INTERNATIONAL CIVIL AVIATION ORGANIZATION

TWENTY-SECOND MEETING OF THE ASIA/PACIFIC AIR NAVIGATION PLANNING AND IMPLEMENTATION REGIONAL GROUP (APANPIRG/22)

Bangkok, Thailand, 5-9 September 2011

Agenda Item 3: Performance Framework for Regional Air Navigation Planning and Implementation

3.5 Other Air Navigation Matters

ICAO FUEL SAVINGS ESTIMATION TOOL

(Presented by the Secretariat)

SUMMARY

Against a background of increasing concern regarding the impact of aircraft engine emissions on the environment, the ability to adequately estimate fuel burn and emissions savings accrued from operational improvements is of high importance.

This paper introduces the ICAO Fuel Savings Estimation Tool, a globally endorsed method, to estimate fuel savings resulting from national or regional operational improvements.

Action by APANPIRG/22 is in paragraph 3.

This working paper relates to Strategic Objective C: Environmental Protection and Sustainable Development of Air Transport.

1. INTRODUCTION

1.1 Operational improvements are a key strategy that can be applied to deliver tangible reductions in aircraft fuel consumption. The Global Air Navigation Plan (Doc 9750) and the Operational Opportunities to Minimize Fuel Use and Reduce Emissions (Circular 303) are among several documents providing guidance regarding operational improvements being implemented to improve efficiency of the ATM System.

1.2 However, to-date, a tool to assist those States without an automated means to estimate, model or report those benefits in a harmonized way, has not been available.

1.3 The purpose of this paper is to introduce the ICAO Fuel Savings Estimation Tool and discuss a strategy o to roll it out throughout the Region.

2. DISCUSSION

2.1 The ICAO Fuel Savings Estimation Tool (IFSET) was developed to be applied globally and has the ability to capture the difference in flight trajectory performance in terms of fuel consumption before and after implementation of operational improvements at local, regional or global level.

2.2 The tool is to assist the States to estimate and report fuel savings consistently with the models approved by ICAO's Committee on Aviation Environmental Protection (CAEP) and aligned with the Global Air Navigation Plan.

2.3 The tool is not intended to replace the use of detailed measurement or modelling of fuel savings, where those capabilities exist. Rather, it is provided to assist those States without such facilities to estimate the benefits from operational improvements.

2.4 Fuel savings can be enabled through the implementation of operational improvements in general categories such as reduced cruise time or distance, availability of optimal altitude, reduced taxi time and more efficient departure and approach/arrival procedures.

2.5 Simplifying assumptions are made regarding, *inter alia*, aircraft weight, aircraft centre of gravity (CG), engine thrust setting, meteorology, airframe/engine combinations, etc. As a result, the tool is not suitable for assessing the effects related to aircraft weight, thrust settings, or differences between aircraft/engine models.

2.6 The tool is intended to report differences in the fuel consumption based on the comparison of two scenarios and it is not appropriate to use the tool to compute the absolute fuel consumption for a specific procedure. It cannot be used for flight planning purposes or any other purpose that may affects safety of operations.

2.7 The tool will estimate the difference in fuel mass consumed by comparing a pre-implementation (i.e. "baseline") case against a post-implementation case (i.e. "after operational improvements"), as detailed in Appendix A to this paper.

2.8 To have all the necessary data to generate an annual report, it is proposed that any operational improvement being planned or implemented by a State/ANSP or the region should use IFSET or a more sophisticated model / measurement capability and report, at least, the data proposed in WP xx.

2.9 It is proposed that the benefits be sent to the regional offices as soon as the State/Region has the definition of the improvements to be made, considering that this information will be used for the generation of the ATM environment report to be issued by the end of 2012.

2.10 Recommendations: Considering the need to have a clearly defined regional approach for using IFSET as a tool for estimating environment benefits, the meeting is invited to adopt the following conclusion:

Conclusion 22 /x — Estimating environment benefits

That:

a) States are urged to use IFSET or a more sophisticated model/measurement capability available to estimate environment benefits accrued from operational improvements and the benefits should be reported on a quarterly basis to ICAO;

b) States agree that all plans to implement operational improvements shall encompass an environment benefits analysis.

3. ACTION BY THE MEETING

3.1 The meeting is invited to:

a) note the information provided in this paper; and

b) approve the draft conclusions at paragraph 2.10 above

— — — — — — — —

APPENDIX A

ICAO FUEL SAVINGS ESTIMATION TOOL (IFSET)

1. Fluxogram

The tool will estimate the difference in fuel mass consumed by comparing a pre-implementation (i.e. "baseline") case against a post-implementation case (i.e. "after operational improvements"), as illustrated notionally in Figures 1 and 2.

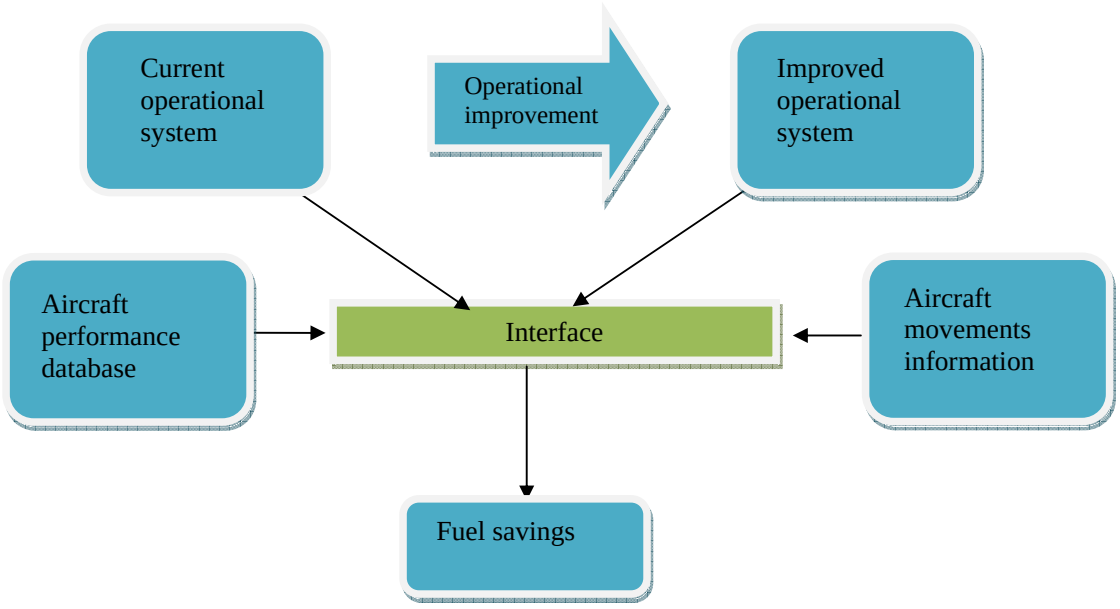


Figure 1. Notional fluxogram.

The selection of the baseline case is an important step of the process. It will be defined by the user and could correspond to:

- the published or planned procedure (AIP, flight plan) scenarios;
- the daily practices;
- a combination of the two;
- other criteria as appropriate.

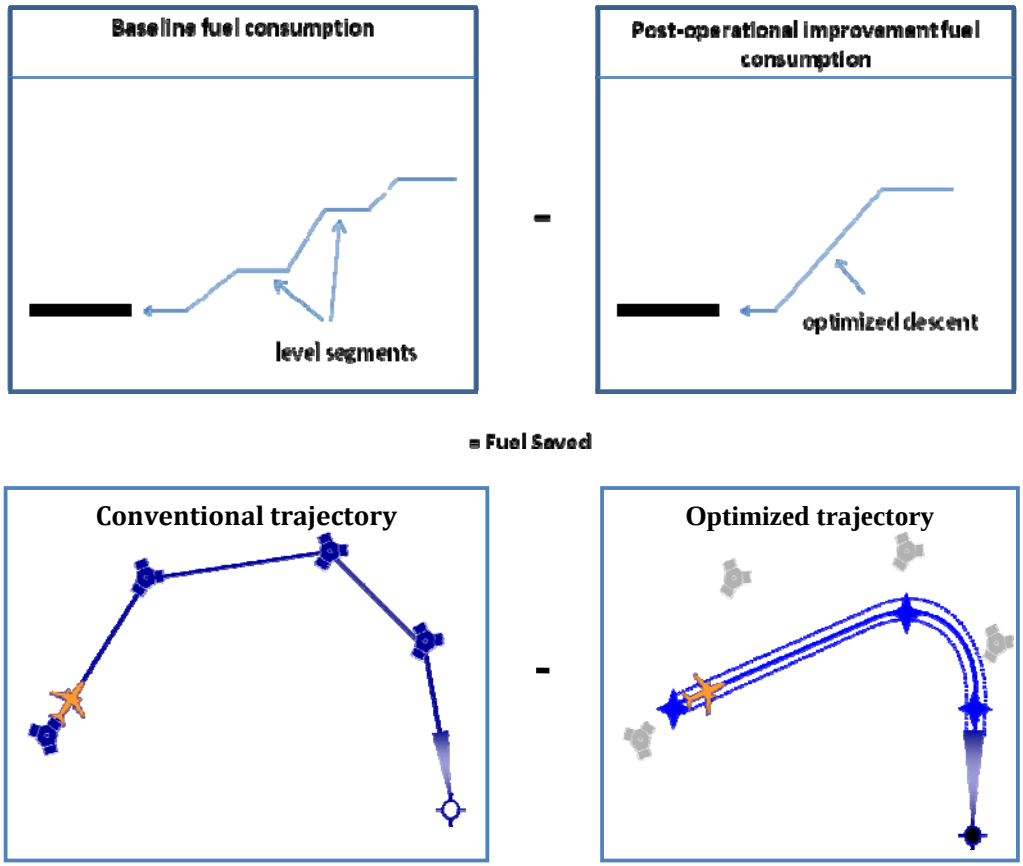


Figure 2- Notional illustration of fuel savings.

In order to compute the fuel consumed in two different scenarios, the following information listed in Table 1 will be required for both scenarios.

Table 1- Data required for computing fuel consumption changes.

- Number of operations by aircraft category

Plus, a combination of the following elements that describes both scenarios

- Average taxi time
- Time spent or distance flown at a specific altitude
- Top of descent altitude and bottom of descent altitude
- Base of climb altitude and top of climb altitude
- Distance flown in a climb or descend procedure

2. Requirements

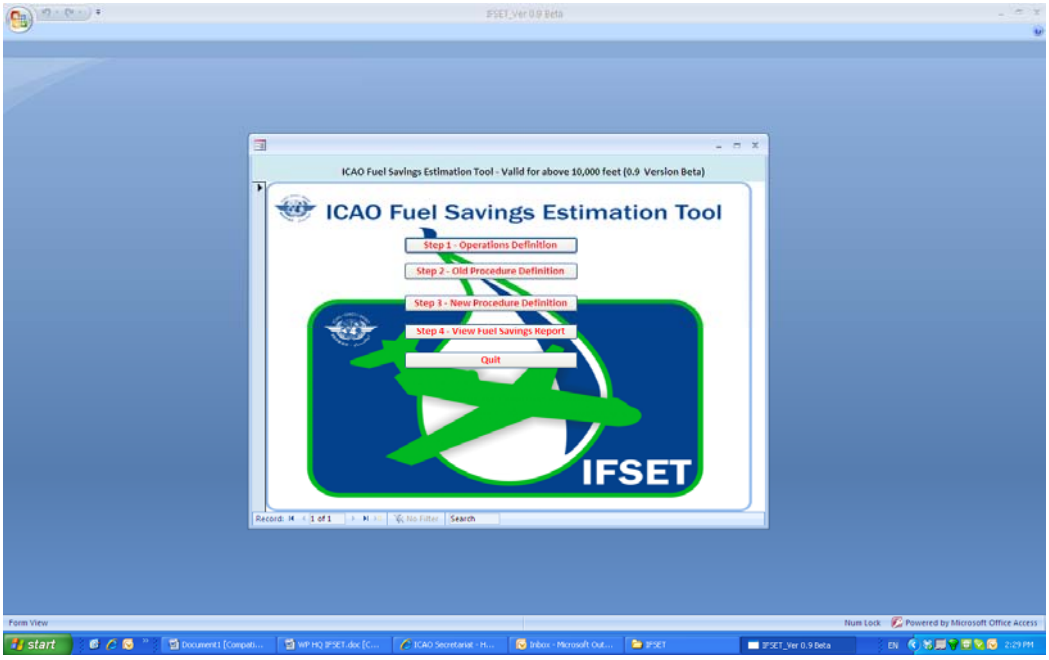
The tool will be a Microsoft Windows application that requires running an operating system of Windows XP or newer. The user interface is intended to be easy-to-use, requiring minimal input from the user.

All analyses begin with describing the baseline and post-implementation cases. As defined in Table 2, the user begins by specifying the number of operations in both scenarios.

This is accomplished by selecting the aircraft categories from a dropdown list and then entering the number of operations. The number of operations entered can be hourly, daily, annually, etc. The resultant fuel savings will be reported on the same basis. The reason that the operations need to be defined in both cases is to permit the consideration of procedures that will only be available to properly equipped aircraft.

3. The tool Step by Step

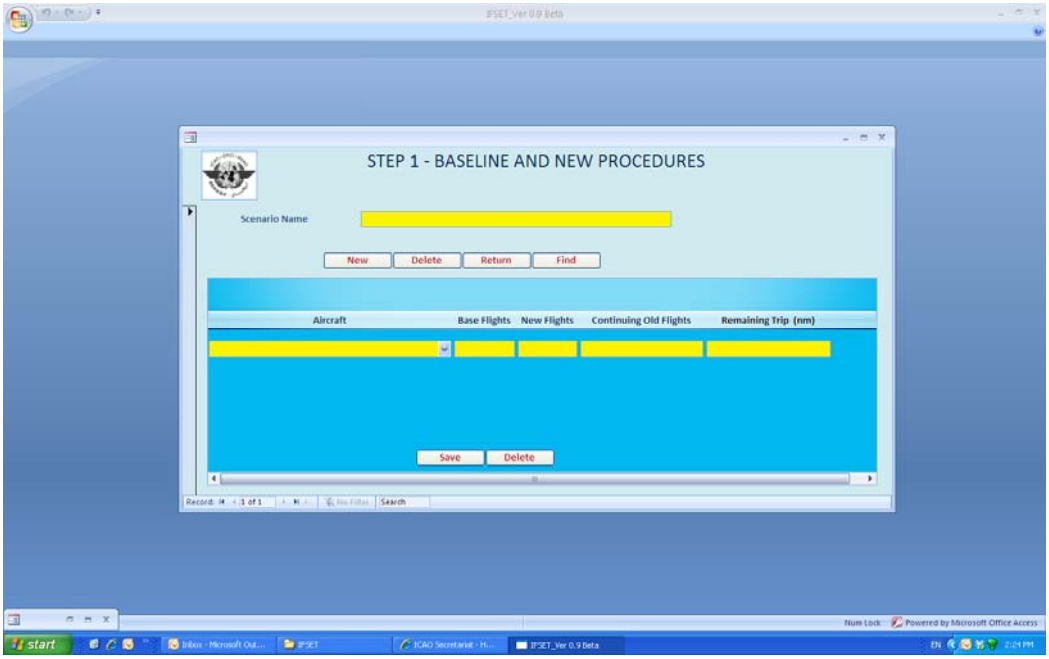
3.1 Main Screen



INPUT

Start by selecting **Operations definition** tab, the following screen opens

3.2 Operations Definition



Command Buttons on this screen (Top)

New - will open a blank screen allowing users to input new scenarios.

Delete - will delete the scenario, the aircraft mix and all associated operational definitions.

Return - will bring the user to the main screen.

Find - will enable the users to select an appropriate scenario among multiple scenarios saved in the database. After selection the scenario can be deleted or the aircraft mix on the second half of the screen can be edited.

Command Buttons on this screen (Bottom)

Save - will save this scenario and the related aircraft mix.

Delete - the user can select a row associated with an aircraft, the number of operations and remaining trip distance and delete that row.

Clicking on **Return** will bring you to the Main Screen where the user will select **Old Procedure Definition.**

INPUT

Scenario Name - Give a name for the operational scenario.

Aircraft - Input the aircraft category mix relating to the scenario under the aircraft column from a drop down list.

Base flights - indicate the number of flights under the old operational scenario.

New flights - indicate the number of flights under the new operational scenario. It means the number of operations benefiting from the operational improvement.

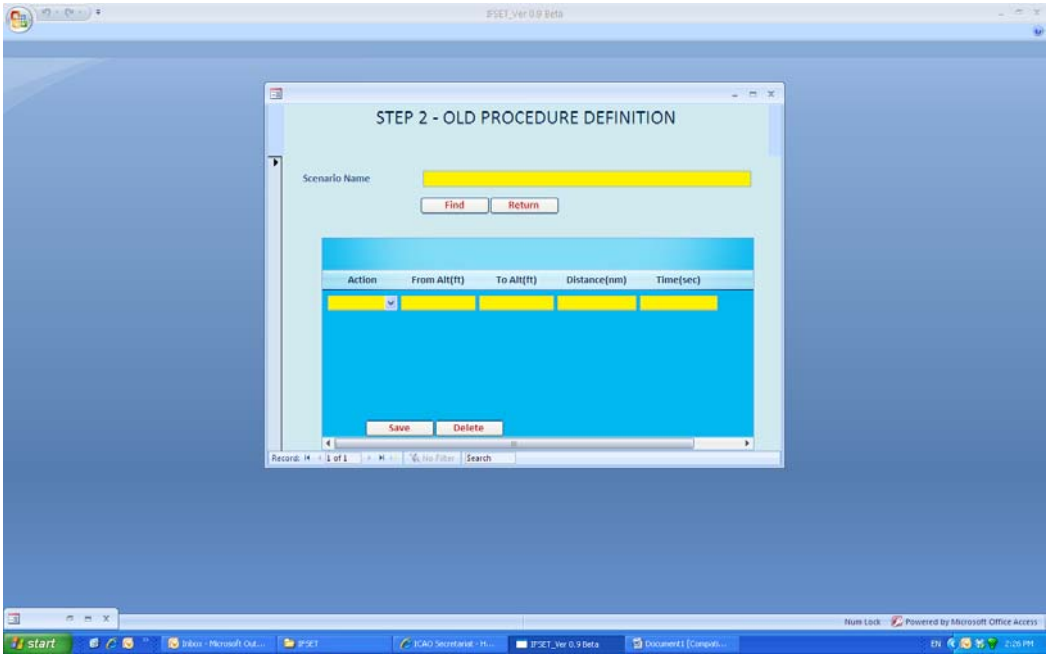
Continuing Old flights - indicates those flights though being part of the new operational scenario continues to follow the old operational definitions. It means number of operations not benefiting from the operational improvement.

Remaining Trip distance - is the distance in nautical miles (nm) appropriate for the aircraft category selected. If not know, the tool assumes a default value.

Click **Save** – it will save this scenario and the related aircraft mix.

Click **Return –** it will bring the user back to the main screen.

3.3 Old procedure Definition



Find the **scenario name** which you have entered earlier under Operations definition by clicking the **Find** Button. Select the Scenario Name and either add or edit appropriate old operational procedures for the selected scenario. The scenario name on this screen is locked and no entry is allowed.

Navigate to the second half of the screen and enter the **Action** followed under the old operational procedures. The allowable actions are Level, Descend, Climb and Taxi selected from a drop down list.

For “Level” Action either the distance in nautical miles or time in seconds can be entered.

For “Taxi” Action only Time in seconds can be entered.

For all actions except “Taxi” enter the “From” and “To” altitudes in feet. For the level action the “To” altitude will be automatically entered after entering the “From” altitude and clicking the “Tab” button.

For “Climb” or “Descend” actions, if there are variations in distance, besides the altitude the distances flown during climbing or descending shall be also entered.

Command Buttons on this screen (Top)

Find – as explained above, this allows the user to select the scenario name entered earlier under operations definition and either add or edit appropriate old operational procedures for the selected scenario.

Return will bring the user to the main screen.

Command Buttons on this screen (Bottom)

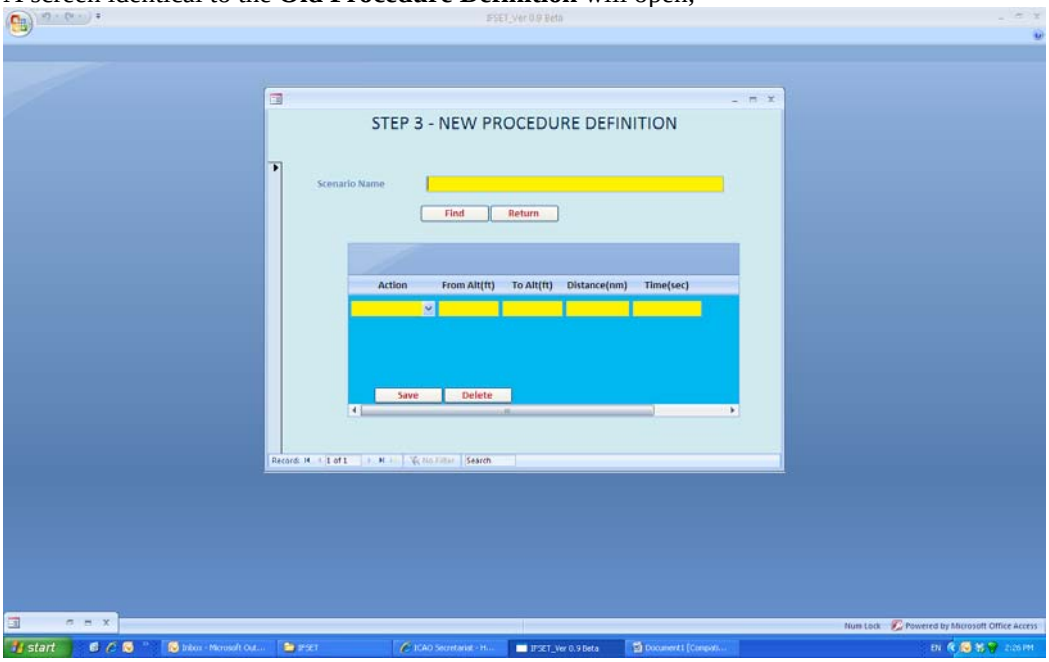
Save will save the old procedure definitions associated with the selected scenario.

Delete will enable the user to select a row of **Action** and delete the same.

Clicking on **Return** will bring the user back to the Main Screen where the user selects “**New procedure definition**”.

3.4 New procedure Definition

A screen identical to the **Old Procedure Definition** will open;

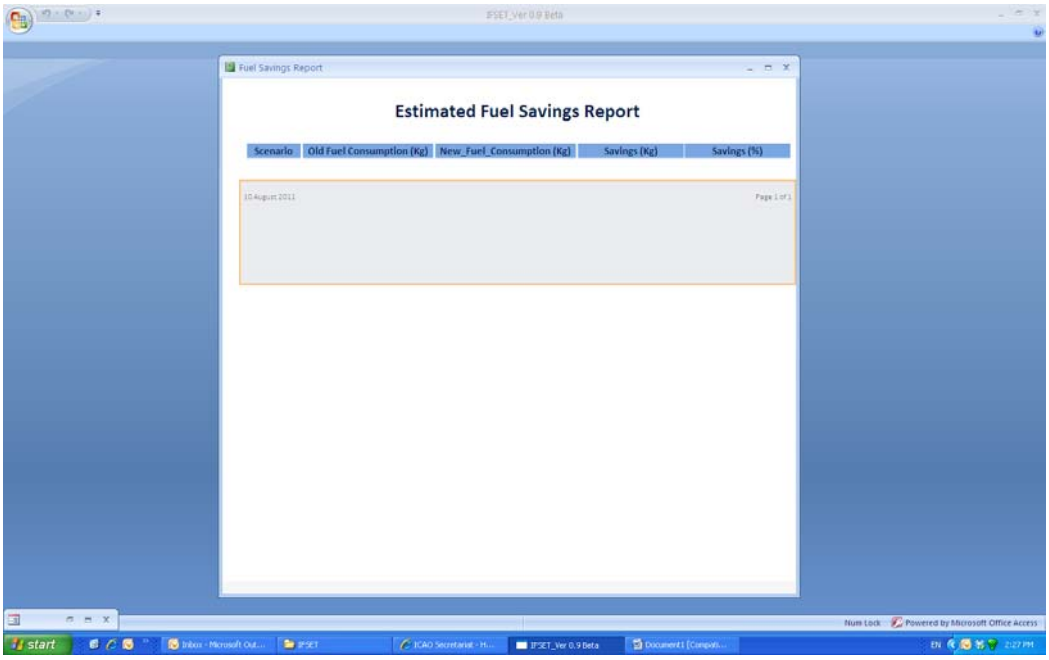


Enter the new operational procedures associated with the selected scenario as described under the "**Old Procedure Definition**".

Clicking on Return will bring you to the Main Screen where the user can select "**View Full Burn Report**".

3.5 Report generation

The report will be displayed as in the screen below.



The fuel consumption in Kg under old and new operational definitions for each scenario will be displayed along with the estimated savings in Kg and percentage.

— END —