Basisprogramme

ENDBERICHT UND ENDABRECHNUNG

Ein **Endbericht mit Endabrechnung** ist am Ende des Förderzeitraums (inkl. Fristerstreckungen) zu erstellen und innerhalb von 3 Monaten an die FFG, Bereich Basisprogramme zu übermitteln. Der Endbericht soll über die im gesamten Förderzeitraum (laut Vertrag) durchgeführten Arbeiten und Ergebnisse berichten. Bei mehrjährigen Projekten ist nach jedem Förderabschnitt (meist ein Jahr) ein Endbericht mit Endabrechnung zu erstellen.

Ein Endbericht soll umfangreicher als ein Zwischenbericht sein und auch eine Bewertung der Ergebnisse beinhalten. Als grober Richtwert kann ein Umfang von ca. 10 DIN A4 Seiten angegeben werden. Bitte schicken Sie Ihre Berichte einfach und ungebunden!

Hinweise: Dieses Formular ist ausschließlich für per Post übermittelte Endberichte gedacht.

Projekttitel:	OPTAIR
Projektnummer:	824802
Firmenname:	Environmental Software & Services GmbH
Förderzeitraum:	01.09.2009 – 31.08.2010
Berichts- und Abrechnungszeitraum:	01.09.2009 – 31.08.2010
Ersteller des Berichts:	DDr. Kurt Fedra
Datum und Unterschrift:	26.11.2010

1. Arbeiten und Termine

Beschreiben Sie (chronologisch) die im Förderzeitraum durchgeführten Arbeiten. Vergleichen Sie den tatsächlichen Ablauf mit dem eingereichten Arbeits- und Terminplan. Beschreiben Sie Änderungen im Ablauf und in der Zielsetzung und beschreiben Sie die Ursachen für diese Änderungen.

Chronological activities in the active work packages during the third and final project year (September 2009 to August 2010) are following the overall three year workplan:

The project is designed for a three year duration, within the framework of the recently extended EUREKA E!3266 WEBAIR. The basic principle is rapid prototyping, with sequential but heavily overlapping work packages; a total of 14 work packages with their respective tasks are foreseen. Experience with international cooperation in WEBAIR is reflected by minimizing dependency of development on external inputs, all of which is designed as optional in a modular architecture. The overall three year time plan is summarized below:

	Project year 1				Project year 2				Project year 3			
	Q01	Q02	Q03	Q04	Q05	Q06	Q07	Q08	Q09	Q10	Q11	Q12
01												
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In the workplan for the third project year, all work packages with the exception of WP 3 and 4 are active. WP 5,6, and 7 are being phased out progressively. While WP 1, 2 and 11-14 cover the entire period. Total effort in the third year was 48 person months, (excluding external consultant efforts) allocated to the work packages as shown below.
Efforts concentrated on a range of test applications including different applications domains (coastal marine, and real-time water resources management) to test the broad applicability of the methods developed, documentation and (ongoing) dissemination.

WP	Work package name, short description	effort	from	to
WP01	Project coordination and management	2	25	36
WP02	Requirements and documentation	1	25	36
WP03	End user participation (stakeholders, DM)	0		
WP04	Instruments of emission control, cost functions	0		
WP05	Dynamic emission modeling incl. dust entrainment	2	25	26
WP06	Simulation models: integration, alternative models	4	25	27
WP07	Assessment: performance criteria: compliance, economics	3	25	28
WP08	Optimization framework, phase I: satisficing	6	25	30
WP09	Computational experiments: cluster and grid infrastructure	6	25	33
WP10	Knowledge representation, heuristics, GA, machine learning	6	25	35
WP11	Optimization framework, phase II: Discrete multi-criteria DSS	3	25	36
WP12	Uncertainty analysis, robustness, GCM scenarios	3	25	36
WP13	Test cases: implementation, performance, validation	9	25	36
WP14	Dissemination activities	3	25	36
	TOTAL EFFORT	48		

WP01: Project coordination and management

This work package has spanned the entire three year project duration at a low level of effort, and includes the maintenance of a common project web server integrated with the E!3266 WEBAIR project: http://www.ess.co.at/WEBAIR) The WEBAIR home page also links to the OPTAIR project description (Figure 1).

Results during the third year:

- Continuing maintenance of the EUREKA Project web server (http://www.ess.co.at/WEBAIR), and the OPTAIR project descriptions, reports and demo link (http://www.ess.co.at/WEBAIR/OPTAIR), were continuously updated with new material;
- Update of supporting documents (scientific literature and technical reports linked from a dedicated document management system, linked also to the emission control technologies as additional documentation, the system currently holds more than 1300 on-line documents related to the various application domains.
- Update of the underlying AirWare system User and Reference Manuals pages (Release R5.8)
- Coordination of a follow-up proposal under EUREKA, WEBAIR-2 on "Web and 3G mobile phone based air quality management: particulates, public health, co-benefits", which extends the basic theme of WEBAIR in three directions:
    - integration of mobile clients to further simplify access and use;
    - concentration of PM10/2.5 as the emerging topic in air quality control; a specific topic is to apply the methodology to the effectiveness of (selective) reduced (inner city) urban traffic;
    - the integration of CO2/GHG and energy efficiency related objectives in the management;

in collaboration with partner on Cyprus (ATLANTIS consulting (original WEBAIR parter; CUT, Cyprus University of Technology) and Croatia, Oikon d.o.o, also an original WEBAIR partner.) As a third country partner AQCC (Air Quality Control Company) of Tehran has joined the proposal, submitted through the University of Technology on Cyprus). The new project will run in parallel with a LIFE+ project on Cyprus, dedicated to dust management, starting in January 2011.

WP02: Requirements and documentation

This work package was only active during the first six months of year three, when a set of on-line questionnaires was tested for a structured compilation of user requirements. Experience has shown, however, that many users prefer a simpler, unstructured specification during face to face discussions, or by simple unstructured email, so that the tools is primarily useful for and used by the analyst rather than an end user directly. The possibility to extend the simple questionnaires into a more complex combinations of first teaching the necessary concepts and then eliciting user requirements through more targeted, and context sensitive questions in an eLearning system is currently explored in a newly started project "CourseWare" under AT:net eLearning, supported by the bmvit (project No. 826084): http://www.ess.co.at/CourseWare.

Results during the third year:

- User requirements for three new test cases were compiled and organized with the methods developed in the first two project years. These new test applications are:
    - Porto do Açu, Brazil, a major coastal industrial district development; the air quality impact assessment includes the formulation of an emission control plan that directly utilizes the optimization methodology of OPTAIR;
    - Delimara Power Station expansion plan EIA, Malta (Figure 2) The impact assessment for the coastal Power Station includes the estimation cost effective emission control methodologies to meet European air quality standards (2008/50/EC) after a planned increase of the plant's capacity by a 144 MW extension. The EIA modeling covers NO_2, PM10, PM2.5, metals and Benzo-a-pyrene, and consider both absolute and relative contribution of the plant to local air quality.
    - Selaata, Lebanon Chemical Company, a fertilizer plant that releases phosphogypsum sludge in the coastal water of Northern Lebanon, The study builds directly on the original brine release optimization designed for HFZ, United Arab Emirates.
- The on-line manual pages are continually being updated (final release R5.8), a dedicated manual management system has been implemented to monitor the distribution and update status of all manual files on an automatic, daily basis on all WEBAIR/OPTAIR application servers: http://www.ess.co.at/MANUALS/AIRWARE/TOC.html
- Murrumbidgee, NSW, Australia. A Proof-of-Concept implementation for a real-time river basin operational control system that directly applies a real-time extension of the OPTAIR methodology, combining meteorological forecasts, water demand forecasts (supplementary irrigation water) to design optimal reservoir release and in-stream (weir)

storage control for the precision delivery of irrigation water. The most critical user requirement here relates to computational efficiency, i.e., to provide optimal (control) solutions in real time.

WP03: End user participation (stakeholders, DM)

Not active in the third project year, nominally completed; however, the stakeholder institutions data base developed in the previous project period is continuously updated and has by now reached 1,240 entries world wide. Contacts with representative stakeholders in the new case studies were mainly based on personal contact and interviews during several site visits, see the section on travel costs below.

WP04: Instruments of emission control, cost functions:

Not active in the third project year, nominally completed; updates to 199 technology data set (Figure 3) the cost functions (piecewise linear cost function representation) is included under WP 10 below); for the new application and in particular Porto do Açu, Brazil, a number of updates to the emission factor data base were made. For the test case in Australia, the instruments for emission control were replaced by reservoir release and in-stream storage control through gates and weirs, controlled by SCADA system driven by the optimization results; the high level of abstraction in the basic optimization problem formulation as an inverse solution based on heuristic search in the decision hyperspace based on well defined target regions in system performance space made that extension straight forward, and required only minor changes in the optimization scenario interface to define these strategies

WP05: Dynamic emission modeling

Only active in the first two months of the third year.

Emission compiled and updated for the latest case studies (Lower Austria and City of Vienna, embedded, both domains embedded in a European EMEP model domain using 2007 emission data for dynamic boundary conditions) have been used in the last round of optimization test runs. Emission for the new case studies (see WP 1,2) were generated with the tools and methods developed in the first and second project year, and the first part of the final third year.

Results during the last six months:

- Implementation of emission inventories (point, area, and line sources) for the latest case studies of Porto do Açu, Brazil (Figure 4) , and the Delimara TPSextension on Malta.

Case study	Boilers & stacks	Areas	Lines (roads)
Porto do Açu	305	74	19
Delimara TPS	2	(~20)	(~50)

- The emission data base includes emission for all substances covered in the optimization technologies (emission reduction instruments).
- The new class of emission sources, mobile emission introduced in the first two month of the third year together with the INPUFF (Lagrangian/Gaussian puff model) model is also set of for 40 point sources representing ships supporting the coastal industrial district of Porto do Açu in the northern (Porto) and southern (Terminal Sul) harbor sections there.

WP06: Simulation models: integration, alternative models

Not active in the final six months. For the simulation of mobile emission sources, INPUFF integrated in the previous reporting period was used without any further development requirements. Also, the Selaata case is being run with the 3D ocean model system ROMS, described in the second project year report. For the water resources real-time optimization test case (Murrumbidgee River, Australia, Figures 5,6), an existing, ready-to-run model system WaterWare (http://www.ess.co.at/WATERWARE) was adapted to the two-phase non-linear optimization framework. Again, we could demonstrate that the high level of (object oriented) abstraction chosen for the basic optimization strategy made the integration of a completely different model system straight forward, with only minor changes required in the first phase (generation of feasible alternatives), while the second phase (reference point optimization) could remain completely unchanged.

WP 07: Assessment, performance criteria:

This work package was only active during the first four months of the third year. A more detailed description was provided in the third year interim report.

The main work was related to the generalization of the performance criteria definitions to cover the extended range of test applications beyond the original ambient air quality (compliance) criteria, that also apply directly to the coastal water test cases. The main extensions include CO2/GHG related emission targets, that also made it possible to partition the search strategy differently, by finding first solution for the emission targets, then exploring them with the more complex and demanding dispersion models to test feasibility against an extended (the original) set of criteria. This strategy lead to first concepts of hierarchical optimization structure that can be organized:

- in space, as nested grids and different resolution;
- in time, by using short by critical sub-periods first;
- thematically, by first solving for one or a few main criteria, then further exploring (within the GA philosophy) the most promising set of solution against the entire set of criteria
- any combination of the above strategies.

The performance criteria were also extended to include a few water resources related criteria for the Murrumbidgee testcase (Figure 7), including

- water supply/demand ratio global, sectoral;
- reliability of water supply, economic efficiency;
- water efficiency, storage volume cyclic stability.

WP 08: Optimization framework, Phase I.

The original two-phase optimization concept was adapted and extended

- with a new strategy aiming at Greenhouse-gas emissions (Kyoto targets, carbon credits, Figure 8) , that combines a first phase of emission related optimization runs with a subsequent air quality based step;
- in direct combination with phase II, using UTOPIA as the default reference point, in the fully automated real-time implementation for river basin management (reservoir release and weir storage control with SCADA)

Results during the last six months:

Not (nominally) active in the final six months of year three. However, the extension for the real-time test case (Murrumbidgee River, NSW, Australia) were implemented in combination with the WaterWare dynamic water budget model.

WP 09: Computational framework, cluster and grid computing.
Provides the necessary performance to generate sufficiently large samples of feasible solutions for the subsequent reference point methodology

Results during the final six months:

- The computational experiments using OpenMP have been continued mainly to determine long-term performance and system reliability (robustness), the basic underlying models (e.g., CAMx, AERMOD, ROM) have been updated to their most current release level to exploit more recent support for parallel computing. In general, the implementation of the search algorithms in fully "task parallel" concurrent jobs on multiple computational cores has demonstrated the highest efficiency and near linear up-scaling with a minimum of organizational overhead.
- To manage the large data volumes resulting from these experiments, and in particular the underlying meteorological model results, additional USB high-volume (4 Terabyte) disks have been installed, and the automated backup system extended accordingly.

WP 10: Knowledge representation, heuristics, GA, machine learning.

The main development here concentrated on the implementation of a new rule/task syntax representation, editor and interpreter for the real-time rules (Figure 9,10) driving the water resources management optimization, directly based on the real-time forward chaining framework designed and developed in the first half of the last year. Due to the increasing number of (nested) rules, a simplification in the implementation was becoming necessary. Details are given in the Murrumbidgee River, NSW, Australia COR/POC (Computer Operated River Basin: Proof Of Concept) report, available as a PDF file on-line: http://www.ess.co.at/WATERWARE/NSW/COR_FinalReport.pdf

Results during the last six months

- The implementation of the real-time rule based expert system was designed to extend the basic optimization strategy in two closely related directions:
  - Drive the real-time (operational control) version of the optimization;
  - support an iterative approach where a first phase based on the exploration of the entire decision space;
  - The resulting pareto (non-dominated) subset of alternatives can then be used as the starting point of a second phase of local neighborhood search around the individual result vectors as a first simple experiment toward a more complex GA strategy. In the real-time operational control case, UTOPIA is used to determine an efficient solution automatically, based on previously (interactively) defined preference structures.

WP 11: Optimization framework, phase II: Discrete multi-criteria DSS

The first phase optimization runs generate a set of alternative solutions, that can be filtered automatically into feasible and non-feasible solutions (the latter are either discarded during the simulations as soon as a constraint is violated, or retained after completion for analytical purposes). After a set of runs has been completed, and a set of feasible solutions generated, they can be exported to a discrete Multi-criteria DSS tool (Figure 11) for further analysis and eventual selection of a preferred (compromise) solution. Where this efficient point (preferred solution) can not be determined interactively by one or several decision makers, a default solution that can be determined reliable and unambiguously for the multi-criteria case is needed. The obvious choice is the non-dominated solution closest to UTOPIA. The measure of distance is an Ndimensional extension of Euclidean distance, in a normalized performance space (each criteria-axis is rescaled between NADIR and UTOPIA), so that position on that axis can be described as % achievement (towards the observed optimum for the respective dimensions),

Results during the last six months:

- The basic DMC (discrete multi-criteria) DSS framework has implemented during the previous project phase has been extended for automatic determination of efficient points (nearest to UTOPIA) for the real-time operational control case. The interactive interface for the DMC post-processor has been further developed to simplify export of large sets of feasible alternatives, the selection of criteria, re-scaling of the decision space, introduction of ex-post constraints, definition of an alternative reference point (displacing UTOPIA to define implicit weights on criteria) etc.

WP 12: Uncertainty analysis, robustness, validation

Validation of the basic simulation models is central requirement and the basis for their use for optimization (Figure 11)

Results during the last six months:

Using the standards defined by the Air Quality Framework Directive 2008/50/EC, that define a range plus/minus 50% around the observations as “acceptable” data or model forecast quality, the tools for mode validation and the comparison of results both as time series of value or matrices (complete spatial coverage at a given point in time) have been further developed to also support sensitivity analysis to determine the relative contribution of different assumptions, parameter of data sets to the model results. A typical case is the comparison of meteorological dynamic boundary conditions for the dispersion modeling, where critical parameter such a PBL (planetary boundary layer or mixing height (convective and mechanical) differ substantially, but also largely determine extreme situations and thus violations of hourly air quality standard.

WP 13: Test cases: implementation, performance, validation.

In addition to the original set of test cases (Cyprus, Korea, Tehran, Sisak, UAE, the Republic of Malta, the City of Vienna and the Province of Lower Austria have been extended to test the general applicability of the optimization methodology. A final set of additional test cases has been added to the project based on thematic extensions (coastal water quality, already addressed in the second project year; real-time extensions for operational control in water resources management; specific emission control for SEA/EIA projects), data availability for validation and co-financing opportunities. While for most of these test cases, only a basic implementation and feasibility analysis (configuration of the model system, definition of performance criteria and preference structures, definition of the linkage to the DMC optimization tools) could be performed, the test case for operational control of water resources in Australia reached a complete implementation of a real-time version of the optimization strategy.

Results during the previous last six months:

These additional test cases include:

- EIA for a coastal thermal power plant, Delimara Power Station, Malta;
- SEA/EIA for an industrial district development (including heavy industries such as iron and steel, cement and building material, thermal power

stations, automotive (car manufacturing), and associated transportation including harbor operations), Porto do Açu, Brazil;

- Urban flooding, Tehran (optimization of land use and drainage networks)
- Coastal water quality, phosphogypsum sludge release from the Lebanese Chemical Company plant at Selaata, Northern Lebanon (Figure 12);
- Real-time water resources management, operational control of reservoir release and weir control (SCADA) for the Murrumbidgee River, NSW, Australia.

WP 14: Dissemination activities. Dissemination strategy of OPTAIR is based on

a. Extensive use of the Internet as the very implementation medium of the system (project web server home page at

    a. http://www.ess.co.at/WEBAIR/OPTAIR
    b. http://www.ess.co.at/WEBAIR (with specific pages for each of the by now twelve operational case studies)
    c. http://www.ess.co.at/WATERWARE/NSW (Murrumbidgee case study)
    d. http://80.120.147/40/Selaata (coastal water quality)
    e. http://80.120.147.38/RIO (SEA/EIA for Porto do Açu, Brazil).

b. The contacts, networks, and distribution channels of the WEBAIR project partners in by now 19 participating countries in E! 3266 WEBAIR including a mailing list for efficient communication between project participants. Project partners are kept informed on project progress with regular email newsletters.
c. Presentations at national and international conferences, national meetings and workshops:
    - A&WMA International Specialty Conference, Xi'an, PRC
        - Non-linear multi-criteria emission control optimization with a 3D dynamic photochemical model system, Fedra, K.
        - Operational web-based air quality forecasts: cascading real-time models for assessment, management and public information. Fedra, K. and Witwer, Ch.
    - International Conference on Hydrological Risks and Urban Flooding, Tarbiat Modarres University, Tehran;
        - Flood forecasting and management: a multi-criteria apporach.
    - Lecture series on Environmental Management and Optimization, Tehran; institutions visited (May/June) include:
        - Ocean and Atmopsheric Department, Ports and Maritime Activities; IAERI (agricultutral water management); DOE, Department of the Environment, Forests and Natural Resources, Offshore Oil Company, Provincial Water resources Management Departments;
    - Lecture series on Environmental Management and Optimization, Tehran; institutions visited (July/August) include:
        - Tehran Province, Environmental Department; Municipal Flood Working Group; Water Resources Management Organization, Mahab Ghodds consultants; National Crisis Management Center; Oceanographic department;
    - New South Wales State Water Corporation, Melbourne:
        - Technical workshop of river basin management;
    - CSIRO special workshop on Water Resources Management, Canberra:
        - Multi-criteria optimization for river basin management;

Manuscripts in preparation for submission to international Journals:

- Validating complex air-quality model systems: and epistemological approach; Fedra, K., Witwer, Ch.
- Multi-criteria optimization of emission control: exploiting co-benefits; Fedra, K., Witwer, C., and Kubat, M.
- Computer-operated River Basins: multi-criteria operational control.

2. Ergebnisse - welche Ziele/Meilensteine wurden erreicht?

Beschreiben Sie die erreichten Ergebnisse. Führen Sie erzielte Leistungsdaten an. Fügen Sie exemplarisch Fotos, Zeichnungen, Diagramme, Versuchsauswertungen, Schemas von Prototypen und Versuchsaufbauten etc. ein. Dieser Teil kann durchaus in Punkt 1. integriert werden – vor allem dann, wenn jedes Arbeitskapitel seine eigenen Ergebnisse hat.

The project could follow the work plan proposed in the third year continuation proposal. Overall, the project has met its primary objective: to test the hypothesis that we can optimize complex, non-linear distributed dynamic (environmental) systems with an inverse method and a multi-tiered implementation exploiting modern (multi-core) processor technology, using 3D dynamic environmental models. This was demonstrated in a number of test cases of environmental management, primarily related to the control of atmospheric emissions (urban and industrial) and ambient air quality standard, but also extended to issues of Environmental Impact Assessment, coastal water quality, and water resources (urban flooding, operational control of reservoir release and weirs (SCADA) for optimal irrigation water management. The primary purpose of a wide range of test cases was to test the general applicability of the methodology, but also the modular implementation architecture and computational tools.
The two-phase optimization structure developed in the previous year was further extended by a real-time version for operational control, applied to river basin management and the precision delivery of irrigation water.
In parallel, the original atmospheric emission control cases with emphasis on complex photochemistry (and thus the need for an original a low-resolution representation) were extended towards a hierarchical model representation, that uses high resolution along different dimensions of the problem representation with a corresponding iterative heuristic solution method.
This approach was tested with

3. Schwierigkeiten – welche Ziele/Meilensteine wurden <u>nicht</u> erreicht?

Beschreiben Sie welche Lösungsansätze oder Projektteile nicht realisiert wurden und führen Sie eine Begründung an.

No major deviation from the work plan for the third year.
The major constraint or shortcoming was the data availability in the individual test cases. Restrictions in the availability of reliable emission and observation data limit the detailed validation of the underlying model system. Limited techno-economic data on alternative "control" methods limit the (economically) realistic description of alternatives.
The obvious consequence and possible solutions are in a more extensive sensitivity analysis, and error propagation/analysis, and stochastic approaches that incorporate these limitations explicitly.

Implementation examples
(screen dumps from the on-line web interface)

Figure 1: OPTAIR project web page

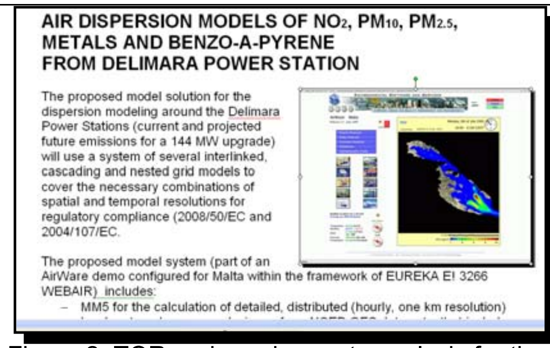

Figure 2: TOR and requirements analysis for the Delimara TPS EIA study, Malta

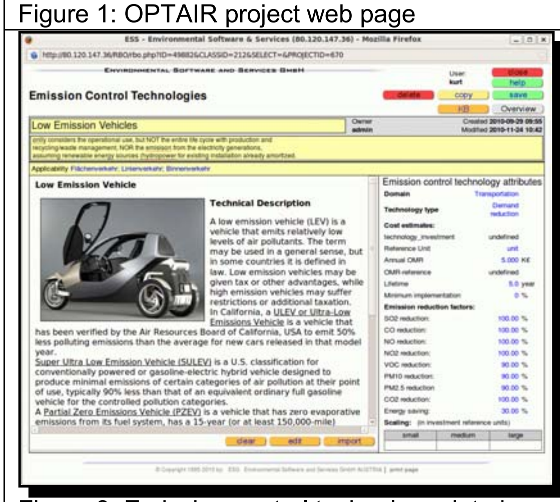

Figure 3: Emission control technology data base (199 technology profile entries)

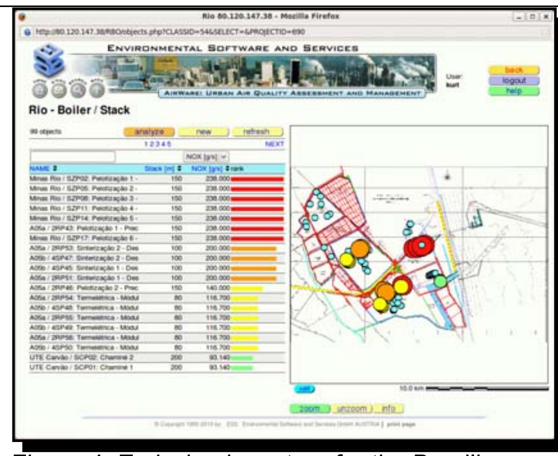

Figure 4: Emission inventory for the Brazilian industrial EIA test case, Port do Acu.

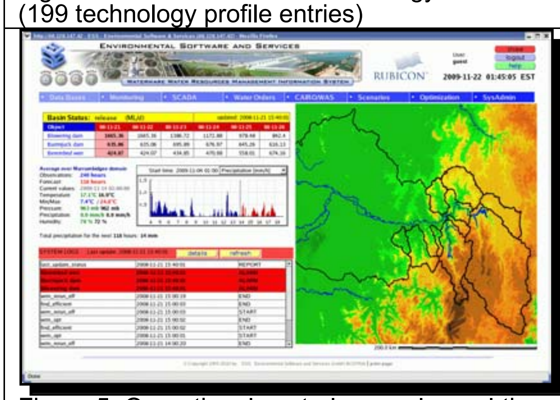

Figure 5: Operational control example, real-time optimization for a river basin, reservoir release and weir control (SCADA) for the Murrumbidgee River, NSW, Australia)

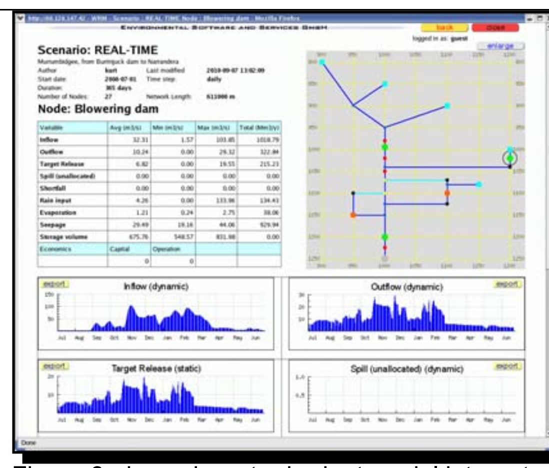

Figure 6: dynamic water budget model integrated with the optimization framework

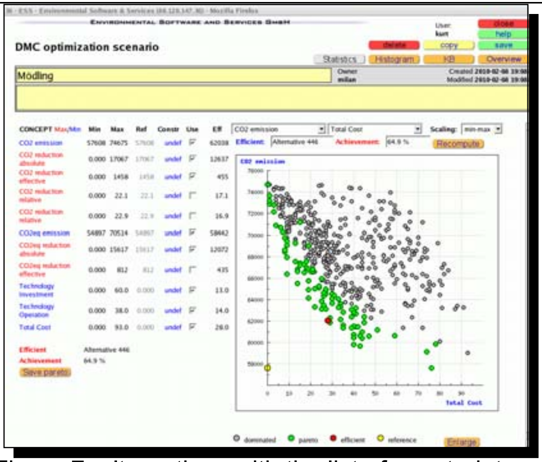

Figure 7: alternatives with the list of constraints defining the criteria/dimensions

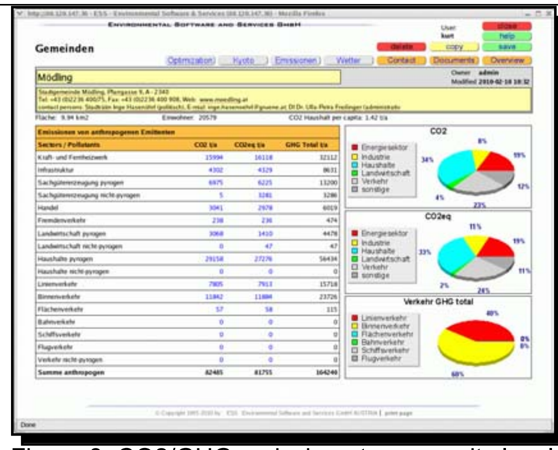

Figure 8: CO2/GHG emission at community level, Lower Austria.

Figure 9: Rule-base for the real-time optimization and heuristics

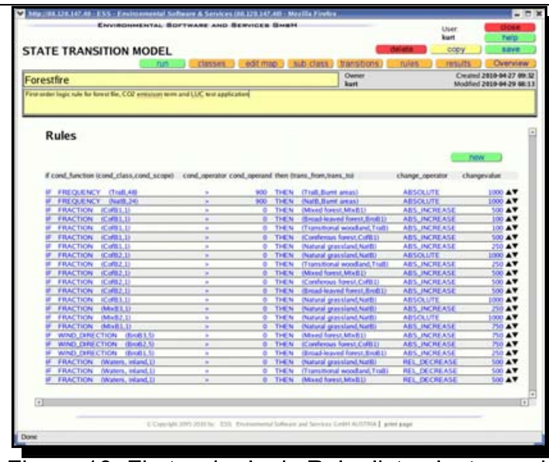

Figure 10: First order logic Rule list selector and editor

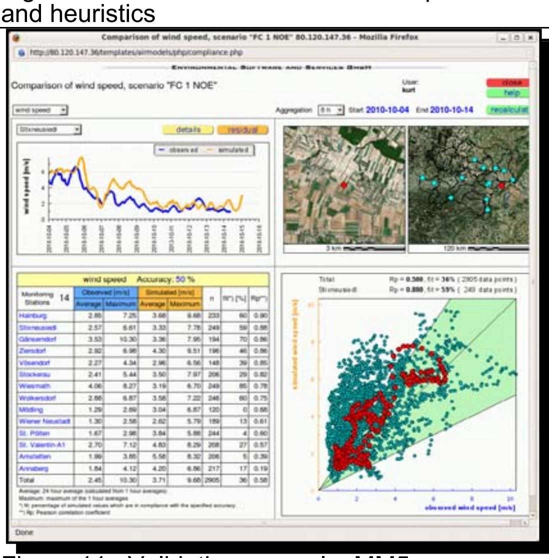

Figure 11: Validation example, MM5 meteorological boundary conditions

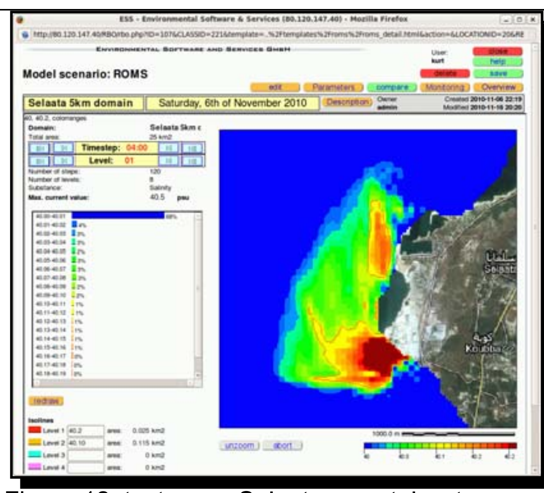

Figure 12: test case: Selaata, coastal water quality (3D ROMS model)

4. Zusammenfassung und Resümee, Wirtschaftliche Verwertung

> Ziehen Sie ein Resümee über das durchgeführte Projekt und führen Sie an, welche Maßnahmen zur wirtschaftlichen Verwertung gesetzt wurden. Ergänzen Sie diesen Bericht mit dem Status von Patenanmeldungen.

Aufbauend auf den Ergebbnissen des OPTAIR Projektes konnten bisher folgende Anschlussprojekte bzw, Anwendungen begonnen werden, oder befinden sich noch in einer Antrags bzw. Angebotsphase:

- LIFE+: Anwendung der Optimierungsverfahren in einem LIFE+ Projekt auf Zypern, bei dem es insbesondere um Kontrollstrategien zur Reduktion der Feinstaubelastung geht; das Projekt wird mit Jänner 2011 beginnen, und baut auf der E!3266 WEBAIR Teilnahme Zyperns auf.
- COR/POC: Das Projekt für die State Water Corporation, New South Wales, Australien, hat ine Echtzeit-Erweiterung der multi-kriteriellen Optimierung zum Inhalt. Das Anwendungsgebiet ist die Flussgebeitssteuerung zur Optimierung des landwirtschaftlichen Wasserverbrauches bzw. Angebots.
- Malta: Einsatz der Emissionkontrolloptimierung im Rahmen eine Umweltvertr-aglichkeitsprüfung für den Ausbau des thremischen Kraftwerkes Delimara (MEPA, Malta Environmental Protection Agency); in Zusamenarbeit mit Ecoserv, EUREKA E!3266 Projektpartner.
- Brasilien: Einsatz der Emissionkontrolloptimierung im Rahmen einer Umweltverträglichkeitsprüfung für ein (schwer)industrielles Entwicklungsgebiet (Porto do Açu) im Norden der Provinz Rio de Janeiro, ca. 1,600 km^2 .
- Libanon: Anwendung der Optimierungsstrategie im marinen Bereich (aufbauend auf der urspünglichen Entwicklung von ROMS/Salintätmanagement für HFZ (Hamyria Free Economic Zone) Dubai, siehe Bericht des zweiten Projektjahres) strategische Umwelverträglichkeitsprüfung für eine Düngerfabrik (Lebanon Chemical Company) in Selaata and der Mittelmeerküste mit Emissionen von Phosphorgypsum aus der Phosphtdüngerproduktion.
- Weitere Projektvorschläge wurden in Zusammenarbeit mit FOCUS-ME (United Arab Emirates) für den Iran ausgearbeitet, und zwar
    - Reduktion der Feinstaubbelastung bzw. optimale Anpassung von Produktionsbedingungen bzw. Wartungsarbeiten an (vorhergesagte) Sandstürme (Umweltministerium bzw. nationales Forschungsprojekt)
    - Regionale Emissionkontrollstrategien (Provinz Tehran) in Erweiterung der im Rahmen von E!3266 laufenden Simulationsstudien für die Stadt Tehran.
    - Urban Flood Management, optimization of land use development and the drainage system layout and capacities.