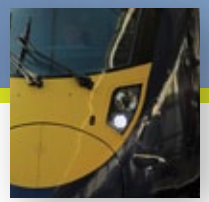
GSA Catalogue



making airports greener

Catalogue of Measures

Green Sustainable Airports

Catalogue of Measures

provincie Drenthe

The Interreg IVB North Sea Region Programme

M2P CONSULTING MOSTERT·PLOOG & PARTNERS

SCHIKORR CONSULTING
AVIATION | LOGISTICS | SUSTAINABILITY

GSA measures are grouped to overall categories as Airport Management, Airport Operations and Public Transport

Overview GSA catalogue of measures

Airport Management

1.1	Benchmarking of eco-efficient airport operations
1.2	Co2 monitoring and Scope 3 certification readiness
1.3	Sustainable infrastructure development for small and medium-sized airports
1.4	Effective noise reduction measures
1.5	Introduction of a company policy for sustainable tendering
1.6	Green airport marketing
1.7	Joint policy recommendations
1.8	Regional economic impact study

Airport Operations

2.1	Eco-efficient Ground Power Units (GPU)
2.2	Sustainable plant & area management
2.3	Sustainable heating & cooling of aircrafts
2.4	LED lighting for taxiways and runways
2.5	Sustainable surface & aircraft de-icing procedures
2.6	Continuous Descent Approach (CDO) for regional airports
2.7	Cost-effective noise monitoring

Public Transport

3.1	Accessibility concepts for airport connecting public transportation
3.2	Green airport-connecting public transportation
3.3	Integrated passenger journey planner
3.4	Integrated airline- public transport ticketing

Legend	
ID	WP 3 Activity
ID	WP 4 Activity
ID	WP 5 Activity

Benchmarking enables transparency on eco-efficient airport operations – methodical challenges prevail

Airport Management

1.1 Benchmarking of eco-efficient airport ops

Study | **Groningen Airport**

General description

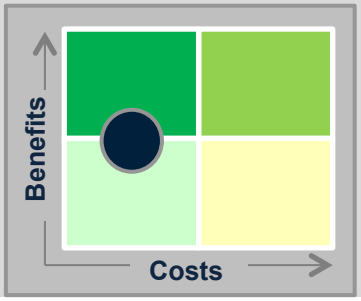
- Benchmarking eco-efficient operations at GSA airports
- Key objective is to identify and learn from 'best practices' by comparing GSA airports
- Study is targeted to benchmark energy consumption and emissions at small and regional airports

GSA study document & contact person

- **Eco-Ops Benchmarking study** on airport-related energy consumption and emissions is providing transparency on:
  - Relevant Key drivers,
  - Leading strategies,
  - Best practices
- Involved GSA partners: GSA airports
- Contact: Onno de Jong, GRQ Airport

Costs & benefits

- Costs for data gathering, analysis and study development
- Benefits by more insight into 'best practices' on promising measures and strategies to decrease costs and emissions



Overall recommendation

- Insight into different levels of airport-related energy consumptions and emissions as baseline for defining own strategy to save energy, emissions and money
- 'best practices' as blueprint for defining green measures
- Benchmarking often limited by lack of data and comparability of peer grouped airports
- Conclusions need to be confirmed by thorough analysis

Proactive Co2 management leverages last Co2 reductions complemented by large scale energy and costs savings

Airport Management

1.2 Co2 Management Toolkit

Study

Bremen Airport

General Description

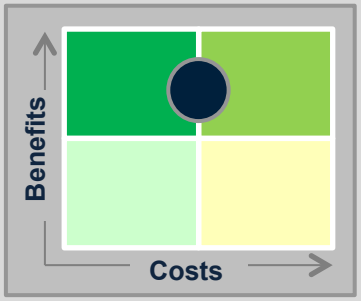
- Analysis of airport resource- and energy consumption and emissions
- Multi-step strategy to decrease costs, consumptions and emissions according to ACI industry standards
- Objective: ACI ACA Scope 3 readiness
- Instrument for airport communication

GSA study document & contact person

- **CO2 monitoring toolkit**
- Deliverable provides manual how to setup state-of-art Co2 monitoring tool and how to achieve ACA Scope 3
- Scope 3 certification readiness for BRE
- Involved partners: BRE, GRQ
- Contact person: Dettmar Dencker, Bremen Airport

Costs & benefits

- Costs: external consultancy support and internal efforts
- Strategy and management tool for lasting Co2 reductions, energy and cost savings



Overall Recommendation

- Powerful management tool to leverage:
  - Lasting reductions, energy and cost savings
  - Baseline for long-term sustainability strategy
- Mitigate risks by tightened EU regulations
- Reliable data to underline airport sustainability goals by external stakeholder communication

Adjustments to the airport's infrastructure can be very effective for reducing emissions to the direct environment of the airport

Airport Management

1.3 Infrastructure design to absorb noise & odor

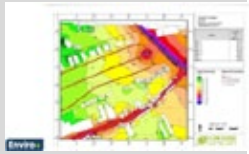
Study | **Kortrijk Airport**

General description

- Assessment of approaches and measures to reduce noise and odor emissions by adjustments of airport infrastructure
- Preparatory concept before starting an infrastructure investment program at Kortrijk Airport, Belgium
- Target group: regional airports

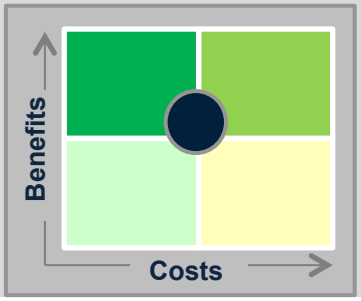
GSA study document & contact person

- **Study on sustainable (re)building of small and mid-size airports**
- Deliverable provides an overview on measures and investments to be taken to reduce noise and odors by airports
- Involved GSA partners: KJK
- Contact: S. Van Eeckhoutte, Kortrijk Airport



Costs & benefits

- Lasting and significant reduction of aircraft noise (several dB) and odor by upgrading airports infrastructure
- Investment costs vary between airports



Overall recommendation

- Catalogue of available measures and techniques highlights effective opportunities to decrease various emissions by infrastructure design
- Highly recommended to define noise and odor mitigation concepts
- High value if used as input for airport planning purposes

Catalogue of the latest and most promising noise reduction measures– local applicability depends on individual airport settings

Airport Management

1.4 Noise reduction toolkit

Study | **Airport Authority Bremen**

General description

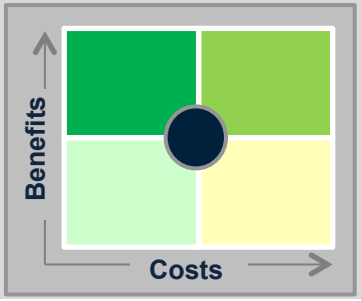
- Assessment of measures and techniques for effective noise abatement
- Study shows recommendations to airports, authorities and airlines

GSA study document & contact person

- **Noise Reduction Model and Toolkit to Limit Noise Exposure to the Environment**
- Insights and overview on state-of-art noise reduction measures for regional and medium sized airports
- Involved GSA partners: all partner airports
- Contact: Andreas Krüger, Ministry of Economics, Labour and Ports, Bremen, Germany (Airport Authority Bremen)

Costs & benefits

- Implementation costs vary between airports, selected techniques and measures
- Benefits: Reduction of noise in the surroundings of airports



Overall recommendation

- Comparison and assessment of noise reduction very valuable as part of 'best-practice' exchange
- On local level the feasibility depends on airport specifics, layout and proximity to vicinity
- For some airports it could be possible to extend the available takeoff run while this causes operational problems for other airports.

New tender policies can be introduced easily – a substantial quick-win to make the airport more sustainable

Airport Management

1.5 Company policy on sustainable tendering

Showcase | **Groningen Airport**

General description

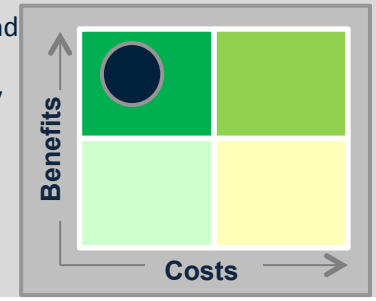
- Development of a sustainable tendering policy
- Key objective is to explicitly value sustainable performance in tendering supply and contracts for airports
- Target groups are small and regional airports that want to tender airport operations in a sustainable way

GSA study document & contact person

- **Showcase: Sustainable tendering of the GRQ runway extension**
- Involved GSA partners: GRQ, Province of Drenthe
- Contact person: Onno de Jong, Groningen Airport

Project costs & benefits

- Benefits through measureable and lasting Co2 reduction, reduced energy consumption and possibly lower costs for sustainable materials (e.g. ground ash as alternative top layer for sand)
- Low costs for implementing tender policy



Overall recommendation

- Consider sustainability performance indicators as decisive element of the scoring model
- Provide extra rewards for leading sustainability concepts
- Ensure that sustainable achievements are prevailing and long-term quality is assured
- Recommendation to follow the Design, Build, Finance and Maintain method (DBFM)

Information tailored for target groups improves public awareness and economic success of regional airports

Airport Management

1.6 Green Airport Marketing

Study

Province of Drenthe

General description

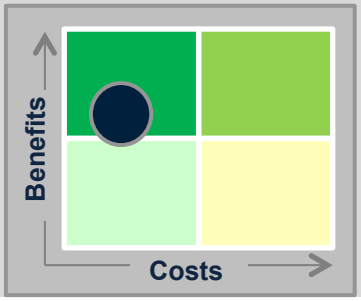
- Using greening of airports for positive attention
- Key objectives: Integrate greening airports into the common marketing
- Target groups: public, boards and politicians

GSA study document & contact person

- **Green Airport Marketing Concept**
- Guide to combine airport and green marketing to sustainability reporting
- Improved passenger experience by communication and information via social media
- Involved: All GSA partners
- Contact person: Ben L.J. van Os, Province of Drenthe

Study costs & benefits

- Limited internal costs for study conduction
- Benefits: improved stakeholder support, better communication and image of regional airports, better understanding of advantage, use and power of social media (positive/negative)



Overall recommendation

- Proven benefits by introducing green airport marketing
- Improved commitment to regional airport by all groups of stakeholders
- Don't make something green that isn't
- Combine passenger experience with sustainability aspects
- Leverage green airport marketing by better use of social media

Joint policy recommendations as contribution to EU policy- and rulemaking process to improve framework for regional airports

Airport Management

1.7 Joint policy recommendations

Position Paper

Province of Drenthe

General description

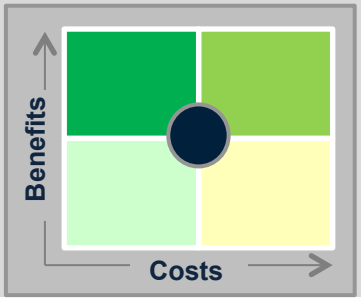
- Overall outlook on future aviation policy and regulation in the EU
- Position paper and recommendations of GSA airports as contribution to EU policy and rulemaking process
- Target groups: European and national rule-, policy and decision-makers

GSA study document & contact person

- **GSA policy recommendations**
- Opinion and policy recommendations to European institutions acknowledging the strategic position of regional airports and public transport operators
- Involved all GSA partners
- Contact: Ben L.J. van Os, Province of Drenthe

Study costs & benefits

- Costs related to initial assessments, internal group alignment and travel to European institutions
- Benefits by more favorable legal framework conditions



Overall recommendation

- European institutions clearly require stakeholder feedback
- Hand-over of group opinion and recommendation is expected to have impact in the long-run
- Expressing own position will aid consideration within legislation and definition of future funding opportunities
- Developing policy recommendations improves knowledge within partnership

Economic and social impact assessment underline importance of GSA airports for their region as well as for the NSR

Airport Management

1.8 Regional Economic Impact of Airports

Study

Province of Drenthe

General description

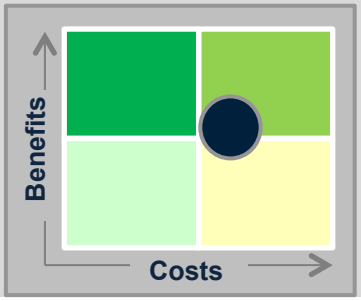
- Assessment of function and role of regional airports
- Key objective is to create transparency on contribution of GSA airports in terms of regional development and economic welfare
- Sound instrument to ensure lasting stakeholder commitment and public consensus

GSA study document & contact person

- **Study on function and Role of Regional Airports**
- Quantitative and qualitative study including SWOT analysis and industry benchmarking methodologies
- Involved : all GSA airports
- Contact: Ben L.J. van Os, Province of Drenthe

Study costs & benefits

- Cost approx. €20.000 plus internal efforts
- Delivers market insights for airport strategy development
- Better stakeholder support and public acceptance



Overall recommendation

- Powerful tool for regional airports to highlight role and importance for regional economy
- Instrument to improve stakeholder commitment and public acceptance
- Application of industry proven methodologies ensure reliable and accepted results (jobs, gross value , etc.)
- Availability of data for quantitative analysis is essential

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Legend	
ID	WP 3 Activity
ID	WP 4 Activity
ID	WP 5 Activity

Introduction of electrified GPUs is proven to be economically and environmentally viable

Airport Operations

2.1 Sustainable Ground Power Unit (GPU)

Pilot — **Billund Airport & Groningen Airport**

General Description

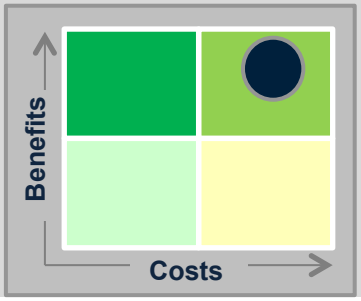
- Assessment and testing of sustainable alternatives to diesel-powered GPU (electrified, bio-diesel)
- Key objective was the development of an eGPU (cable system) together with airport users
- Target groups: airports and ground handlers

GSA study document & contact person

- **Sustainable GPU report**
- Assessment of eGPU and biodiesel powered GPUs
- Involved: Groningen Airport, Billund Airport
- Contact: Jette Gelsbjerg, Billund Airport
  Onno de Jong, Groningen Airport

Pilot costs & benefits

- Associated costs (estimated): € 55-65.000 per eGPU
- Benefits: Reduced energy consumptions, costs savings (-90% for operations) and lower emissions



Overall Recommendation

- Electric GPU far more effective than diesel or bio-fuel GPU
- Moderate investment, replace diesel GPU by electric GPU
- Significant reductions in costs, consumptions and emissions proven by field testing at Billund Airport
- Bio-diesel powered GPUs are not recommended as business case did not show real benefits in terms of costs savings and reduced energy consumptions

Energy plants as substantial element of airport area management strongly support decreasing carbon footprint of airport operations

Airport Operations

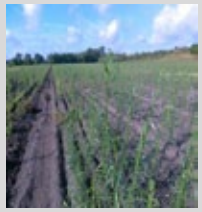
2.2 Sustainable Plant & Area Management

Research Report & Pilot

Billund Airport & Groningen Airport

General description

- Assessment of energy plant farming as element of airport area management
- Understand effects on air quality, noise emissions and bird strike risks
- Target group: Airports, energy suppliers

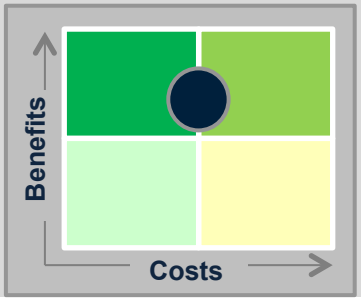


GSA study document & contact person

- **Study on Sustainable Plant & Area Management** (University of Wageningen on maximal reduction of Co2 and fine durst through planting of trees)
- Research and experience in willow farming at airport areas
- Involved : Billund Airport and Groningen Airport
- Contact: Jette Gelsbjerg, Billund Airport
  Onno de Jong, Groningen Airport

Project costs & benefits

- Establishm. cost €1700-1900 /ha
- Operating costs €250-300 ha/yr
- Benefits include the income from sale of wood chips €250-350 per ha/yr, reduction of risk of bird strike, contribution to the production of green energy



Overall recommendation

- Especially willowing farming has a proven business case as willows are fast growing energy plants with very limited risks of bird strikes
- Key driver to decrease airports carbon footprint by growing own energy plants for heating airport facilities
- Thorough assessment of right location at airport area necessary to maximize output

Realising CO2 neutral heating through district heating powered by willows grown on the airport property and electricity cooling

Airport Operations

2.3 Sustainable Heating and Cooling of A/C

Research Report & Pilot

Billund Airport

General description

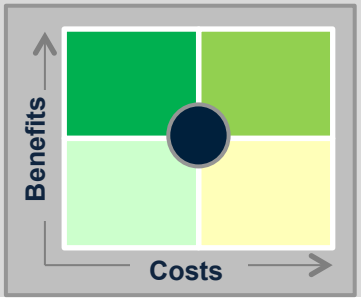
- Replacement of traditional diesel heaters by stationary heating devices and electricity-based cooling (district from willow planting at the airport)
- The key objective is to reach 90% Co2-neutral A/C heating in 2020
- Target group: Regional airports

GSA study document & contact person

- **Research report on heating and cooling of aircraft**
- Technical information on requirements, setup and application, experience report, test results , business case
- Involved partners: Nilan, Thomas Cook Airlines, Billund Airport
- Contact: Jette Gelsbjerg, Billund Airport

Expected costs / benefits

- Associated costs : €90-€100.000 per unit
- Major benefits are savings in energy consumption and reduction of emissions



Overall recommendation

- Generally, the solution for heating and cooling of AC is recommended as very beneficial
- The benefits depend on local conditions (energy supply)
- Techniques and measures shall be verified at local levels
- More experience and tests are required to validate long term performance

Case study on LED lighting delivers transparency on economic benefits for decision making

Airport Operations

2.4 LED Lighting for Taxiways and Runways

Feasibility Study | **Southend Airport**

General description

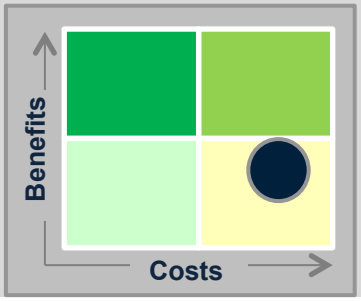
- Evaluating the business case for installing LED lighting compared to standard Tungsten Halogen Fittings
- Key objective was to show feasibility of implementing LED lighting
- Target group: Used as a tool by other airports looking to install LED

GSA study document & contact person

- **Aeronautical Ground Lighting - Evaluating the business case for use of LEDs**
- Involved partners: LSA Airport, BRE, GRQ, KJK, BLL
- Contact: Sam Petrie, Southend Airport

Expected costs & benefits

- LED at present is significantly more expensive than T&H
- Less maintenance, does not completely remove need for inspections,
- LEDs offer a superior operational performance



Overall recommendation

- LED lighting offers a superior operational performance over tungsten halogen lighting
- Benefits differ depending on the operation and size of the airport
- Initial costs could be high if changing all of the circuits
- Increased operational benefits from totally new installation instead of retrofit
- More evidence required to validate long term performance

Sustainable winter management techniques enable reductions in de-icing liquids and promise a full sustainable run-off treatment

Airport Operations

2.5 Sustainable Winter Management

Study | **Sandefjord Airport**

General description

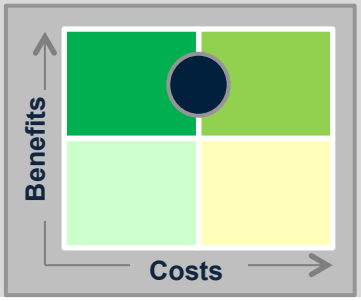
- Identification of techniques and measures to decrease use of deicing liquids and water contamination by run-off
- Research on biodegradation of fluids used for runway and aircraft de-icing
- Target group: Airports, Deicer

GSA study document & contact person

- **Winter Management Toolkit**
- Baseline report and analysis
- Sustainable run-off treatment
- Innovative deicing solutions
- Involved partners: TRF, BLL,BRE, GRQ
- Contact: Lars Guren, Sandefjord Airport

Costs & benefits

- Costs : External consultancy support, internal efforts
- Benefits: reduction in use of RWY deicing granulate , lower water contamination, cost savings



Overall recommendation

- Generally, assessed solutions are recommended as very beneficial
- Possible constraints associated with airport layout and storage capacity for contaminated water
- Some measures require comprehensive investments to established storage capacities such as central de-icing pads
- Techniques and measures shall be verified at local levels

CDO is an effective measure to leverage fuel savings, noise reduction and lower emission of airport and airline operations

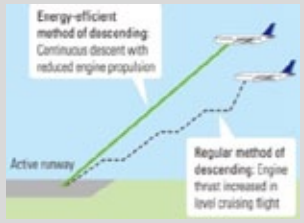
Airport Operations

2.6 Continuous Descent Ops for regional airports

Pilot | **Groningen Airport**

General description

- Implementation of continuous decent approach to reduce operational constraints at airports due to aircraft noise and emissions
- Key objectives: reduce aircraft emissions, fuel savings, noise reduction
- Target groups: airline s, airports

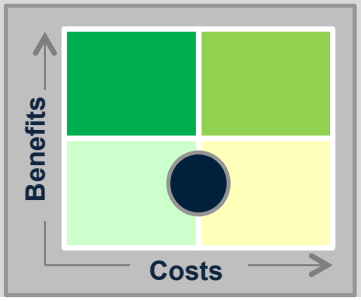


GSA study document & contact person

- **CDA brochure & CDO report**
- Providing how-to information and an experience report
- Involved GSA partners: GRQ, LVNL, Eurocontrol, NLR, transavia.com,
- Contact: Onno de Jong, Groningen Airport

Expected costs & benefits

- Costs: external consultancy support and personnel costs for project management
- Benefits: noise reduction with 5-7 dB (A), fuel saving 25-40% during the last 45 km of approach, lower emissions



Overall recommendation

- Upon implementation of CDO at GRQ, the results are rated very positively by all partners involved
- CDO offers real benefits like saving fuel costs, reducing emission and noise from aircraft engines
- Difficulties of implementation lie in overcrowded airspace reducing the implementation possibilities and thus the environmental benefits of CDO

Affordable environmental monitoring can be a feasible alternative for regional airports

Airport Operations

2.7 Cost effective noise monitoring techniques

Research Report | **National Physical Laboratory (UK)**

General description

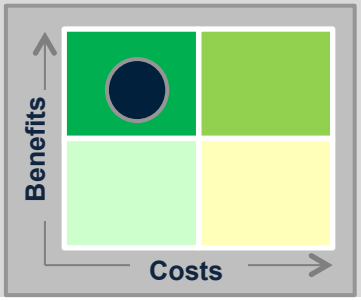
- Low costs noise monitoring equipment developed by UK market leader
- Key objective is to make cost efficient noise measuring more self sufficient, reliable, and enable remote data analysis
- Target group: Regional airports' environmental management

GSA study document & contact person

- **Report on affordable environmental monitoring**
- Final report on technical specification of equipment, test application and data analysis
- Involved partners: Institute for Sustainability, Southend Airport
- Contact: Richard Jacket, National Physical Laboratory

Expected costs & benefits

- Costs: hire of lower cost monitoring equipment and installation and data monitoring /evaluation costs
- Benefits: methodology and data shared across regional airports, cost reductions



Overall recommendation

- Upon completion of the test, the GSA commercial airports may want to combine resources and establish the business case for holding a joint and shared pool of environmental monitoring equipment, ensuring it fits the national and local technical specifications. Data analysis could be shared and jointly undertaken. This reduces costs for hiring equipment on an individual basis significantly.

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ID	WP 5 Activity

Connecting an airport to public transport infrastructure is a significant investment which may need to be backed up by several partners

Public Transport

3.1. Sustainable Airport Accessibility

Study | **Kent County Council**

General description

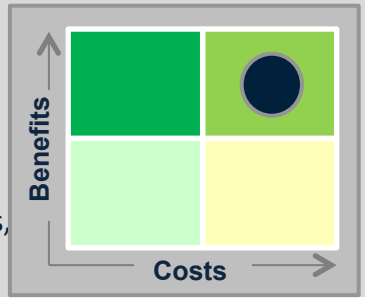
- Analysis of public transport deficiencies and potential quick win and long term solutions at each partner airport
- Analysis of bus service provision to Manston and Lydd airports in Kent and applicability of solutions to partner airports
- Analysis of the business case for a new rail station to serve Manston Airport

GSA study document & contact person

- **Public Transport Accessibility Study** (M. MacDonald, ‘11)
- **Innovative Bus Services Study** (M. MacDonald, ‘12)
- **Business Case for Thanet Parkway Rail Station** (Pre-investment Rail Access Study) (Peter Brett, ‘13)
- **Public Transport Model for Regional Airports**
- Partners: Kent County Council, Southend, Billund, Bremen, ZVBN, Sandefjord, Groningen, Drenthe
- Contact: Joseph Ratcliffe, Kent County Council

Expected costs & benefits

- Costs of new public transport infrastructure dependent on specific location and passenger demand
- Benefits -reduced road congestion & carbon emissions, and enhanced accessibility



Overall recommendation

- Quick win solutions identified at each regional airport should be considered for implementation
- Demand responsive bus services may be the first step towards scheduled services and dedicated airport buses
- A new rail station is high cost but high benefit, if remote from the terminal, bus connectivity depends on demand
- Cooperation with regional authorities is essential

“Electrifying” public transport to and from the airport requires substantial investments, strong public demand and political backing

Public Transport

3.1. Green Airport-Connecting Public Transport

Study

Ministry of the Environment, Construction and Transportation in Bremen

General description

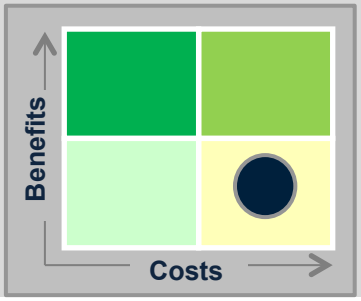
- Feasibility study for a potential trolley bus line which services the Airport of Bremen
- Survey of (technical) advantages and limitations of a trolley bus transit system
- Target group: regional decision makers

GSA study document & contact person

- **Feasibility Study of Trolley Bus on Line Servicing Bremen Airport**
- Involved partners: Ministry of the Environment, Construction and Transportation (SUBV) and local transport authority, BSAG
- Contact: Rebecca Karbaumer, SUBV

Expected costs & benefits

- Costs: external consultancy support and personnel costs for project management
- Benefits: knowledge gained about technically and economically feasible options for reducing emissions, noise and fuel costs



Overall recommendation

- Study provides insight into the technical and financial feasibility of a trolley bus line servicing the airport
- Recent experience has shown a high level of investment necessary but potential for saving fuel costs, reducing emissions and noise from bus engines
- Difficulties of implementation lie in the extent of financial investments required and lack of capacity utilisation to make trolley bus operation cost effective for the specific bus line

Integrated passenger journey planner makes public transport more attractive – investment in software and infrastructure required

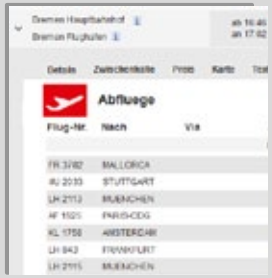
Public Transport

3.3. Integrated Journey Planner

Pilot | **VBN**

General description

- Improving public transport passenger information
- Integrating real time data into public transport journey planner
- Optimized information at the airport with basic public transport information

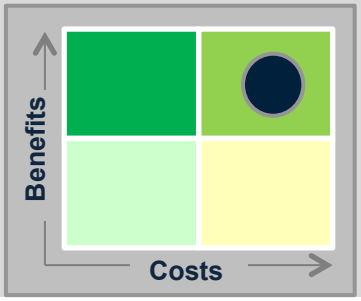


GSA study document & contact person

- **Manual on Integrated Passenger Information**
- Manual on integrating data, data formats and passenger requirements
- Involved partners: VBN, ZVBN, Bremen Airport
- Contact: Tim Semmelhaack, ZVBN

Expected costs & benefits

- Associated costs: costs for software extensions (journey planner) and infrastructures (displays)
- Benefits: increased passenger satisfaction and attractiveness of public transport



Overall recommendation

- Powerful tool to increase attractiveness of airport connecting public transportation by providing seamless and integrated real time travel data
- Support open data initiatives to facilitate access to public transport data and airport data
- This actions supports improvement of data dissemination

Acceptance of airport-connecting public transport can be improved by integrated ticketing solutions – only limited support by airlines

Public Transport

3.3. Integrated Airline – Public Transport Ticketing

Study

VBN

General description

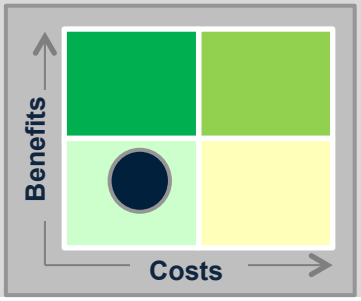
- Analysis on integrated ticket solutions public and air transport
- Key objective is to show best practices from other airports and identify financing options
- Target group: larger regional airports

GSA study document & contact person

- **Study on integrated ticketing**
- Deliverables provide study on best practice and challenges on implementing integrated ticketing solutions
- Involved partners: VBN, ZVBN
- Contact: Tim Semmelhaack, ZVBN

Expected costs & benefits

- Associated costs: ticket control infrastructure (optional)
- Benefits: reduced ticket distribution costs and increase in public transport attractiveness



Overall recommendation

- Generally recommendable, but airlines should be incentivized to offer integrated airline – public transportation ticketing solutions
- A single airport and public transport provider cannot implement viable solutions

provincie Drenthe

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