
Chapter 6	10.00	0.00–10.00	100.00 %	
Chapter 7	10.00	0.00–10.00	100.00 %	
Chapter 8	8.00	0.00–10.00	80.00 %	
Chapter 9	10.00	0.00–10.00	100.00 %	
Chapter Average 30%	2.93	0.00–3.00	97.78 %	
Quiz				
Quiz Chapter 1	10.00	0.00–10.00	100.00 %	
Quiz Chapter 2	9.00	0.00–10.00	90.00 %	
Quiz Chapter 3	9.00	0.00–10.00	90.00 %	
Quiz Chapter 4	9.00	0.00–10.00	90.00 %	
Quiz Chapter 5	9.00	0.00–10.00	90.00 %	
Quiz Chapter 6	10.00	0.00–10.00	100.00 %	
Quiz Chapter 7	10.00	0.00–10.00	100.00 %	
Quiz Chapter 8	0.00	0.00–10.00	0.00 %	
Quiz Chapter 9	10.00	0.00–10.00	100.00 %	
Quiz Average 30%	2.53	0.00–3.00	84.44 %	
Forum				
Forum 1	-	0.00–10.00	-	
Forum 2	-	0.00–10.00	-	
Forum 3	-	0.00–10.00	-	
Forum 4	-	0.00–10.00	-	
Forum 5	-	0.00–10.00	-	
Forum 6	-	0.00–10.00	-	
Forum 7	-	0.00–10.00	-	
Forum 8	-	0.00–10.00	-	
Forum 9	-	0.00–10.00	-	
Forum 10	-	0.00–10.00	-	
Forum Average 20%	0.00	0.00–2.00	0.00 %	
Work				
Upload the document here. From friday 11 until sunday 13 (23:00)	-	0.00–10.00	-	
Work Average 20%	0.00	0.00–2.00	0.00 %	
Plus				
Plus	0.40	0.00–1.00	40.00 %	
Category total	0.40	0.00–1.00	40.00 %	
Questionario				
Grade	-	0.00–100.00	-	
Category total	-	-	-	
TOTAL 100%	5.87	0.00–11.00	53.33 %	

5.2. Origin and occupation of the students

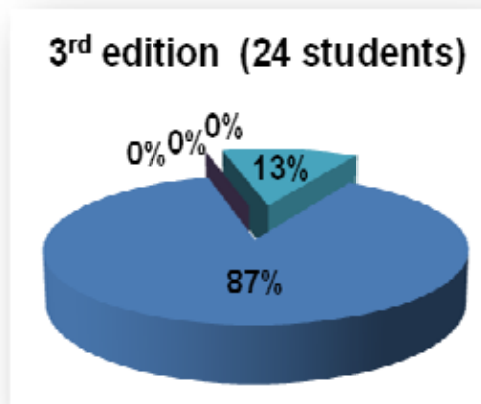
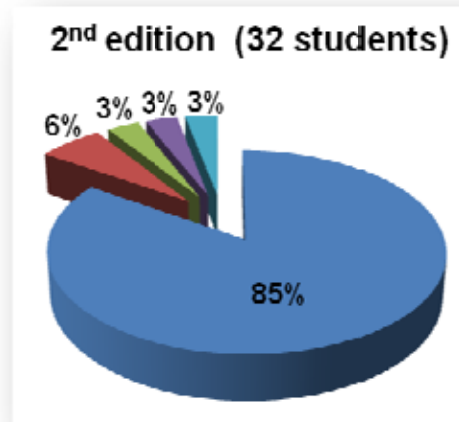
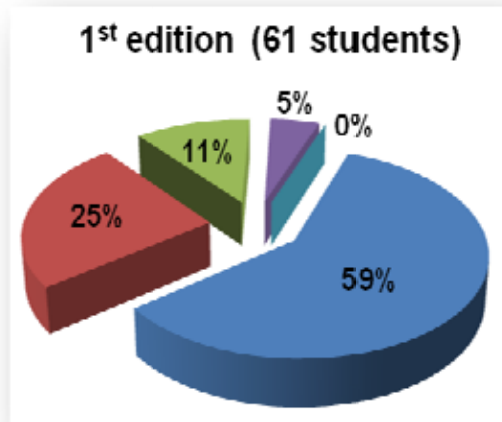
Countries of origin

COUNTRY	Nº STUDENTS (190)
SPAIN	85
CAPE VERDE	17
GERMANY	15
MOROCCO	8
GREECE	7
UNITED KINGDOM	7
AUSTRALIA	7
USA	6
TUNISIA	5
NETHERLANDS	4
PORTUGAL	3
UNITED ARAB EMIRATES	3
ITALY	2
MALTA	2
JORDAN	2
BELGIUM	2
CHINA	2
EGYPT	2
ALGERIA	1
INDIA	1
SOUTH AFRICA	1
SAUDI ARABIA	1
PALESTINE	1
CUBA	1
FRANCE	1
REPUBLIC OF KOREA	1
SWEEDEN	1
CANADA	1
CHILE	1

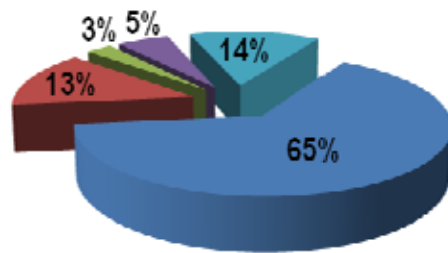
A great percentage of students (68%) are from UE; this importance was quite expected due to the dissemination has been made mainly in the countries represented in the partnership. Concerning the rest of students, it is remarkable the significant participation of African people. On the other hand, students from 29 different countries of the five continents have participated in the course, which is a very relevant amount and shows the international impact of this initiative.

Students origin

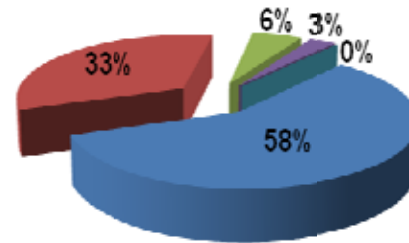
■ Europe ■ Africa ■ Middle East ■ Australia ■ America



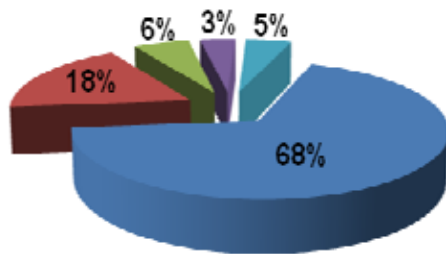
4th edition (37 students)



5th edition (36 students)

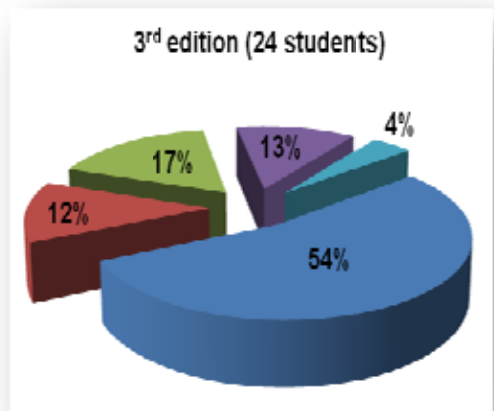
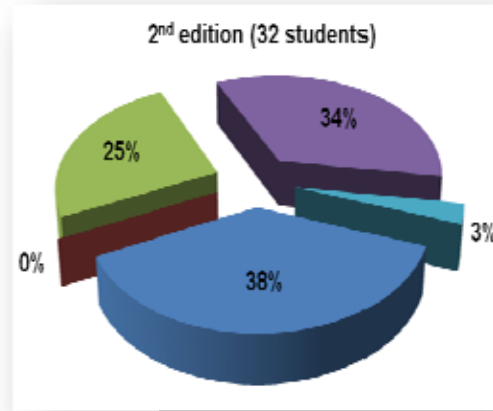
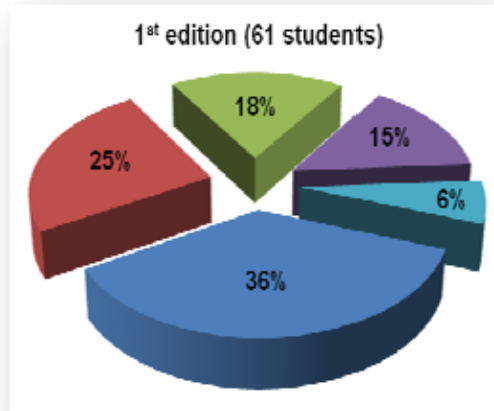


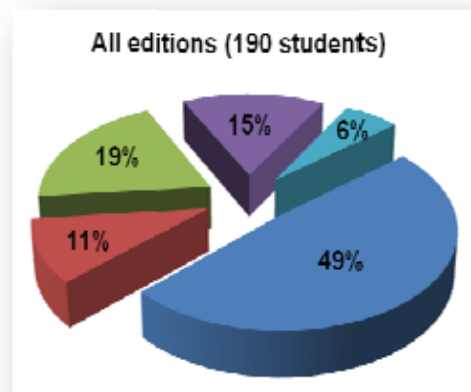
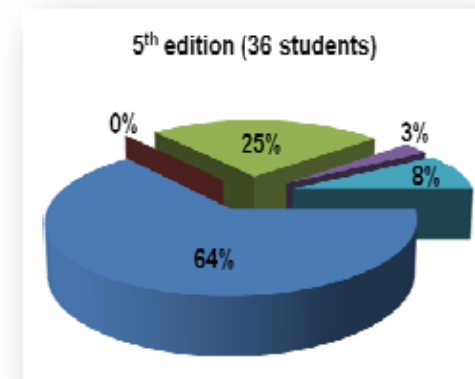
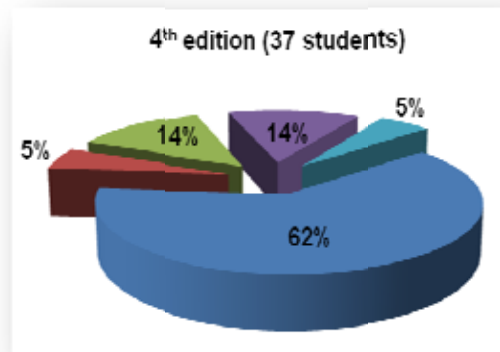
All editions (190 students)



Students occupation

■ Professionals ■ Professors ■ Students ■ Researchers ■ Others

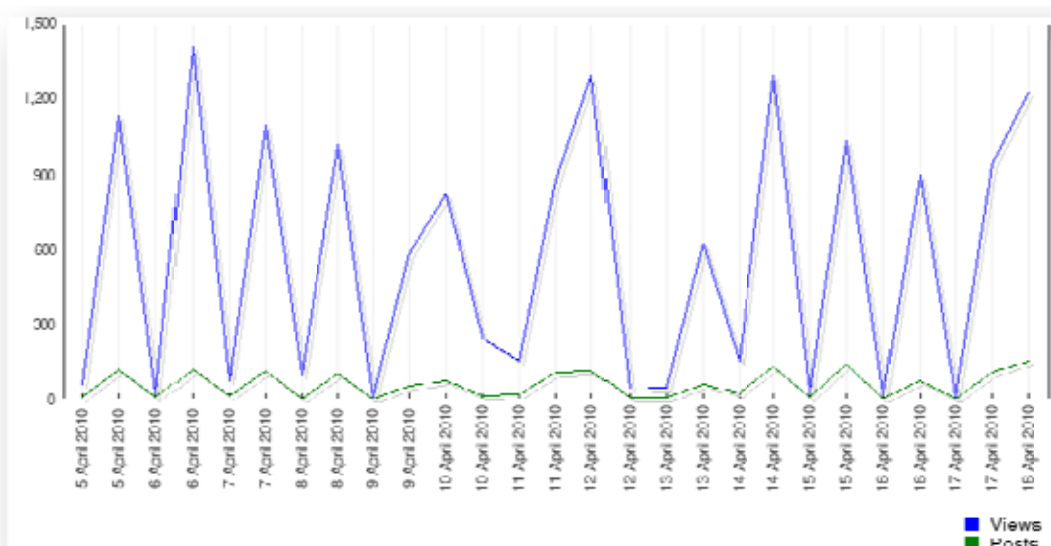




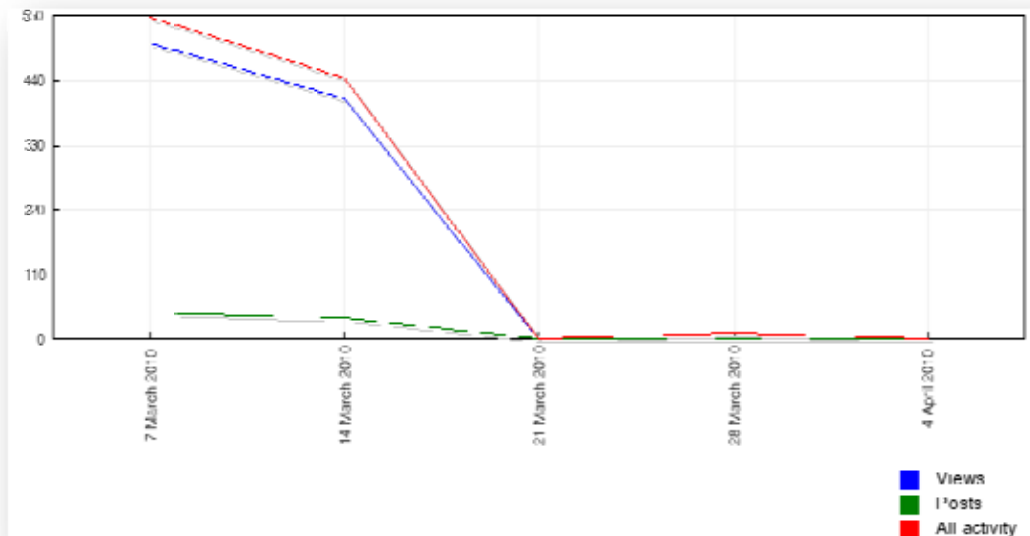
The participation has been different along the five editions. In general, professionals are the collective with the most important participation (almost 49%), followed by students and researchers. There was a significant role of professors in the first edition. The group called "others" includes all those professionals not related to desalination and/or renewable energies and the unemployed people. In general, students have obtained higher marks than professionals, mainly due to increased time availability that makes their participation and dedication to the course more complete. Anyway the inputs from professionals in the forums have been very interesting and highly valued by the other students.

5.3. Summary of statistics

PRODES - All activity (views and posts) Student. The graphs below show the activity undertaken by a student during the entire course.



In the figure above we can see how many times have the students viewed the contents of the course and all the posts made each day during the course. In the figure below we can see the same items but each week.

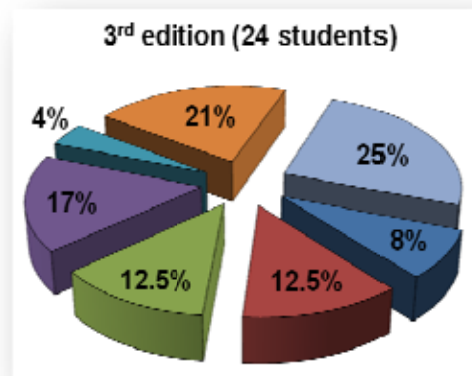
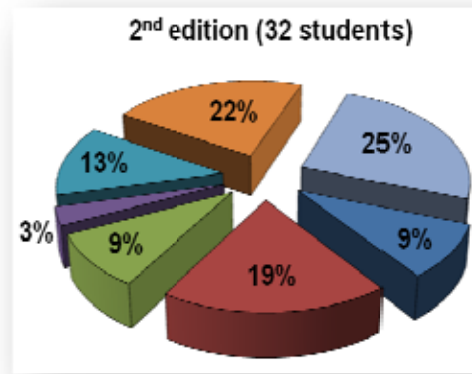
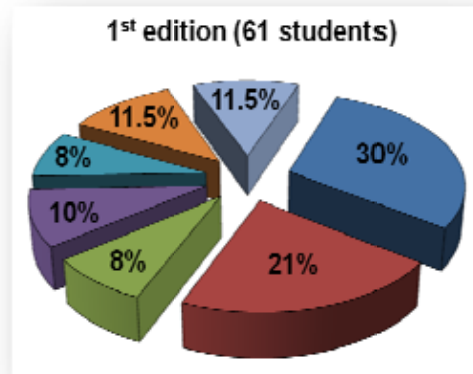


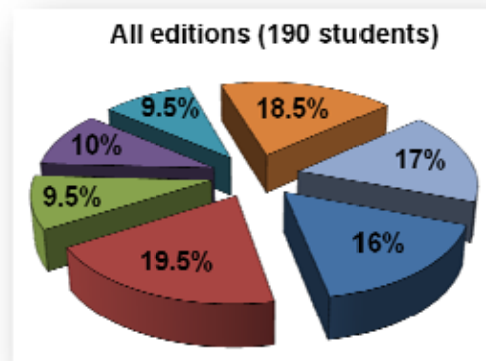
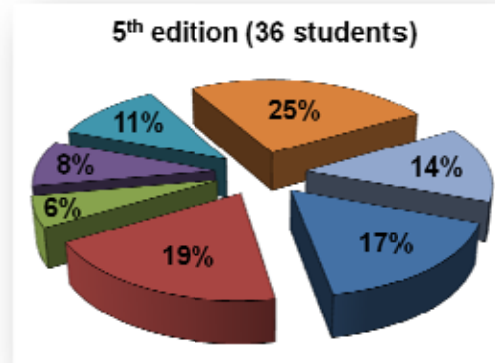
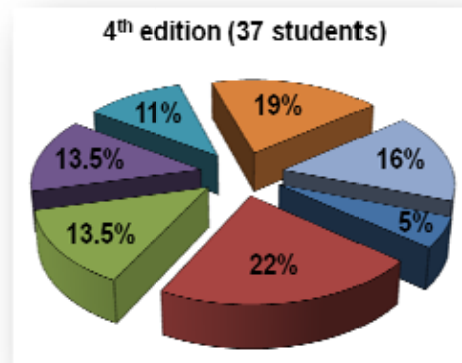
5.4. Summary of marks

In all the editions there has been a group of students who registered in the course, but that finally did not participate at all or failed, particularly in the first edition, wherein 50 out of the 61 registrations were free. On the other hand, the marks distribution is very similar for the editions 2 to 5; for instance it is remarkable that marks over 8 are more than 35% and marks over 7 are about 45%.

As commented above, within the 1st edition 61 students were registered but 18 of them abandoned. Thirteen students did not complete satisfactorily the course mandatory activities, so only 30 students got there “attendance certificate”. All those students who did not make the course or failed were given the opportunity to repeat it for free in the second edition. It is important to remark that the fact that the failure rate or “without mark” exceeds 35% is not because the course is very difficult, but that the final grade depends on the student’s involvement.

■ No marks
 ■ Mark < 5
 ■ Mark $\geq 5 \leq 6$
 ■ Mark $> 6 \leq 7$
 ■ Mark $> 7 \leq 8$
 ■ Mark $> 8 \leq 9$
 ■ Mark > 9





5.5. Summary of evaluation of the course and testimonials

After completing the e-learning course, students were required to fulfill a questionnaire in order to evaluate the course, with the aim of improving it in next editions. It was totally voluntary and anonymous. Up to 88 responses were obtained in the five editions (the mean marks obtained in each question are shown in the figure below).

PRODES E-LEARNING COURSE. EVALUATION QUESTIONNAIRE

1. General aspect of the platform	1 (very poor) to 5 (excellent) 4.2
2. Theoretical material of chapters 1 to 9	1 (very poor) to 5 (excellent) 4.1
3. Interest of chapter 10	1 (very poor) to 5 (excellent) 4.5 MOST VALUED
4. Games	1 (very poor) to 5 (excellent) 3.4 LESS VALUED
5. Complementary info of the platform (videos...)	1 (very poor) to 5 (excellent) 3.9
6. Interaction with the teacher	1 (very poor) to 5 (excellent) 4.2
7. Forums, interaction with other students	1 (very poor) to 5 (excellent) 3.9
8. General impression of the course	1 (very poor) to 5 (excellent) 4.3

Some of the relevant observations made in the evaluation questionnaire were:

- *Many thanks for the high level of **pedagogy** tools used in this course: the **clarity** by which the chapters, the quiz and the forums, were **structured** and the **good organization** of team managers (many thanks for their availability and sympathy) were the force points of this course.*
- *The way of these types of E-learning courses is new to me. I feel that the course is very **attractive** and the material gives very **good information** about the use of renewable energy in desalination. Hope that later there will be courses specialized in each type of renewable energy use in desalination.*

- *I think you offered a very **good introduction** to the basics of desalination, the different types of technologies and all the aspects which are associated with them. I found the idea of the **forum** especially **strong** because it allows people to discuss their views on the technologies. However in some cases the questions were too straight forward to allow for an active discussion (after two people replied, one could often not add a new insight to the discussion). Nevertheless I found the forum to be something that has a lot of potential when developed further. I think next to the course material itself this was the most important part.*
- *Despite the fact that I was too busy with teaching activities in my institution, **I have really enjoyed** this course. To complete this course, I hope that some other courses will be scheduled in the future such as detoxification and disinfection of water using solar energy.*
- *I found the theoretical information of the course: **good structured, interesting** and quite **complete**. The **forums are useful** to discuss the topics as well as the quiz to evaluate some ideas learned. Some suggestions from my side: it would be good if you can go back in the slide of the chapter or to review last chapters, to look up some information or if you could download the chapters. I found too much the number of email received each time that someone make a comment in a forum. I think that one email per day will be enough.*
- *For me, the main advantage of the course is that you not only learn what is written on the books but people from all over the world show you different situations and points of view which you are not used to. Not often you have the chance to learn so much in such a short time!*
- *Overall, the course very good. Only several issues: it would be interesting to be able to download chapters in pdf. In the chapters, there are patterns that are difficult to see (small, blurry ...) practical exercises are of great interest. Thank you all.*
- *The course is very well presented but still need some improvements. Students need a minimum background on water desalination and RE to permit a good comprehension. Also, I suggest to more detail the theory of RE technologies especially wind and solar (i.e, weibul distribution, wind availability statistic analysis, PV technology...). The quiz questions are well suited and in good concordance with the course content. To enlarge benefit, the forum discussion of actual course has to be essential before going to the next course, as well as the quiz to oblige students to participate. Finally, congratulations to all the teachers team for the excellent work. The course will be an excellent support for me to prepare my future lectures.*
- *The course material is excellent, and the course platform is good. I have no doubt that both will further improve as your experience in offering it increases.*

- *The expertise and experience of the team in the chosen field is excellent. So is most of the rest of the course.*
- *Thank you for taking the time to set this up.*
- *I think it's a very good course for non-experts in the field and I hope to have the opportunity to do more courses with you.*
- *It would be interesting to see what discussions came out from the other groups of students and to see if the students coming after us can build on those discussions so that when everyone has completed the course we can receive a summary of the most interesting and important discussions.*
- *These courses are very interesting for me, thank you very much.*
- *I liked the course very much. It presented a good overview of desalination with RE and the forums encouraged me pretty much to read and study further on the topics. I especially appreciated the practical case.*
- *Thank you for this great course. Is there a mechanism to keep in touch with the teacher and students after the course ends? Like a network, e-group or so?*
- *I liked this training course very much, it was very useful to systematize my ideas regarding RE desalination and to learn more. In the forums it was very interesting to learn about the different perspectives of the other students.*
- *It has been a very exciting experience for me, to get to learn about two interesting issues to me and how they could be integrated together, being the water desalination and renewable energy. I also liked the e-learning platform, which allowed me to learn in my own pace while still under guidance of an experienced teacher. Finally the interaction with other people from different parts of the world and different experiences yet sharing the same interest is very beneficial. I highly recommend this course for anyone who has the motivation to learn about water desalination using renewable energy as a tool for a sustainable future.*
- *I teach online courses in different web platforms, and I wanted to congratulate you for the very good performance of the course (especially monitoring the student's progress) and for the good development of the materials. In relation to the price, I think it's an excellent training choice to introduce the treated area. Thank you very much and congratulations.*
- *It was very interesting to do this course. I learned a lot and I am very enthusiastic to continue with this topic when possible. It was a lot of fun too, especially due to the way the course was set up (interactive, good presentations, quizzes and forum, etc.).*

- *Interesting approach. The limited time window definitely a good idea, otherwise I would have let it drag on for weeks. A great summary of the various RE-D technologies.*
- *It's being a very interesting course, there's only a little thing I'd change to improve it. In the theory courses, it would be easier to follow if instead of the capital letters, the whole word was written, as for example MED-> multi effect distillation, RO-> reverse osmosis, MD-> membrane distillation... etc. The rest is ok. Thank you.*
- *It would be more interesting to continue may be in another course, going in depth into w/t technology and related scenarios. Thank you.*
- *Very much enjoyed and appreciated this course. It came just in time as I needed to get a quick education in desal for my masters assignment in renewable energy systems which deals with this very topic. So thank you very much for this good training, although it was tough to fit in at night with our Australian time zone...;) I hope this course will continue and expand!*
- *I found the course very useful; I feel I learnt a lot. I found the interaction in forums between the participants extremely interesting. I hope that more similar courses along the same lines will be organized. Thanks.*
- *I am very happy with the course content. Even with my general knowledge of RE desalination, I've learned new things. So, it was worth it. I would have preferred a bit more technical content - but I know this is not the purpose of this course. May be in the future, there could be a separate advanced course. But overall, I think it's a great course for beginners in the desalination industry. I would definitely recommend the course to my fellow colleagues working on desalination.*
- *I would suggest having two threads in each forum. One which is marked and the other for other discussions on the technology - which is not marked. I think it would help if the thread which is subject to marking is made entirely visible when all students have posted their contribution or past the deadline. This would give more confidence to the late students. It would be great also if we could upload relevant photos on desalination in the forum (without using web links). In regards to the quiz, may be there could be a reminder when submitting the answers if any question weren't answered...it happened to me once. Overall, great course!*
- *Perhaps a downloadable version of the glossary would be helpful.*
- *The course has been pretty well; I am really satisfied with the content and the evolution. Totally recommended, thank very much.*
- *Very good course at low budget to students. Theories and introduction are well organized and presented. Learning from such platform is flexible and enjoyable, and exchange of ideas from classmates of different origins enhanced learning motivation and thinking*

process. I would recommend my colleagues to attend the course should they be available in the near future.

- *On improvements, I suggest allowing the contents are accessible for a period of time after course completion.*
- *First of all, thanks for the course. In general one will see much later, what the long-term use was, but already today I believe that I learnt new stuff.*
- *I had some ideas during the last 2 weeks, which I would like to share with you:*
 - *When first starting, I could not enter, because I clicked "desalination course" instead of "PRODES". This page should be improved or better explained.*
 - *As I did the course next to my normal day to day business, I would have needed more flexibility in the time. I would have liked to start the chapter 6 and 7 during the weekend to save time this week. I would suggest opening all chapters from the beginning and letting everybody work at his/her pace.*
 - *It took a while until I realized, that I have to take part in the forums and that my answers are rated. I would have appreciated this information more clearly.*
 - *Same for the questions inside the chapters.*
 - *I would have expected more detail information during the course. Either in the chapters or as additional files. (Maybe I just did not found them?)*

But in total, I'm pleased with the course. Thanks!
- *Generally, I was impressed with the course. I found it interesting and as an introduction into the subject I learnt a lot.*
- *The idea on having a quiz at the end of every chapter was good as it gave us a chance to test what we had learnt. The chapters were the right length - not too long.*
- *I would do a similar course again or recommend this one. Price was right too. If paid this for me it was reasonable. If it was much more I don't think I would have committed.*
- *Overall, good course, good forums and interesting.*
- *The course has been very interesting for me. I have learnt about some RE I didn't know. The interaction with the teacher and the other students has been very satisfactory.*
- *Perhaps I have missed some more technical data, but the duration of the course doesn't permit to get into them. Thank you.*
- *The course is very clear and understandable. I will maybe add some bibliography, as book to consults and continue to learn about these topics.*

6. Dissemination activities

The course has been disseminated by the following ways:

- Sending invitations to the ITC contacts and the partners
- Dissemination through universities with proximity or directly linked to the partners
- Contacting relevant entities and companies, as EDS and IDA
- Searching in internet relevant universities and research centers of America and Africa
- Mentioning them in seminars, workshops or relevant events in which ITC has participated.
- Publishing three announcements in the digital version of the journal “Desalination and Water Reuse”, D&WR).

About more 500 contacts is the rough estimation of the invitations sent by e-mail. On the other hand, much more people have probably been informed through the announcement in D&WR, different regional and international websites and other links related to water and or energy. Thus, the number of people who have known / seen the link of the course will probably be much higher.

As a reference, if the topic “desalination e-learning ProDes renewable” is written in google (without quotes), the number of suggested links is more than 3,000.

7. Possible improvements and further actions

According to the results of the completed editions of the e-learning course, the experience has been very positive, not only for the students, but also for the teachers. The students have the opportunity of receiving interesting information in a very short period of time and of exchanging points of view. On the other hand the teachers participate in this information exchange and complete their training from the queries and comments of the students.

The development of editions has allowed the authors to identify elements to be improved:

- Enlarge the period of the course: an important percent of students have difficulties to follow the course day by day, despite that there are 10 chapters to be completed into 14 days. Thus, it could make sense to think in a course of one month, maintaining the same mandatory content and adding more optional items.

- Enhance the participation of students in increasing the elements of the course by suggesting new videos, podcasts, links...
- Increase the words of the glossaries.
- Increase the words used in games.
- Development of the course in other languages, particularly those spoken in the origin countries of the partnership (Italian, Greek, Spanish, Portuguese, German) and in French, which is one of the most spoken language in the developing world, wherein more success and applicability can have this training action.



User guide for Students

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1. Introduction



Moodle is open source software developed in Australia by [Martin Dougiamas](#) © and a team of international contributors. This means that the program is freely available to anyone from the web site <http://moodle.org>. The Moodle download contains a standard set of tools. In addition, there are many contribution Moodle tools (i.e. not part of the standard distribution) and hacks developed by different educators around the world.

When writing this manual we assume that you have at least a basic knowledge of using a computer including input devices like a mouse and keyboard. In addition, it is assumed that you are familiar with your web browser and navigating between pages on the internet.

When you have switched on your PC, you open your browser program. The **Mozilla Firefox** browser works best with Moodle. If you have not already got it in your PC, you can download it for free from

<http://www.mozilla-europe.org/en/firefox/>

Moodle also works in the **Internet Explorer**, but not quite as well.



In this guide you will be introduced to the basics of using Moodle as part of your studies. The most appropriate use of this manual is to have it to hand whilst you use Moodle for the first time.

How to best use this guide is up to you. It has been written so that you can either work through it in a linear way or jump to any specific sections as you wish.

1.1 Getting Started

Our experiences of Moodle tell us that it is a pretty intuitive tool to use. How easy *you* find it will depend on your own background. That said, a general rule of “have a go and see what happens” can be applied in most cases.

On the Moodle *Home* page you can find our *Frequently Asked Questions or FAQ*. These should help with any difficulties you encounter after working through this user guide. They are found in the *Main Menu* to the top Chapter 0 of the Prodes Moodle Course.

This document will guide you through:

- Loggin on the platform
- how to edit your profile
- page layout including blocks
- basic navigation around the site and your courses
- messaging
- forum
- activities and resources
- games

2. Loggin in

Moodle is basically a web site like any other and is therefore available wherever there is an internet connection.

To get to the Moodle website open your web browser and go to:

<http://agora.cognosfera.org/course/view.php?id=20>

This will take you to the Course page (Figure 1).

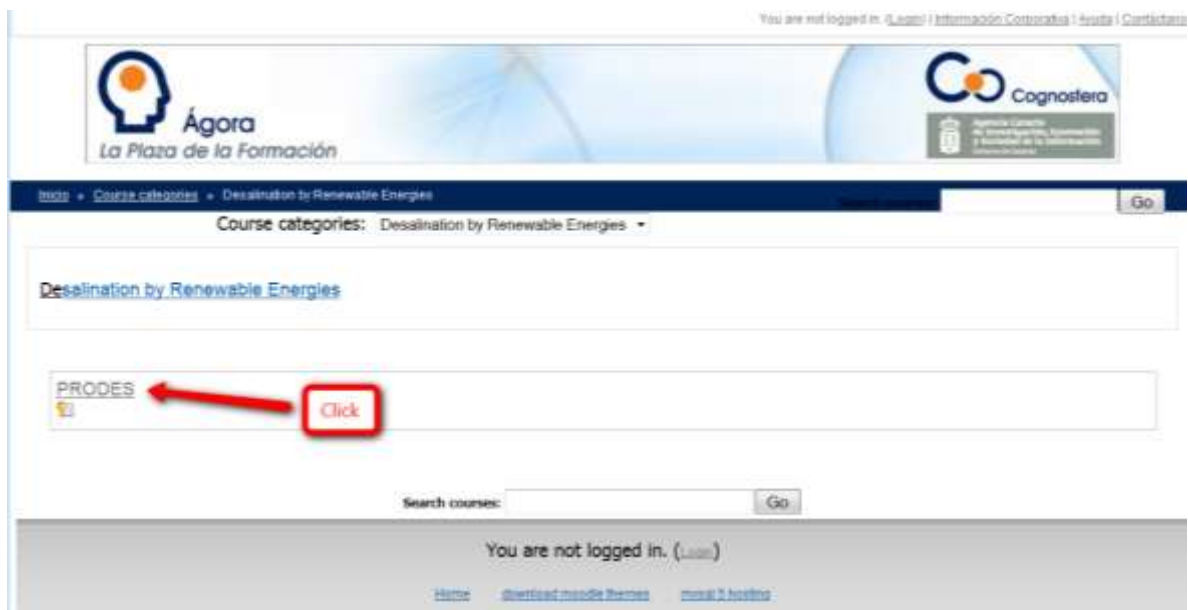


Figure 1

One you click on the PRODES link, you will go to the logging page (Figure 2).



Figure 2

You should be able to log in using your *username and password send it by email*. If you encounter any problems, contact with us by email:

prodeslearning@gmail.com or follow the link on the Moodle login page (“Yes, help me log in” button).

Once you have logged in you will be taken to your *Home* page (Figure 3). This is personalized for each student and will contain some *blocks* and a list of your chapters. We will refer to this later.



Figure 3

Once you have logged in we strongly recommend that you first *Edit your profile*.

3. Editing your profile

Now that you are logged on to Moodle we would advise that you go straight to *Edit your profile*.

Editing your profile will allow you to become familiar with the options available to you in order to personalize your environment.

To edit your profile from your Home page, click on your name on the banner at the top of the page. (Figure 4)

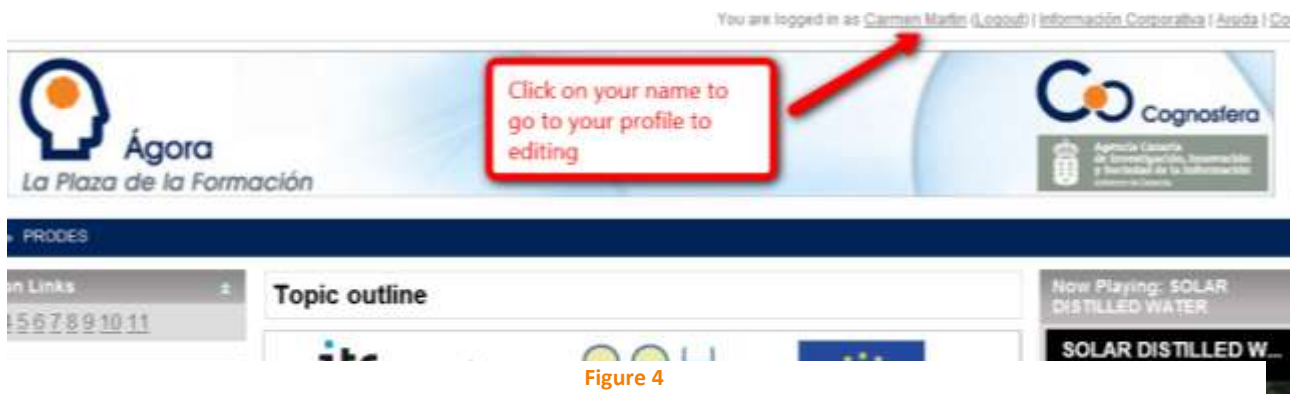


Figure 4

From here you will be taken to your profile page. Select *Edit Profile* from the middle tab under your name. You will now see a page containing a series of options. (Figure 5 and 6)



Figure 5

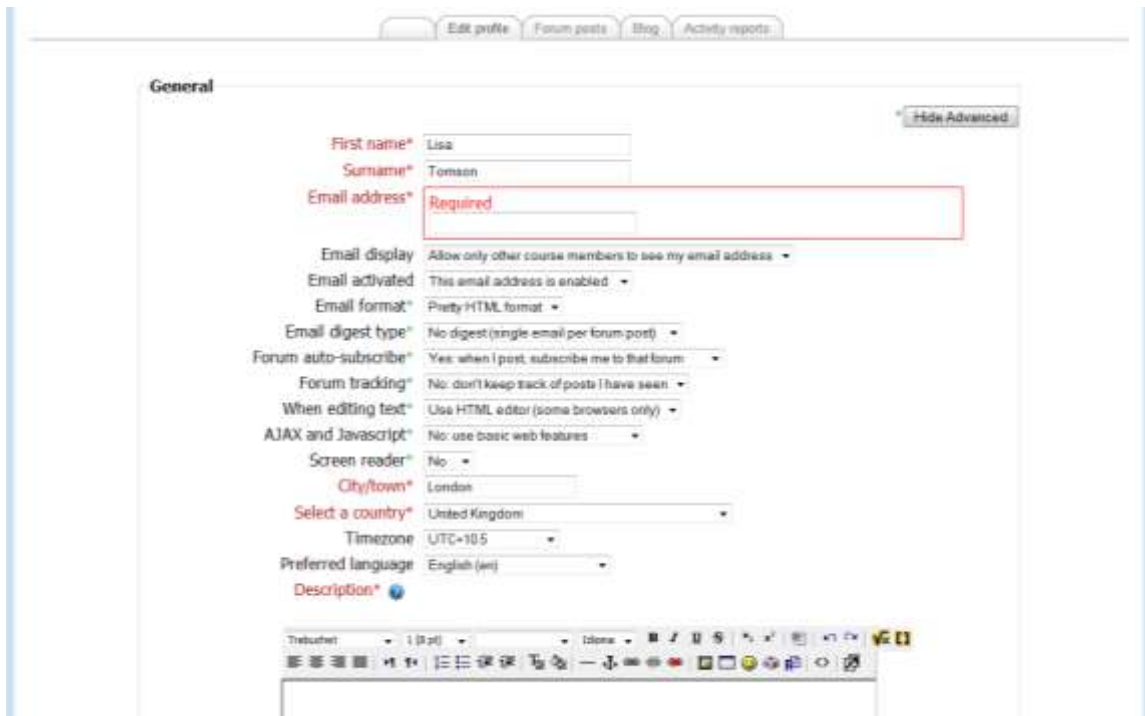


Figure 6

We will go through those options and give advice on selections. Whilst you may alter any of the setting most should be left as they are in order to ensure that Moodle functions for you at its best.

Next table shows the fields that you could change and a little explanation.

Field	Setting and explanation
Email address	You can use any real email address but to be sure you keep up with course developments it should be the one that you check frequently
Email display	It is up to you which of these options you select but our advice is to keep in mind that the purpose of Moodle is collaboration and communication.
Email digest type	You should change this to <i>complete</i> to ensure that you receive your course email.
Description	This field is mandatory but the information you include could be anything. A good example would be the course you are reading.
New picture	To add a picture to your profile, click the Browse button. Look up the picture you want to use in your PC and double-click it. Make sure that you use your own picture and not a copyrighted image. The link to the picture will appear in the browse box (note that the picture file must not be too big, 50 Kb or less is usual). User pictures will be automatically resized to fit the picture box (100px X 100px).

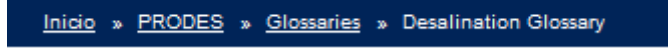
The various other optional items (accessible with the second **Show Advanced** button) allow you to add your contact information (e.g. Skype, Yahoo and MSN IDs and telephone numbers) to your profile. Remember that all Moodle users have access to that information once it is in your profile, so reflect on whether you really want to share it with everyone.

You can now click **Update profile** at the bottom of the page and you will see your updated profile. Note that you can always return to your profile and make changes in your selections and personal information when required.

4. Basic Navigation

There are a number of ways to move around the course and to know where you are within the course.

“Breadcrumbs” – this is a menu positioned below the course title which shows your position in the course. For example:





- *Inicio*: Clicking on this would take you to the screen which displays all of the courses on the site.
- *PRODES*: Will take you to the main course index page of PRODES.
- *Glossaries*: Clicking on this would display a list of all Glossaries in this course.
- *Desalination Glossary*: Because this is in a different font (without underlined it indicates that is your current location within the course).

Notice that the breadcrumbs menu changes to reflect your current position.

While in a course activity you can move to another activity or resource in the course by means of the following:



The Previous  and Next  buttons will take you back and forth between the activities and resources in the order in which they appear in the course topics, while clicking the drop down list will allow you to select from the complete list, in topic order, and navigate directly to your selection.

Finally, it is possible to navigate between pages by using the “Back” and “Forward” navigation buttons on your web browser. This is not recommended; you will obtain more consistent results by using the navigation options within the website and course pages.

5. Page Layout and Blocks

The *Course* page you see as a student has *Blocks* on both sides and the *Main Content* through the middle.

Blocks have different information about the course: like videos, tutorials, tag clouds to related web pages, and other “2.0” utilities.

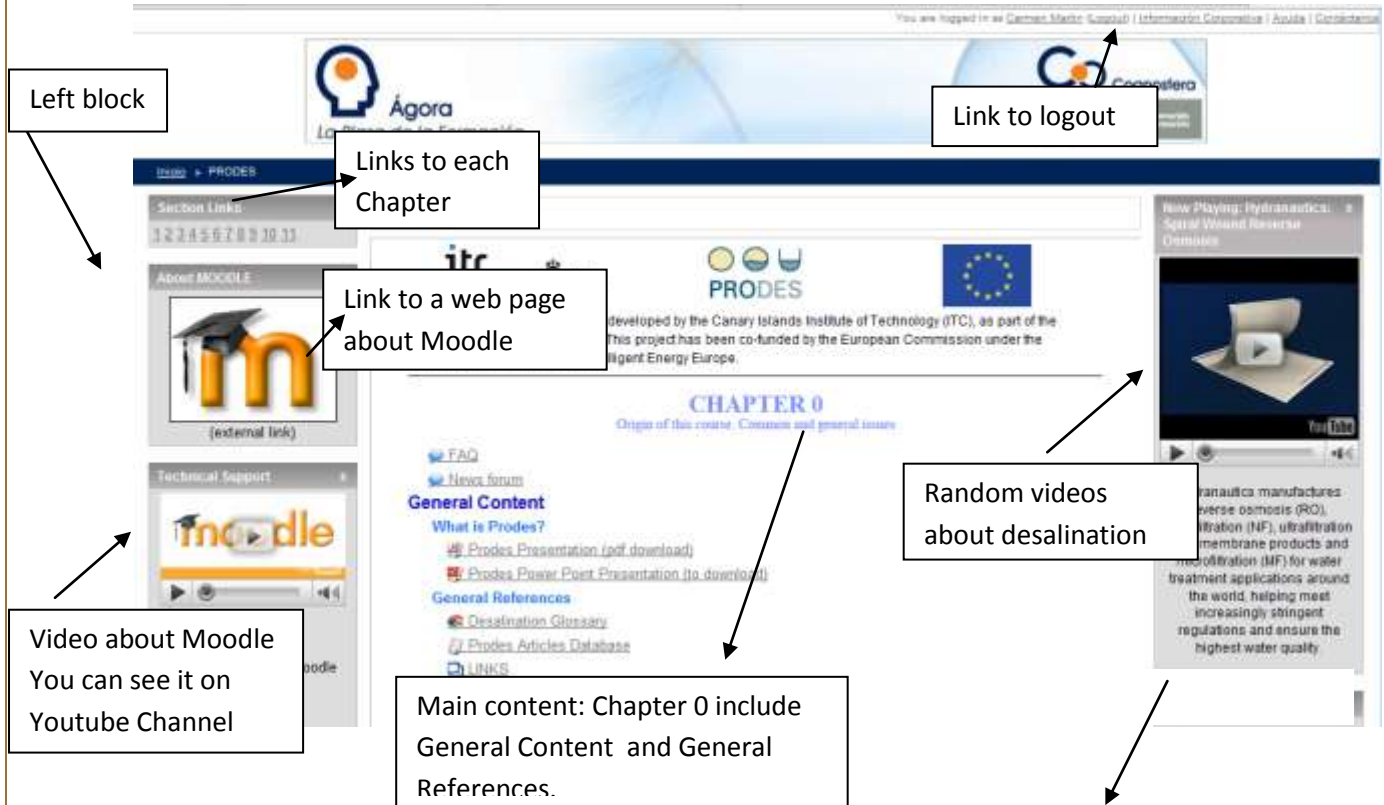


Figure 7

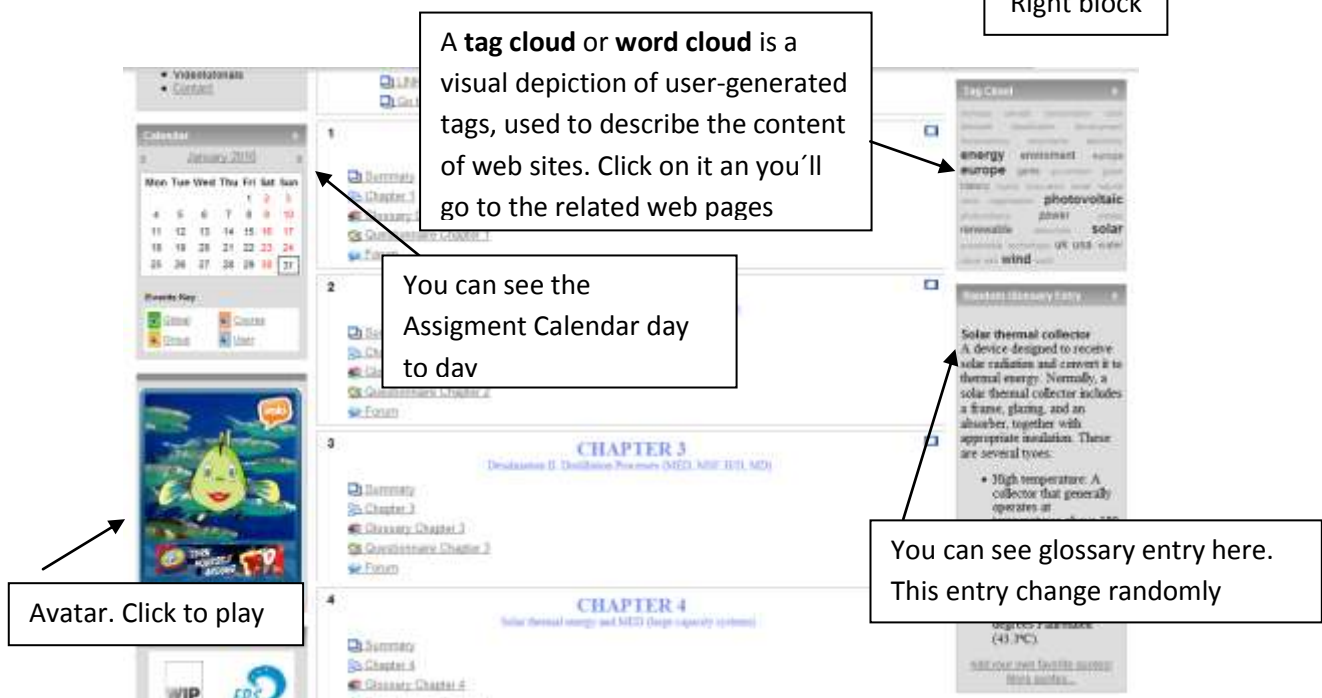


Figure 8

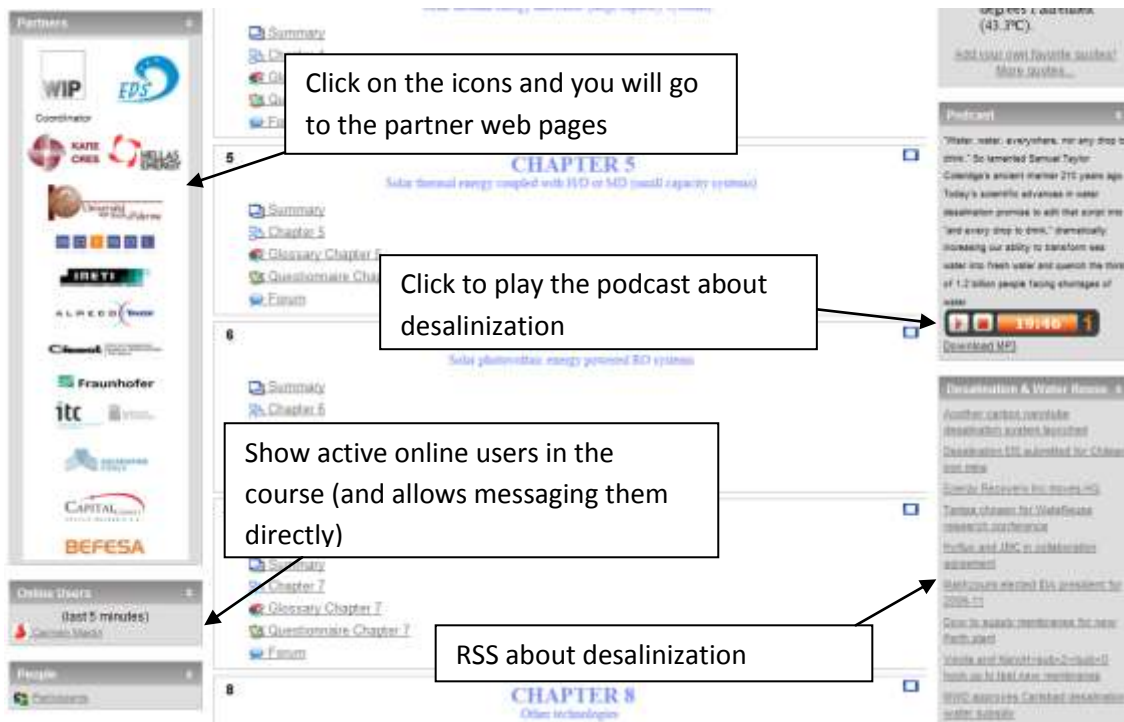


Ilustración 9

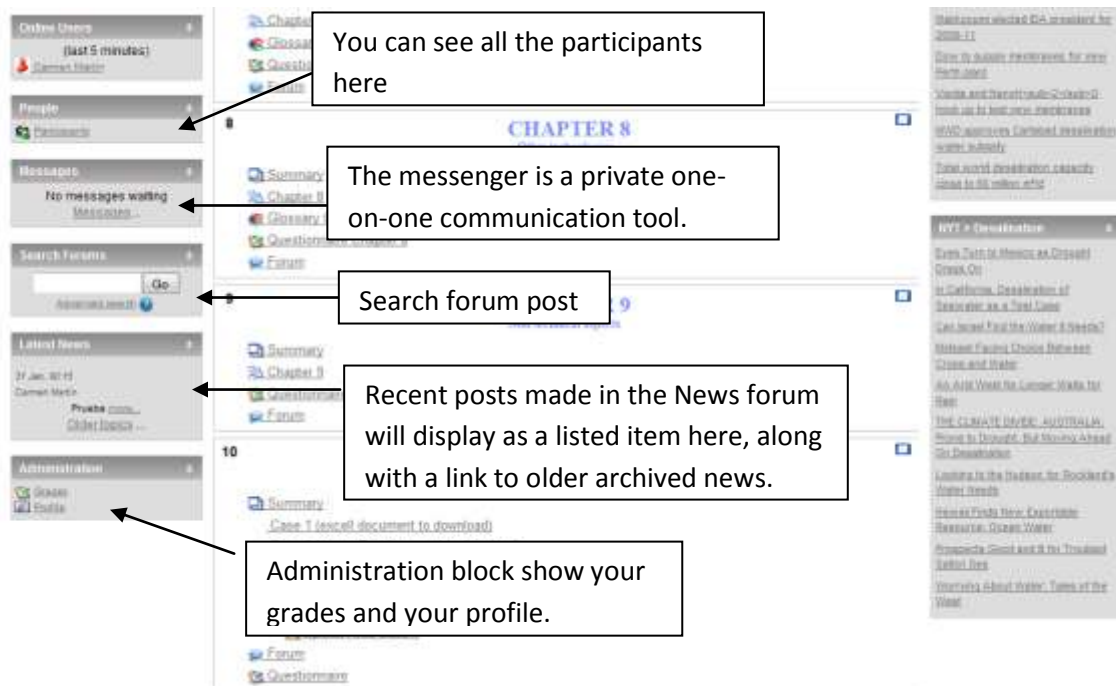


Ilustración 10



- [Game's Words](#)
- [Hangman Game](#)
- [Crossword](#)
- [Snakes and Ladders](#)
- [Sudoku](#)

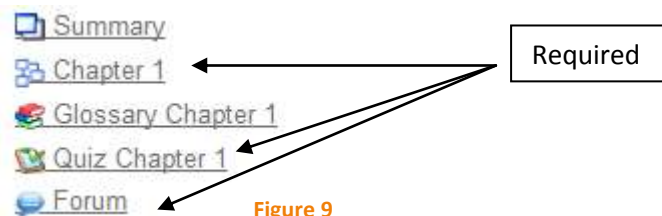
Select a game to play and learn about desalination.

The first is through the main course content in the middle of the page. Clicking on these links will take you directly to the activity or resource. The second is to use the different resources on the blocks.

Here the links take you to a list of activities/resources organized in their Chapters e.g. all the lessons, forums or all the quizzes. You can then select one by order. Once you have opened a resource, where appropriate further instructions should be given. For example when you enter a forum you will be given the option to add a new discussion or click on an existing discussion to read postings. It is important to remember that you cannot break anything in Moodle so if you have any doubts just click and see what happens. N.B. you may wish to exercise caution if you are taking part in assessed work.

The order of the each chapter is:

- Summary
- Lesson Chapter
- Glossary
- Quiz
- Forum



Click on the Summary to know about the Chapter, and use the glossary to know a little more about each topic, there are optional. But Lesson, questionnaire and forum are required (Figure 9).

To pass each chapter you'll have to read the lesson and answer the questions, answer correctly the Quiz and participate in the forum.

6. Forums and the Text Editor

The Forums are the interactive part of the course; it's what makes this a real course, not just an online book. Participation is key.

Here's how: Enter a forum by clicking on one in the index page of each Chapter (Figure 10)



Figure 10

On the grey panel is the forum topic, to focus the discussion. Click on the hipertext



Figure 11

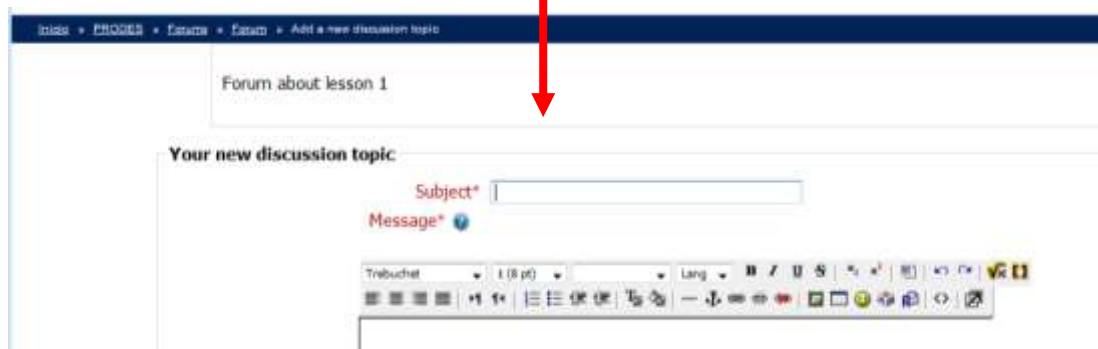


Figure 12

Click on the button that is says “Add a new discussion topic” to add your own posting, with a new topic. Don’t do it if you only want to follow the discussion.

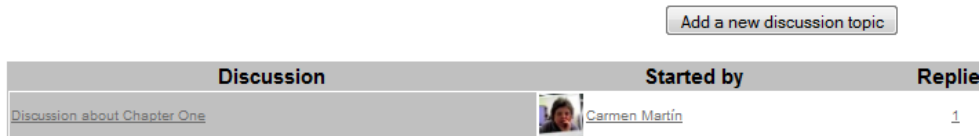


Figure 13

There is a text editor for you to customize your posting: you can add color, change fonts and styles, attach images, etc...Play around to get a feel for it. Below, you can see a wide range of small icons; these are tools to edit your text with (font, bold, italics, indent, etc.).

You can reply to others' postings, by reading their posting, and clicking *Reply* in the right hand side of their message. Its important to reply the posting of the tutor.



Figure 14

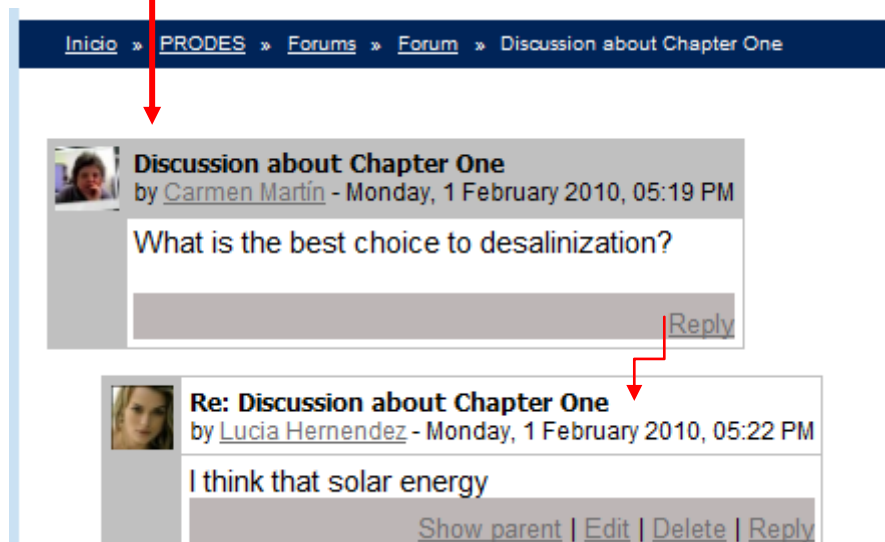


Figure 15

7. The Lesson

The *Lesson* is an interactive method of delivering content. (Figure 16)

The lesson can be a series of pages presented in a linear fashion, like a slide show.

The lesson is scored with the use of questions for a grade.

You have to read the entire lesson and answer the different questions. If you don't have the correct answer the lesson starts again.

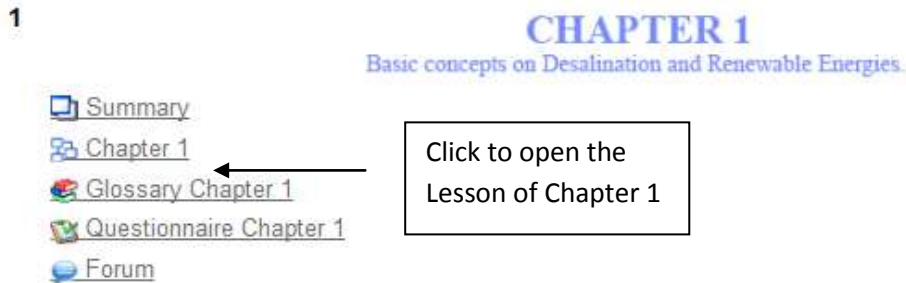


Figure 16

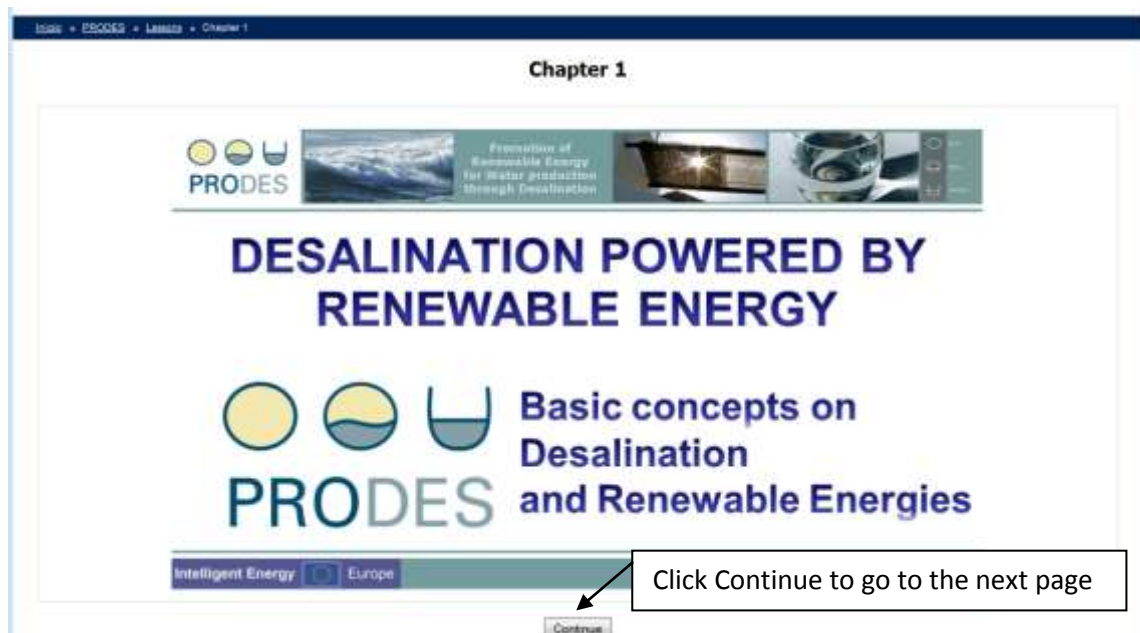
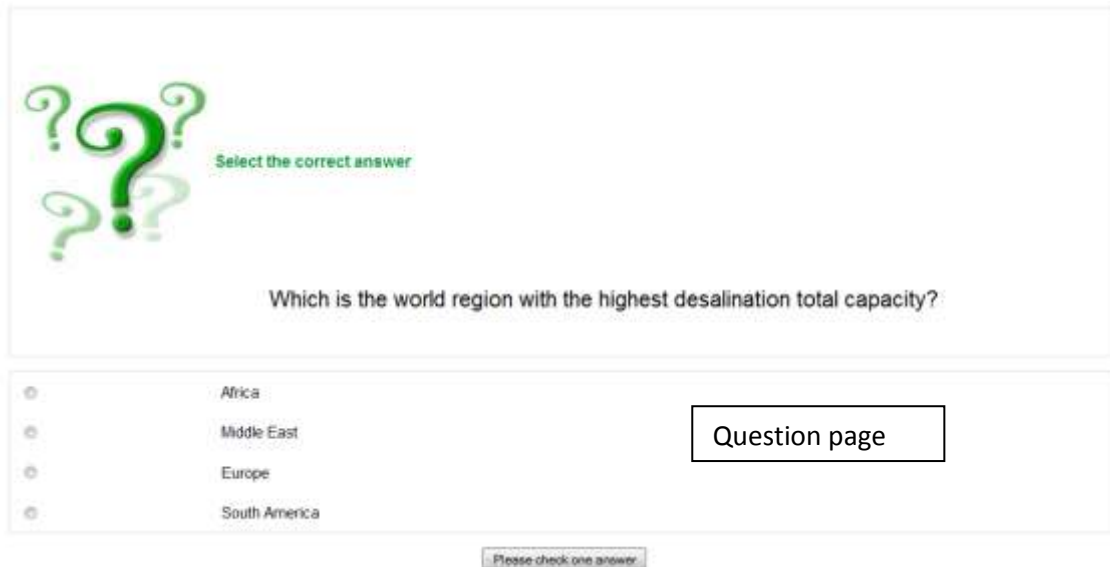


Figure 17



Figure 18



Select the correct answer

Which is the world region with the highest desalination total capacity?

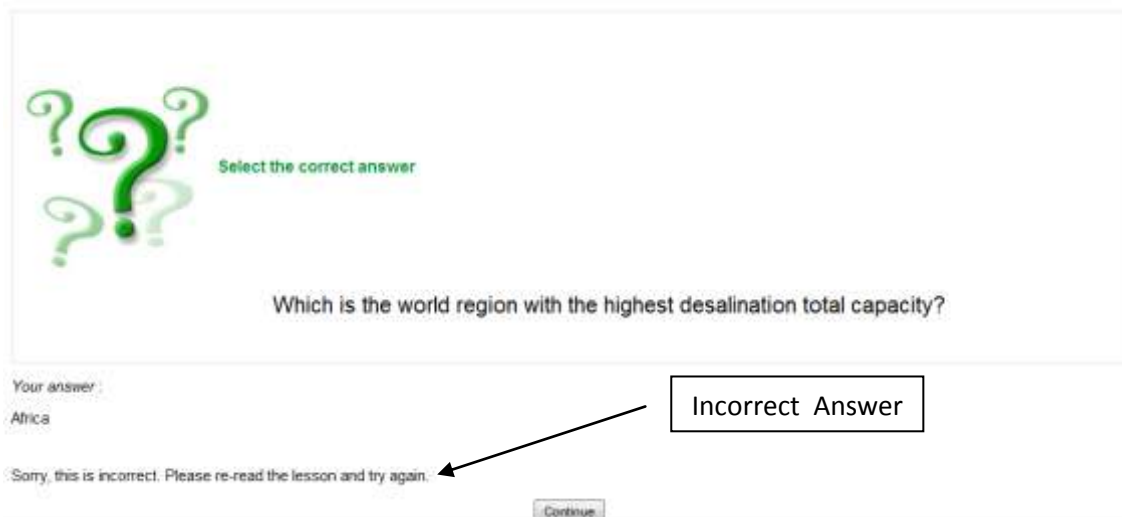
- Africa
- Middle East
- Europe
- South America

Please check one answer

Question page

Detailed description: This figure shows a quiz question page. At the top left is a graphic of several green question marks of varying sizes. To its right is the text 'Select the correct answer'. Below this is the question: 'Which is the world region with the highest desalination total capacity?'. Underneath the question are four radio button options: Africa, Middle East, Europe, and South America. At the bottom of the question area is a button labeled 'Please check one answer'. To the right of the options is a box labeled 'Question page'.

Figure 19



Select the correct answer

Which is the world region with the highest desalination total capacity?

Your answer :
Africa

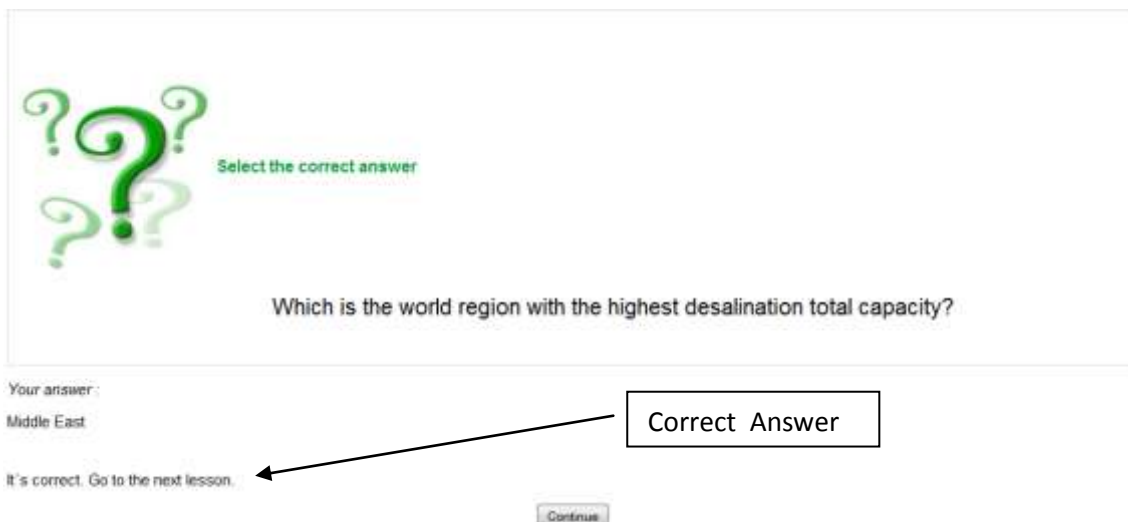
Sorry, this is incorrect. Please re-read the lesson and try again.

Continue

Incorrect Answer

Detailed description: This figure shows the feedback for an incorrect answer. It features the same question graphic and text as Figure 19. Below the question, it displays 'Your answer : Africa'. A message follows: 'Sorry, this is incorrect. Please re-read the lesson and try again.' Below this message is a 'Continue' button. An arrow points from a box labeled 'Incorrect Answer' to the feedback message.

Figure 20



Select the correct answer

Which is the world region with the highest desalination total capacity?

Your answer :
Middle East

It's correct. Go to the next lesson.

Continue

Correct Answer

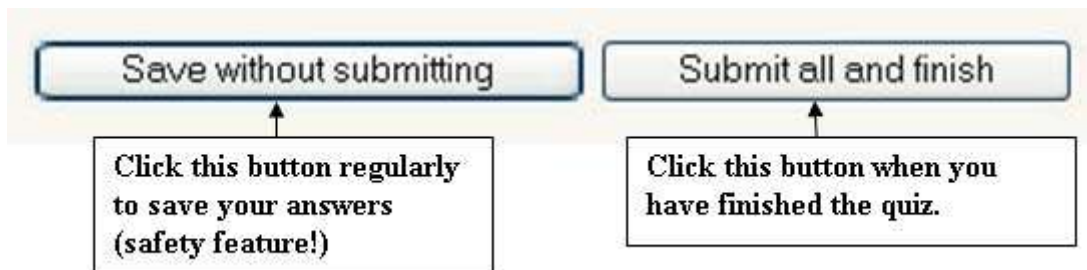
Detailed description: This figure shows the feedback for a correct answer. It features the same question graphic and text as Figure 19. Below the question, it displays 'Your answer : Middle East'. A message follows: 'It's correct. Go to the next lesson.' Below this message is a 'Continue' button. An arrow points from a box labeled 'Correct Answer' to the feedback message.

Figure 21

8. Quiz

The Quiz tool is used to make on-line tests, which can consist of various question types. Each Chapter (1 to 9) has one Quiz, that you have to answer correctly.

At the end of your quiz you'll find two buttons. One, **Save without submitting**, is meant as a safety feature to save your answers from time to time, while you are working on the quiz. If something happens, like a power failure or something, your answers remain saved. The second button, **Submit all and finish**, is to submit the quiz when you have answered all the questions (If you omit to submit a quiz before the availability runs out, your answers will be saved but your grade will be zero!):



Note that when you click either button you must **give the quiz page time to save and reload before moving to another page!** This can take some time depending on the size of the quiz page, the number of essay questions and the speed of your connection. So, before moving to another page, make sure the quiz page has reloaded entirely and the timer (if any) has reappeared!

You only have one time to do the quiz. Once you have submitted and finished a quiz, you are shown a result page like this:

You will be able to review the quiz and see feedback and/or correct answers displayed (sometimes you need to move your mouse over the answer to see the feedback). Learning from your mistakes is one of the most efficient ways of learning. The result of the quiz will be displayed on your Grades page.

9. Serious Game

In order to learn in a constructivism form, we create different games with words related to desalination. You can play the time you want because there is no score.

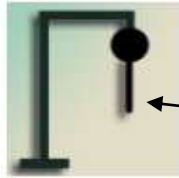
The games are:

- Hang Man
- CrossWord
- Snakes and Ladders
- Sudoku

a) **Hang Man:** This game takes words from a Glossary a hangman puzzle.

Example:

Water obtained by condensation of steam or water vapor.



You have **4** tries

Wrong letters

Letters: A B C D E **F** G H I J K **L** M N O P Q R S T U V W X Y Z

Grade : 3 %

Water obtained by condensation of steam or water vapor.



You have **ONLY 1** try

Correct Answer

C _ _ **D** _ _ _ **A** _ _

Letters: **A** **B** **C** **D** E F G H I J K L M N O P Q R S T U V W X Y Z

Grade : 16 %

Water obtained by condensation of steam or water vapor.

CONDENSATE

Congratulations

Game Over.

You can finish the game or play a new one.

[New game](#)

[End of game](#)

Grade : 41 %

- b) **Crossword:** This game takes words a Glossary generates a random crossword puzzle. You can press the button “Check crossword” to check if the answers are correct. Every crossword is dynamic so it is different to every student.

Example:

La Plaza de la Formación

Inicio > PRODES > Games > Crossword

.....
Across, 9 letters.

Organic nonfossil material of biological origin constituting a renewable energy source.

BIOENERGY

OK Cancel

Click the crossword and answer the question

Check crossword End of crossword game Print

You can check the answer , end the game or print the crossword.

The result

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

1

2

3 B I O E N E R G Y

4

5

6

7

8

9

10

11

12

13

14

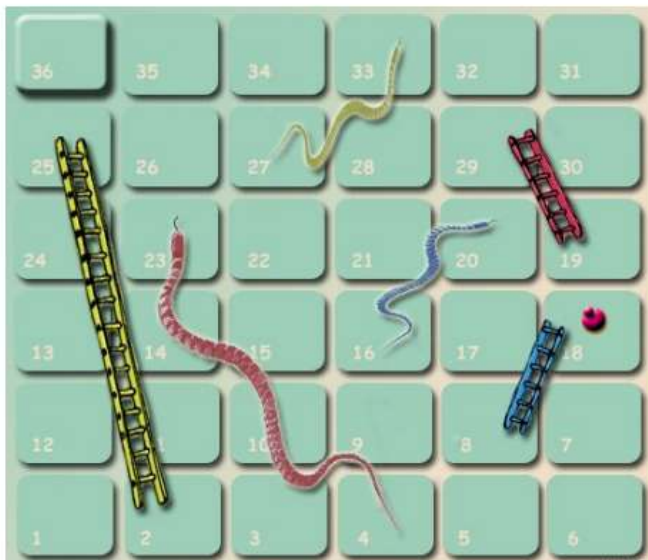
- c) **Snakes and Ladders:** You have to traverse a traditional “Snakes and Ladders” board by answering questions taken from a Glossary. As you get an answer right, the dice is rolled and a random number displayed. The game piece is moved ahead that many squares. If the game piece is in the bottom of a ladder and the answer is correct, it goes to the top. If the game piece is in head of snake and the answer is wrong, it goes to the tail.

EXAMPLE:

A process that separates small particles from water by using a porous barrier to trap the particles and allowing the water through.
 Answer:

Grade answers

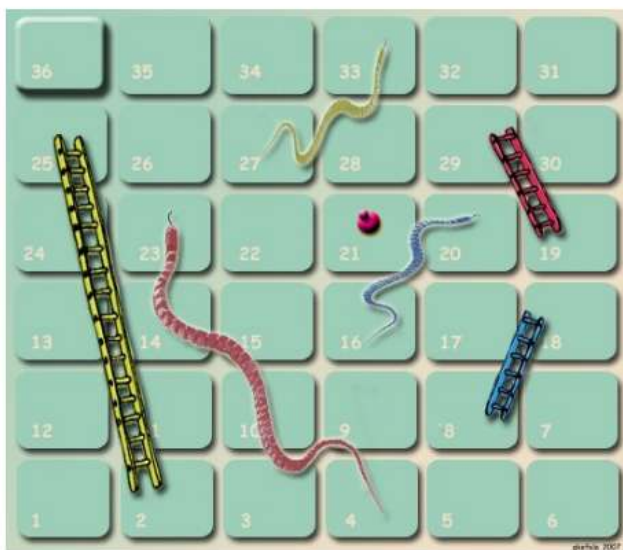
Correct answer



Check the answer and roll the dice

Grade answers

Ions with positive charge
 Answer:



$18 + 3 = 21$



- d) **Sudoku:** These Game Shows a sudoku puzzle with not enough numbers to allow it to be solved. For each question you correctly answer, an additional number is slotted into the puzzle to make it easier to solve.

EXAMPLE:

1	<input type="text"/>	<input type="text"/>	6	A11	A12	<input type="text"/>	9	5
5	<input type="text"/>	<input type="text"/>	9	<input type="text"/>	<input type="text"/>	<input type="text"/>	3	2
9	<input type="text"/>	<input type="text"/>	8	<input type="text"/>	A18	<input type="text"/>	<input type="text"/>	<input type="text"/>
<input type="text"/>	6	<input type="text"/>	A37	4	<input type="text"/>	1	<input type="text"/>	<input type="text"/>
<input type="text"/>	5	<input type="text"/>	<input type="text"/>	1	A42	3	<input type="text"/>	6
<input type="text"/>	2	A36	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
A55	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	8	<input type="text"/>	1	3
<input type="text"/>	A59	7	A67	3	5	2	<input type="text"/>	<input type="text"/>
<input type="text"/>	A62	4	<input type="text"/>	<input type="text"/>	7	<input type="text"/>	<input type="text"/>	<input type="text"/>

Grade answers

A11. The chemical transformation of a substance in solution into an insoluble form (precipitate).

Answer:

A12. A process that separates small particles from water by using a porous barrier to trap the particles and a

Answer:

A18. A measure of non-transparency of water due to the presence of suspended matter.

ANNEX II – Practical Exercise

PRESENTATION

WHAT IS THIS ?	MEANING OF CELLS (4 different colours: yellow, green, blue, white)
<p>This EXCEL file is the tenth and last chapter of the e-learnig course. The idea is to complete the theory of the previous chapters by running the basic equations for a simple design of an autonomous desalination system.</p>	<p>Data or information to be read Results (automatic filling) TITLES Default value or empty, to be modified or filled by you</p>
HOW TO USE IT ?	
<p>Please, proceed as follows: 1. Read the INPUT DATA sheet to become familiar with the data, please pay attention to the Observations column; 2. Go to the RESULTS sheet and see the output data; 3. Go to the last sheet, read carefully every question and reply them. You will be requested to run a specific simulation by modifying some input data and then comment the results, which will be generated automatically. Use additional cells to copy & paste some results in order to answer the questions. If you have any problem, do not hesitate to contact your teacher.</p>	
THE OBJECTIVES	<div style="border: 1px solid black; height: 15px; width: 100%;"></div>
<p>The main objectives are to have a first contact with the main operation and design parameters of the system, to have a first idea of the main amounts and to identify preliminary findings / conclusions.</p>	
THE AUTHORS	
<p>Team of the Water Department of the ITC (Vicente J. Subiela, Baltasar Peñate, Juan A. de la Fuente)</p>	

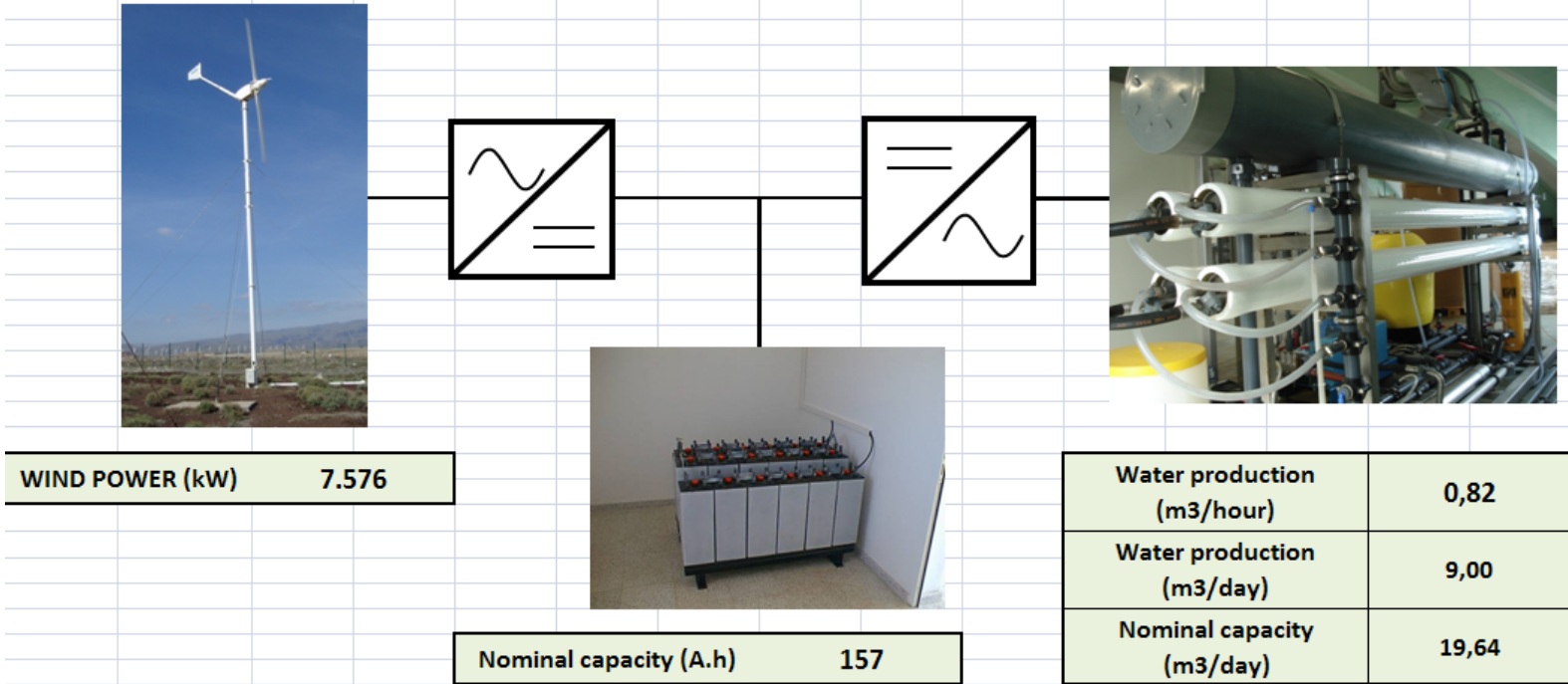
Case 4, INPUT DATA

PRESENTATION				
Consider a place with availability of solar resources and a certain water demand. Check the input data and complete the empty values according to the indications of the column "Observations"				
INPUT DATA. (*) means mandatory field				
	Concept	Value	Unit	Observation
LOCAL DATA	Number of people *	300	units	Recommended value: under 500
	Per capita water demand *	30	liters/day	From 20 - 50 l/day
	Location		-	Place (Country)
DESALINATION PLANT	Efficiency of RO pump *	80%	%	About 80%
	Efficiency of feed pump *	50%	%	About 50%
	Operation pressure in RO *	60	bar	Consider 50 - 65 bar for seawater and 8 - 15 for brackish water
	Pressure in feed pump *	5	bar	Consider 3 - 6 bar
	Recovery *	35%	%	Consider 30 - 40 % for seawater and 65 - 75 % for brackish water
	Estimated daily operation time *	11	hours / day	Consider 12 hours for a very good wind place, 9 for a medium, 6 for a low
BATTERIES	Operation DC Voltage *	48	VDC	Most common and recommended value
	Efficiency of batteries & inverter *	65%	%	Consider from 62 - 70 %
	Number of autonomy days *	1	-	Days with energy supply from batteries. One day is the recommendation
	Discharge depth *	62%	%	Consider from 60 - 65 %
	Unitary DC Voltage *	2	VDC	Most common value is 2 VDC
	Efficiency of charge controller *	90%	%	Consider from 85 - 95 %
	Efficiency of inverter*	90%	%	Consider from 85 - 95 %
WIND DATA	Equivalent hours	3500	hours	Ratio between output energy and nominal power. Consider 2,000 h. for a medium-low wind place; 3,000 h. for a medium-high, and 4,000 h. for a high wind
UNITARY COSTS	Unitary Cost of RO unit	3000	€/installed daily cubic meter	Suggested values: 3,000 € for seawater and 1,000 € for brackish water
	Unitary Cost of wind system	4	€/peak watt	
	Unitary O&M cost	3,5	€/m3	
	Lifetime of installation	20	years	Between 15 and 20

Case 4, RESULTS

	Concept	Value	Unit	Observation
LOCAL DATA	Total local demand	9.000	liters/day	
DESALINATION PLANT	Demanded product water flow	0,82	cubic meters/hour	
	Nominal capacity	19,64	cubic meters/day	
	Feed water flow	2,34	cubic meters/hour	
	Power of RO pump	4.870	Watts	Equation includes the conversion from bar to Pa and from hours to seconds
	Power of feed pump	649	Watts	Equation includes the conversion from bar to Pa and from hours to seconds
	Total demanded power	5.519	Watts	
	Total daily demanded energy	60.714	Watts.hour	
	Energy required in stops	3.036	Watts.hour	Consider 5% of energy demand for pumping for flushing, valves, control and other auxiliar loads.
BATTERIES	Energy demanded to batteries	4.670	Watts.hour	Energy to cover just the RO demand during stops.
	Usefull capacity of batteries	97	Ampers.hour	
	Nominal capacity of batteries	157	Ampers.hour	
	Number of batteries vessels in serial	24	units	
WIND SYSTEM	Daily energy form the wind generator	72.650	Watts.hour	
	Total installed wind power	7.576	Watts	
ESTIMATED ECONOMIC COSTS	Cost of the RO unit	58.909	€	
	Cost of the wind system	30.305	€	
	Cost of water	4,86	€/cubic meter	Bank interest, costs of transport, building and other expenses are excluded

Case 4, SUMMARY & QUESTIONS



QUESTION 1

Calculate two examples, one for seawater and other for brackish water and compare the results. Copy the above values (Wind power, nominal capacity of batteries and water production) and comment the differences.

ANSWER

QUESTION 2

Consider two locations, one with high wind and other with low wind, and compare the above results. Which is the relation between the wind power for the two situations?. Comment the results

ANSWER