

**CDM-EB89-AA-A05**

## Concept note

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# Further development of the online platform for voluntary cancellation of CERs

Version 01.0



**United Nations**  
Framework Convention on  
Climate Change

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## **1. Procedural background**

1. The Executive Board of the Clean Development Mechanism (CDM) (hereinafter referred to as the Board) approved activities to further nurture demand for the CDM and its certified emission reductions (CERs) at its eighty-seventh meeting (EB 87), as part of the 2016 Management Plan (MAP) for the CDM. One of the priorities that the Board emphasized was the need to further develop the online platform for the voluntary cancellation of CERs (hereinafter referred to as the platform) so as to make it more user-friendly.
2. At its eighty-eighth meeting, the Board considered a concept note on the further development and promotion of the platform and requested the secretariat to provide feedback on the development activities and to propose a solution for simplifying the process for selecting CERs (also referred to as offsets) on the platform by users at its next meeting.
3. With its decision 6/CMP.11, paragraph 5, the Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol (CMP) requested the Board and the secretariat to facilitate access to the section concerning sustainable development in the project and programme design documents of the CDM project activities and programme of activities on the platform.
4. This work relates to the activity 'Further development and promotion of the voluntary cancellation tool' under objectives 2(a): 'Facilitate the acceptance of CERs for compliance purposes'; 2(b): 'Enhance the use of the CDM for voluntary purposes'; and 2(c): 'Further develop the CDM as a key tool for monitoring, reporting and verifying the outcomes of mitigation finance with a resource allocation' as referred to in table 5 on page 16 of the CDM two-year business plan 2016–2017 and management plan 2016 (EB87, annex 1).

## **2. Purpose**

5. This concept note provides an update on the latest technical developments of the platform and feedback from the analysis of user activities since its launch. Further on, it discusses possible solutions for introducing a capability for fast-track selection of offsets, previously referred to as the "express option", and concludes with recommendations for further technical development of the platform.

## **3. Key issues and proposed solutions**

### **3.1. New features released in April**

6. In April, the secretariat released version 3 of the platform. Version 3 delivered:
  - (a) Bank transfer payment method;
  - (b) Layout and reporting optimizations;
  - (c) Attestation preview;

- (d) Set of functionalities for the providers of CERs (hereinafter referred to as the providers), including colour coding for tracking orders, exportable report with order details, and automatic invoicing for orders with tax;
  - (e) Links to the sections with information on sustainable development co-benefits in the project design documents (PDDs).
7. The addition of the bank transfer payment modality expands the geographical coverage of the platform to every country with a functioning retail-banking system. The bank transfer payment method requires the offset provider to e-mail banking details to the respective purchaser for each order and to confirm online when a payment is received in order for the voluntary cancellation to take place. The new payment method can be added to a provider as a stand-alone method or in addition to the existing PayPal and credit card payment methods. Experience gained with this payment method will be analysed with a view to optimizing its use.
  8. The new functionalities for providers allow their activities to be scaled up by automating invoicing and by introducing reliable tracking and online reporting of their activities. The automatic invoicing is currently activated for transactions involving tax. Depending on the interest, it can be switched on for all paid orders.
  9. With respect to facilitating better access to the information on sustainable development co-benefits, the platform's project view pages now contain links to the relevant sections of the PDDs. This is in addition to sustainable development report links and to displaying the relevant co-benefits categories on the right-hand side of the project view pages. Depending on the behaviour of the browser, the added links to the PDDs may not open the relevant pages exactly. For ease of reference, notes indicating the relevant PDD page number are included next to each link.

### **3.2. Analysis of user activities and proposal for translation of the platform**

10. An analysis of user activities from the initial launch of the platform is included in the appendix, figures 1 and 2. The trends seen from analysing cancellation transactions and total CERs cancelled on the basis of country of origin remain unchanged since the last report at the previous Board meeting because the recent activity remains low.
11. Figure 3 of the appendix adds new information on the language preferences of users according to the country from where they access the platform. The conversion rates of sessions on the Go climate neutral now site to sessions on the platform and to cancellations and the conversion rates of sessions on the platform to cancellations indicate that:
  - (a) Users from English-speaking countries (or where English is a common second language) complete cancellations more often. The same applies to users from French-speaking regions;
  - (b) Russian and Arabic have low conversion rates, while users who access the platform from China have higher conversion rates but overall low volume;
  - (c) Users from Spanish-speaking regions are the second largest group that accesses the Go climate neutral now site and have a high rate of moving from there to the platform but show a very low conversion rate to cancellations. This indicates that the platform's availability in English only is a barrier to taking action and that

translating it to Spanish has the best potential to increase the number of users as well as the conversion rates.

12. The Board has previously expressed the view that the secretariat should consider translating the platform into all UN languages. While some of the translation work could currently be accommodated by internal resources (for French and Spanish), translation into other languages would require external services. The approximate cost of external translation would be USD 10,000 per language and could be completed in two to three months. For languages that could be accommodated internally, the secretariat estimates a translation effort of one man-month per language.
13. Considering the above analysis and cost implications, the secretariat recommends that work begins to translate the platform into Spanish and French as soon as possible. Adding the remaining UN languages could be considered as a second stage and be managed as a package for external service delivery.

### **3.3. Options for fast-track selection of offsets**

14. In contrast to the few known online facilities for offsetting greenhouse gas emissions, which offer offsets at a single price, the UN platform allows a multitude of providers to offer their products at different prices, currently ranging between US\$ 0.85 and US\$ 5.00 per tonne. The product variety and price differentiation require purchasers of voluntary cancellation of CERs (the purchasers) to make their selections on the basis of a product search. This search process complicates the experience of the purchasers, particularly those who are not interested in the particular characteristics of the offsets but wish to have a simple user interface.
15. The Board requested the secretariat to identify and propose solutions for enabling purchasers to expressly select offsets for a given quantity with just a few clicks. The Board made this request with the understanding that such “express option”, if implemented, could serve other purposes, such as integration of the platform with other information systems that generate demand for cancellations.
16. The Board also requested that the solutions not be based merely on lowest price but that they aim to randomize the selection as much as possible in order to avoid favouring projects that can afford low-price offers. Another suggestion was a portfolio-based selection model, in which the order quantity would combine offsets from multiple projects.
17. In developing the solution options, in addition to the Board’s guidance, the secretariat sought to:
  - (a) Identify simple options that could be upgraded if the experience and future demand suggest so;
  - (b) Limit complexity to minimize implementation costs;
  - (c) Cover only offers that can be paid online (with PayPal or credit card) to satisfy the “express” condition;
  - (d) Factor-in the “lowest-price” criterion because it is a primary consumer preference.

18. This section continues with elaborating three possible models for automating the selection of offsets from active offers. It then suggests how the models could be used individually or combined in a final-solution concept.
19. The idea behind each of the three models is either ordering the active offers in a queue to be picked-up, or making a random selection on the basis of probability ranges. The criteria for ordering/ranking the offers and the principles for selecting the offsets are stated for each model, alongside the advantages and disadvantages. The idea of building a portfolio of offsets for orders that pass a threshold quantity is also explored.
20. It should be noted that the three models apply only to the selection of offsets and not to the checkout process. The possibilities for simplifying the checkout are limited, or nil, because the platform, as an underlying principle, does not store user payment details or participate in any way in the financial transactions between users.
21. The three options are:
  - (a) The lowest-price model;
  - (b) The revolving model;
  - (c) The random model, based on probability ranges.

### **3.3.1. The lowest-price model**

22. Arguably, it would be unreasonable to ignore the price motivation in developing options for express selection of offsets, as rational consumer choices are typically based on the price/quality relationship. By its very definition, the express option assumes that the purchasers are not interested in the source of offsets and/or their attributes (as they consider all offsets offered on the UN platform of equal quality). Therefore, they may only be interested in the simplicity of the process and the price they have to pay. Assuming price indifference runs the risk of returning purchasers being confused by possible price volatility if the express selection is completely randomized and they happen to pay prices once closer to the lower- and once closer to upper-price-bound.
23. To improve the prospects of higher-priced offsets being selected (and not just the least expensive ones), the lowest-price option is recommended for use only in combination with one of the other two options. This is explained later on.
24. The mechanism of this options is the following:
  - (a) All active offers are ordered in a queue from lowest to highest price per tonne;
  - (b) If more than one offer has the same price, the first in the queue will be the offer for the project that is longer on the platform;
  - (c) As express orders start to generate revenue, additional re-ordering of same-price offers will be based on the accumulated revenue, with offers with more revenue moving to the back of the queue within the price level;
  - (d) Offers for the same block of CERs that are cancelled and re-published with a different price will be queued according to the three criteria above. This is possible because the platform permanently stores information about accumulated

revenue per issuance request and date on which a project joined the platform (this prevents gaming by reissuing orders at different prices);

- (e) If the order quantity cannot be satisfied by the first offer in the queue, the selection will move to the first offer that can;
- (f) Offsets will be picked up from the first offer in the queue until the offer's quantity is exhausted.

25. Advantages of this option:

- (a) A rational consumer who is indifferent to the offset's characteristics and who bases the choice on price;
- (b) No price volatility as the lowest-price offer that meets the desired quantity is picked-up;
- (c) Easy to understand by users.

26. Disadvantages of this option:

- (a) Unequal possibility for all projects to be selected. Favours only cheap offsets;
- (b) Projects with high-quantity availability can crowd out all other projects;
- (c) Price wars.

27. A tabular simulation for this model is presented in table 1 of the appendix.

### 3.3.2. The revolving model

28. This option is built on the lowest-price option. It avoids high-quantity low-price offers blocking the queue and smooths out price volatility. It achieves these two objectives by introducing queue rounds, maximum quantity/revenue amount per round and price mirrors. The mechanics are as follows:

- (a) The principles of queuing offers are the same as in 3.3.1., including the principle of selecting the first offer in the queue that satisfies the order quantity.

In addition:

- (b) All projects are assigned the same maximum quantity of offsets per round of queuing, e.g. 5,000 tonnes.<sup>1</sup> Alternatively, the limit can be established in relation to revenue earned from the express option (rather than quantity);
- (c) Offers from the same project will participate in a round of queuing until the quantity (or revenue) limit is exhausted, irrespective of how many offers are published for the project (e.g. offers for the same block can be cancelled and re-published with changed parameters, multiple offers per project at different prices, etc.);

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<sup>1</sup> No consideration was given to CERs' applicable commitment periods as the policy is to permit offers on any CERs held in the CDM registry for which the share of proceeds is paid.

- (d) To avoid a price drop when transitioning from one queue round to the next, the offers in each subsequent queue round will be ordered in reverse to the preceding one, e.g. lowest-to-highest price will be followed by highest-to-lowest price order, and vice-versa, while all other parameters remain the same;
  - (e) To avoid stranded situations, a condition for a maximum number of days in first position may be added.
29. Advantages of this option, in addition to those listed in 3.3.1:
- (a) While price is still a factor, the chances for a project to be selected would be a function of time and demand (large-quantity offers would not crowd out other offers due to the set limit per round);
  - (b) Price volatility between rounds is smoothed out through the mirroring effect.
30. Disadvantages of this option:
- (a) The round limit quantity/revenue should be carefully established, as changes would have an impact on the impartiality of the method;
  - (b) Purchasers may be paying substantially more than the lowest available price. In effect, this is a premium for using an express option;
  - (c) If the revolving limit is set at revenue level, less expensive options will attract more sales<sup>2</sup>;
  - (d) The mechanism of this option, what it actually offers to the user, is difficult to be explained in a few words (e.g. in an online tip) in order to enable a choice by a purchaser of voluntary cancellation (see section 3.3.5.).
31. A tabular simulation for this model is presented in table 2 of the appendix.

### **3.3.3. Random model on the basis of probability ranges**

32. This model has the following features:
- (a) Probability ranges are assigned to all CER blocks through a simple mechanism (based on infinitesimal values). All ranges are distributed between the values zero and one;
  - (b) Random numbers between zero and one are generated automatically (on the basis of a simple algorithm) and matched to a probability range. The offer to which the range applies will supply the offsets;
  - (c) As revenue per block is earned, the probability ranges are adjusted inversely proportionally (irrespective of number of reissued offers for the block and seniority/online-availability of the project according to the entry date on the platform).
33. Advantages of this option:
- (a) From provider's perspective, price is not a factor in selecting the offsets;

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<sup>2</sup> This is considered a disadvantage in view of the Board's guidance to limit favoring of low-price offers.



- (b) Maximizes the principle of equal chance for selection.
34. Disadvantages of this option:
- (a) From purchaser's perspective, price is not a factor in selecting the offsets;
  - (b) Favours projects with multiple offers/blocks;
  - (c) Significant price volatility.
35. A tabular simulation for this model is presented in table 3 of the appendix.
36. To address price volatility, this model is suggested for use either in combination with one of the other two models (see section 3.3.5) or in combination with a maximum amount that the purchaser is willing to pay for a given quantity. In the latter case, the purchaser will be requested to key in two values in the express option screen:
- (a) Quantity of offsets;
  - (b) Maximum amount willing to pay (not individual price per tonne).
37. A simple division of total amount by quantity would determine the threshold price per tonne under which all offers are eligible for a random selection.

### **3.4. Sourcing orders from multiple offers – the portfolio model**

38. The portfolio model is a concept that can be built on any of the three express selection models. It would involve the quantity for the order to be fulfilled by combining offsets from multiple offers and thus further increasing the changes for individual projects to be selected.
39. This model would be meaningful for a minimum order quantity with a pre-defined number of projects that form the portfolio. The parameters for minimum order quantity and number of projects to fulfil the order quantity would be an arbitrary choice, e.g. an algorithm stating: "For an order quantity of 20 tonnes, select from four projects".
40. An alternative approach would be to define a fixed number of offsets per project (rather than a minimum order quantity) for inclusion in the order quantity, which, after being reached for one project, would move to the next project randomly.
41. To increase the frequency with which a project is selected (not the quantity or revenue), the portfolio model could be implemented as an add-on to each of the three selection models identified earlier. However, the portfolio model would require the current restriction for separate checkout per vendor to be removed. This has become technically possible with the latest version of the software for the integration of the platform with PayPal (the PayPal plug-in). The cost of introducing the portfolio approach would incur additional development costs of around EUR 30,000, not including staff effort by the secretariat.
42. The impact on user experience and project success rate from introducing the portfolio approach is difficult to estimate, but it is considered not to be significant. Furthermore, its addition at a later stage is technically possible at the same cost. Therefore the recommendation is to postpone the portfolio option to a later stage.

### 3.5. Proposed express option solutions

43. The three express selection models could be used in different combinations or as a stand-alone choice in the express option process. For example, the express option process could follow the path where the purchaser first states the desired quantity of offsets and at the second step either:
- (a) Makes a choice of the selection model (which is supported by a short description of what each model entails); or
  - (b) Specifies a maximum amount willing to pay that triggers a specific [defined] selection model.
44. While in (a), the choice could be any of the three models, for simplicity it is proposed that the choice be limited to one of two models, e.g. between lowest-price and random model or between revolving and random model. The lowest-price and the revolving models are close in concept; having to rely on short descriptions for the choice may be confusing for the user. To enable the choice, after the field for quantity, the user interface can provide radio buttons with pop-up descriptions for each model for the purchaser to tick.
45. In (b), the maximum amount would be used to limit the sample of offers eligible to fulfil the order. The fraction “total amount divided by quantity” would determine the threshold price per tonne under which all offers are eligible. From within that sample, the final selection could be made on the basis of the revolving or the random model (described in sections 3.3.2 and 3.3.3, respectively). If the resulting threshold price is too low, the system will automatically reply that no offer meets the requirement of the user.
46. Neither of these two final-solution approaches have apparent advantages over the other. Therefore it is difficult to make a specific recommendation. The strength of the arguments would depend on the point of view of what is fair and what is valuable to each group of users. From what the Board has expressed as earlier preferences and considerations, it appears that approach (b) better fits the requirements for simplicity and randomization of selection (i.e. it avoids favouring lowest price).
47. A graphical representation of the two solution approaches is included in point 4 of the appendix.

## 4. Impacts

48. Implementing the recommendations is expected to have positive impact on the demand side for voluntary cancellation by offering a simplified user experience in three languages.
49. Implementing the express option mechanism can serve as the basis for integrating the platform with other systems that can generate demand for voluntary cancellation in a business-to-business or business-to-client solution model. This is because integration of this kind would require an automated approach that integrates the system with the platform to select offsets.

## **5. Subsequent work and timelines**

- 50. The translation of the platform into Spanish and French with internal staff resources is expected to take approximately three months and can be completed in the second half of 2016.
- 51. Implementing an express option would also take up to three months, including planning, development, testing and release.
- 52. The two activities are independent and can be completed in parallel.

## **6. Budget and costs**

- 53. The estimated cost for implementing either of the two recommended solution approaches is up to USD 60,000. This cost can be absorbed by the current 2016 MAP.
- 54. The translation of the platform into Spanish and French can be accomplished by internal effort and absorbed by the staff resources approved in the 2016 MAP.

## **7. Recommendations to the Board**

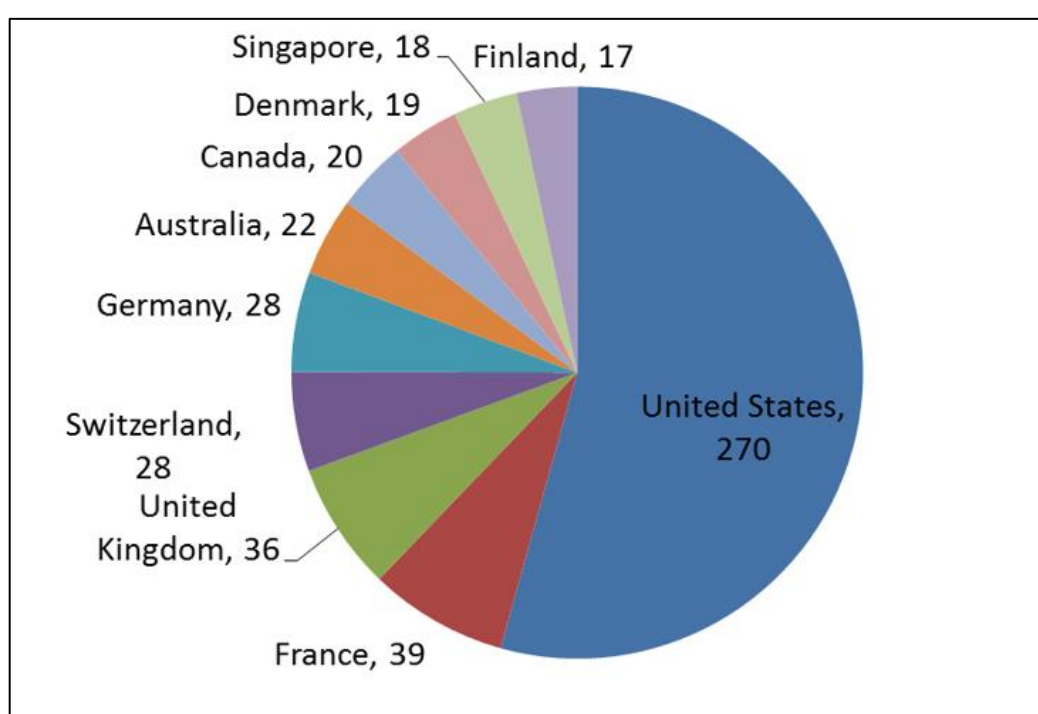
- 55. The secretariat invites the Board to consider and provide guidance on the following recommendations:
  - (a) To make the platform available in Spanish and French in 2016;
  - (b) To approve one of the following solution approaches for the implementation of an express option for selection of offsets:
    - (i) Purchasers to be required to state a desired quantity and to choose between lowest-price and random model for selecting offsets;
    - (ii) Purchasers to be required to state a desired quantity and a maximum amount they are willing to pay. The selection to be completed on the basis of the random model, factoring in the stated maximum amount.
- 56. The Board may wish to provide further guidance as it deems appropriate.

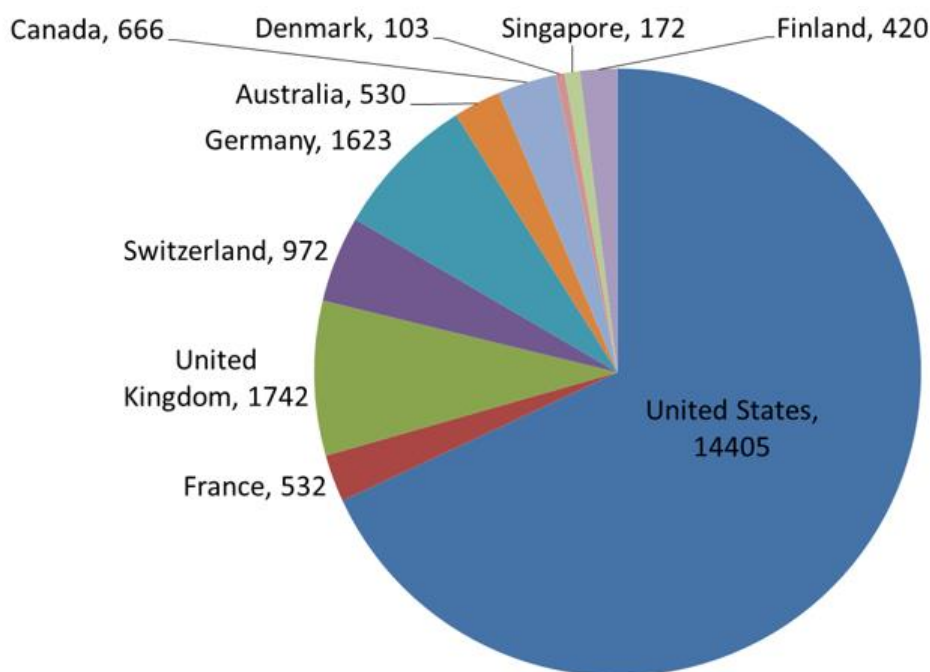
## Appendix. Visual aids

### 1. Information on user activities based on country of origin

1. The following two figures illustrate the number of transactions per country and number of CERs cancelled per country. Up-to-date figures will be provided in the presentation to the Board.

**Figure 1. Number of transactions per country**

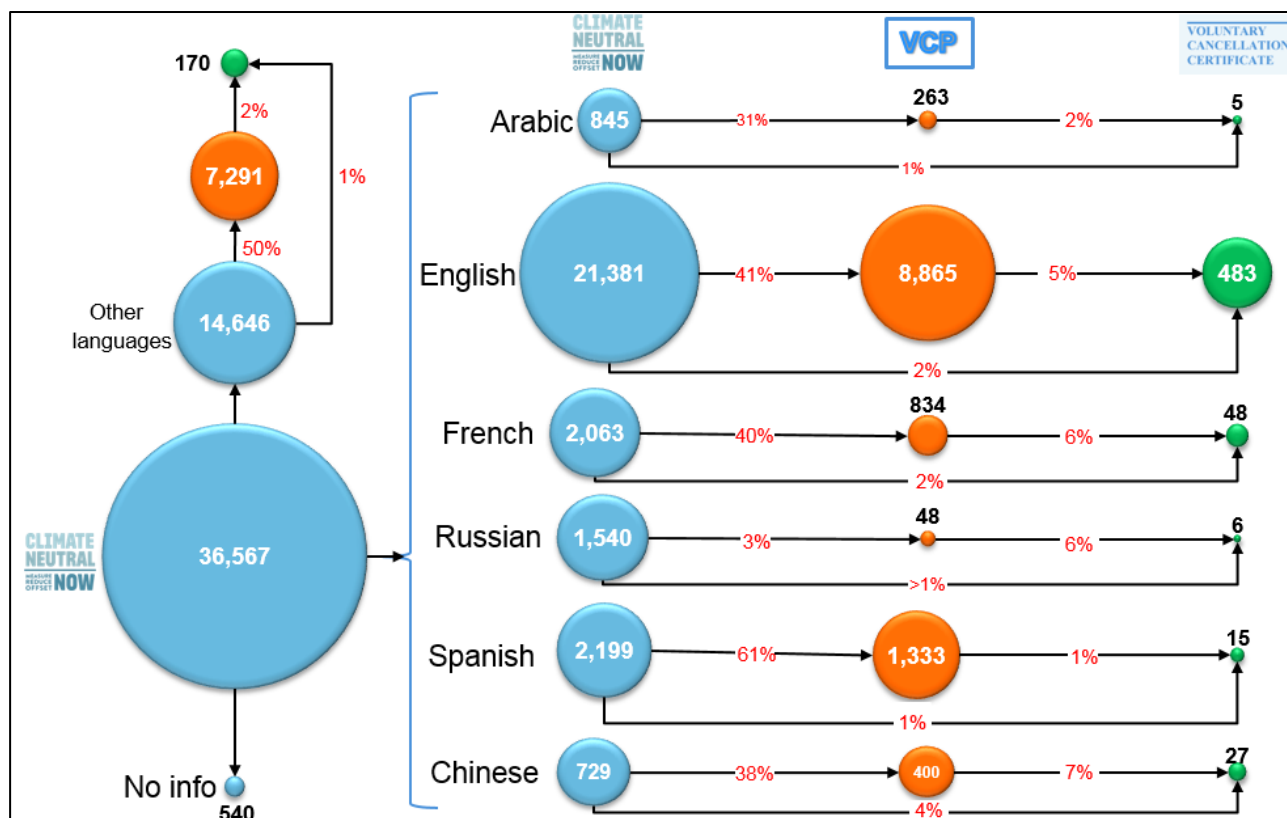


**Figure 2. Number of CERs cancelled per country**

## 2. Information on language preferences based on country of origin

2. Figure 3 illustrates user activities (expressed in individual sessions) on the Go climate neutral now site and on the platform and how these convert into completed voluntary cancellation transactions. The languages are determined on the basis of the country from where the access takes place. The following should also be noted:
  - (a) The total number of sessions is grouped in UN official languages (36,567) and other languages (14,646). The left-side of the figure represent a breakdown of the session per UN language;
  - (b) The percentage values represent the conversion rates into sessions on the platform and into cancellations.

Figure 3. Language preference according to country of origin




### 3. Tabular presentation of the express selection models

#### 3.1. The lowest-price model


Table 1. A simulation based on the lowest-price model

T=0					
Offer Nr.	Date	Price	CERs	CERs sold Express	Acum. Revenue
1	26/09/2015	1	10000	0	0
2	20/11/2015	1	12300	0	0
3	12/12/2015	1.5	14600	0	0
4	21/12/2015	2	44500	0	0




15 CERs paid from offer 1

T=1					
Offer Nr.	Date	Price	CERs	CERs sold Express	Acum. Revenue
2	20/11/2015	1	12300	0	0
1	26/09/2015	1	99985	15	15
3	12/12/2015	1.5	14600	0	0
4	21/12/2015	2	44500	0	0



70 CERs paid from offer 2

T=2					
Offer Nr.	Date	Price	CERs	CERs sold Express	Acum. Revenue
1	26/09/2015	1	99985	15	15
2	20/11/2015	1	12230	70	70
3	12/12/2015	1.5	14600	0	0
4	21/12/2015	2	44500	0	0



30 CERs paid from offer 1

T=3					
Offer Nr.	Date	Price	CERs	CERs sold Express	Acum. Revenue
1	26/09/2015	1	99955	45	45
2	20/11/2015	1	12230	70	70
3	12/12/2015	1.5	14600	0	0
4	21/12/2015	2	44500	0	0

### 3.2. Tabular presentation of the revolving model

Table 2. A simulation based on the revolving model

Control_Round	150
MaxDaysFirst	3

initialization								
Offer Nr.	Date	Price	CERs	CERs sold Express	Accum. Revenu	Max Round	Round	Days on Top
1	9/26/2015	1	10,000	0	0	150	0	0
2	11/20/2015	1	12,300	0	0	150	0	0
3	12/12/2015	1.5	14,600	0	0	100	0	0
4	12/21/2015	2	44,500	0	0	75	0	0

T=0								
Offer Nr.	Date	Price	CERs	CERs sold Express	Accum. Revenu	Max Round	Round	Days on Top
1	9/26/2015	1	10,000	0	0	75	0	0
2	11/20/2015	1	12,300	0	0	75	0	0
3	12/12/2015	1.5	14,600	0	0	50	0	0
4	12/21/2015	2	44,500	0	0	38	0	0
4	12/21/2015	2	44,500	0	0	38	0	0
3	12/12/2015	1.5	14,600	0	0	50	0	0
2	11/20/2015	1	12,300	0	0	75	0	0
1	9/26/2015	1	10,000	0	0	75	0	0

T=1								
Offer Nr.	Date	Price	CERs	CERs sold Express	Accum. Revenu	Max Round	Round	Days on Top
2	11/20/2015	1	12,300	0	0	75	0	0
1	9/26/2015	1	99,985	15	15	75	0	0
3	12/12/2015	1.5	14,600	0	0	50	0	0
4	12/21/2015	2	44,500	0	0	38	0	0
4	12/21/2015	2	44,500	0	0	38	0	0
3	12/12/2015	1.5	14,600	0	0	50	0	0
2	11/20/2015	1	12,300	0	0	75	0	0
1	9/26/2015	1	10,000	0	0	75	0	0

T=2								
Offer Nr.	Date	Price	CERs	CERs sold Express	Accum. Revenu	Max Round	Round	Days on Top
1	9/26/2015	1	99,985	15	15	75	0	0
3	12/12/2015	1.5	14,600	0	0	50	0	0
4	12/21/2015	2	44,500	0	0	38	0	0
4	12/21/2015	2	44,500	0	0	38	0	0
3	12/12/2015	1.5	14,600	0	0	50	0	0
2	11/20/2015	1	12,300	0	0	75	0	0
1	9/26/2015	1	10,000	0	0	75	0	0
2	11/20/2015	1	12,100	200	200	75	2	0

T=3								
Offer Nr.	Date	Price	CERs	CERs sold Express	Accum. Revenu	Max Round	Round	Days on Top
3	12/12/2015	1.5	14,600	0	0	50	0	0
4	12/21/2015	2	44,500	0	0	38	0	0
4	12/21/2015	2	44,500	0	0	38	0	0
3	12/12/2015	1.5	14,600	0	0	50	0	0
2	11/20/2015	1	12,300	0	0	75	0	0
1	9/26/2015	1	10,000	0	0	75	0	0
1	9/26/2015	1	99,985	85	85	75	1	0
2	11/20/2015	1	12,100	200	200	75	2	0



↓

T=4									
Offer Nr.	Date	Price	CERs	CERs sold Express	Accum. Revenue	Max Round	Round	Days on Top	
3	12/12/2015	1.5	14,580	20	30	50	0	1	—
4	12/21/2015	2	44,500	0	0	38	0	0	—
4	12/21/2015	2	44,500	0	0	38	0	0	—
3	12/12/2015	1.5	14,600	0	0	50	0	0	—
2	11/20/2015	1	12,300	0	0	75	0	0	—
1	9/26/2015	1	10,000	0	0	75	0	0	—
1	9/26/2015	1	99,985	85	85	75	1	0	—
2	11/20/2015	1	12,100	200	200	75	2	0	—

↓

T=5									
Offer Nr.	Date	Price	CERs	CERs sold Express	Accum. Revenue	Max Round	Round	Days on Top	
3	12/12/2015	1.5	14,580	30	45	50	0	2	—
4	12/21/2015	2	44,500	0	0	38	0	0	—
4	12/21/2015	2	44,500	0	0	38	0	0	—
3	12/12/2015	1.5	14,600	0	0	50	0	0	—
2	11/20/2015	1	12,300	0	0	75	0	0	—
1	9/26/2015	1	10,000	0	0	75	0	0	—
1	9/26/2015	1	99,985	85	85	75	1	0	—
2	11/20/2015	1	12,100	200	200	75	2	0	—

### 3.3. Tabular presentation of the random model

Table 3. A simulation based on the random model

T=0								
Offer Nr.	Date	Price	CERs	CERs sold Express	Accum. Rev.	Inf	Sup	Next Random
1	9/26/2015	1	10,000	0	0	0.00	0.25	0.518
2	11/20/2015	1	12,300	0	0	0.25	0.50	
3	12/12/2015	1.5	14,600	0	0	0.50	0.75	
4	12/21/2015	2	44,500	0	0	0.75	1.00	

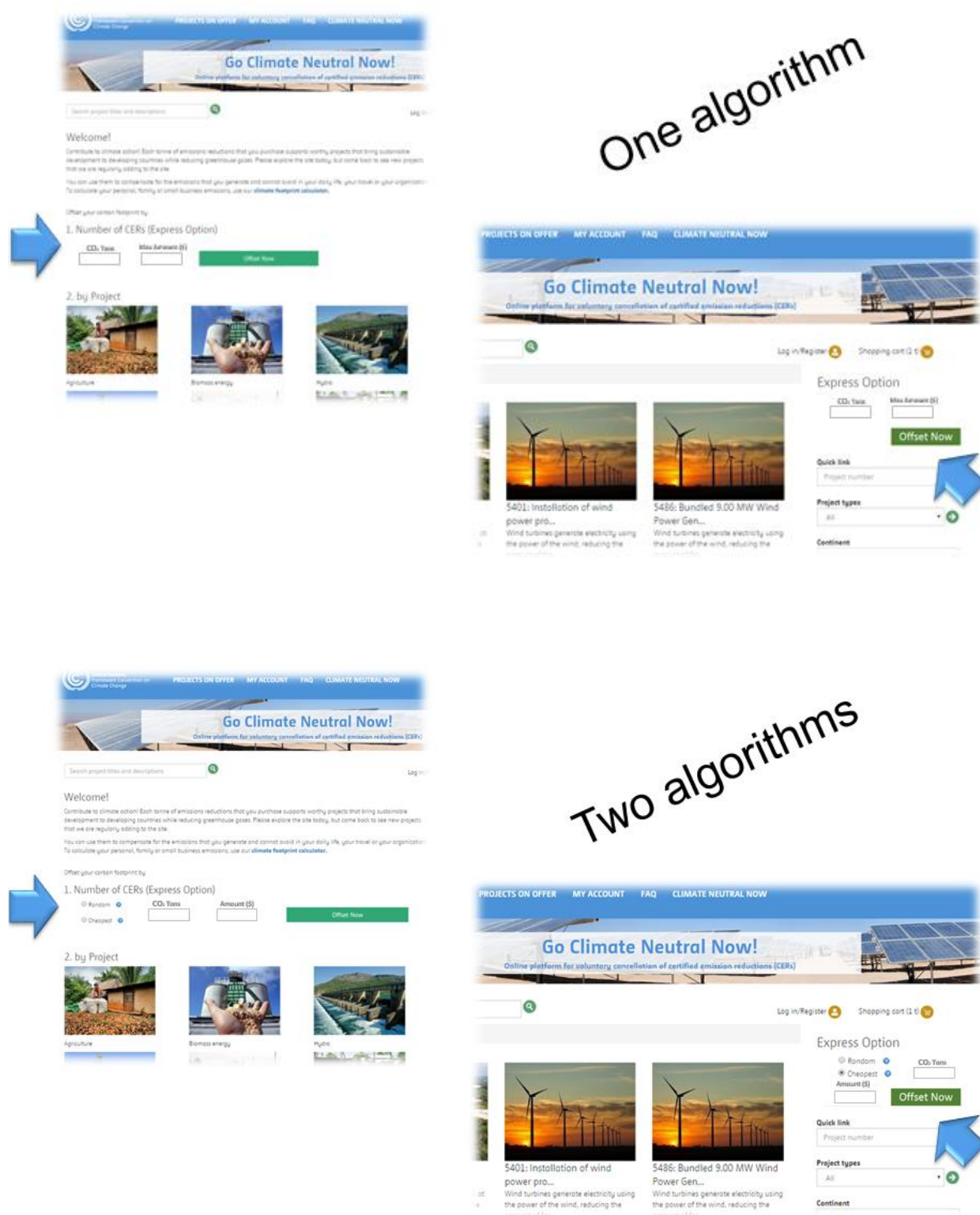
↓ 15 CERs

T=1								
Offer Nr.	Date	Price	CERs	CERs sold Express	Accum. Rev.	Inf	Sup	Next Random
1	9/26/2015	1	10,000	0	0	0.00	0.33	0.158
2	11/20/2015	1	12,300	0	0	0.33	0.67	
3	12/12/2015	1.5	14,600	15	23	0.67	0.67	
4	12/21/2015	2	44,500	0	0	0.67	1.00	

↓ 70 CERs

T=2								
Offer Nr.	Date	Price	CERs	CERs sold Express	Accum. Rev.	Inf	Sup	Next Random
1	9/26/2015	1	10,000	70	70	0.00	0.08	0.374
2	11/20/2015	1	12,300	0	0	0.08	0.41	
3	12/12/2015	1.5	14,600	15	23	0.41	0.67	
4	12/21/2015	2	44,500	0	0	0.67	1.00	

#### 4. Mock-up user screens for the two solution approaches



### Document information

<i>Version</i>	<i>Date</i>	<i>Description</i>
01.0	25 April 2016	Initial publication as an annex to the annotated agenda of EB89.
Decision Class: Operational		
Document Type: Information note		
Business Function: Governance		
Keywords: CERs, offsetting, language, pricing, technical aspects, voluntary cancellation		