

Norway HSR Assessment

Economic and Financial Analysis

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- Overall Conclusions

Background

Purpose of Appraisal

- In Phase III the focus has been on **common comparative appraisal**
 - Indicate what level of overall economic and financial performance might be delivered by HSR alternatives in Norway
 - Enable **comparative** economic and financial performance of a large number of alternatives, across multiple corridors, to be understood
- **Not** aimed at determining precise absolute economic and financial performance in detail as impractical to do in Phase III

Types of appraisal

- **Economic Appraisal** considers the relative scale of scheme costs and social and economic benefits – puts a monetary value to costs, impacts and benefits
 - On a consistent basis and over an identified lifetime
 - Costs / benefits estimated for the future are “discounted” relative to what they would be worth if realised today - an annual discount rate is applied
 - Draws on the output of other work
 - Cost and risk estimates for alternatives
 - Demand and revenue forecasts
 - Freight, Environmental and Safety analyses
- **Financial Appraisal** focuses on the potential for revenue from HSR operations to cover the ongoing costs over a defined operating period
 - Uses the same information as the economic appraisal...BUT
 - Ignores social benefits and focuses solely on financial cashflows
 - Indicates the likely need for ongoing Government financial investment / support after the initial capital investment has been made

Approach to Economic Appraisal

- Two **Economic Appraisal** frameworks used for HSR study:
 - ‘Standard’ framework
 - Consistent with JBV guidance used for conventional rail projects
 - ‘Alternative/Extended’ framework
 - Builds on ‘Standard’ framework but
 - is adjusted/extended to increase relevance for HSR assessment
 - aimed at better representing how HSR would be perceived and valued relative to other modes
- Alternative framework found to represent potential performance better – recognised to be the case by experts on the Study Steering Group
- Results presented today are those using the Alternative framework

What the Appraisal captures

- Impacts on private transport users; including changes in:
 - Travel time (access, waiting and on board time) and comfort
 - Fares
- Revenue income and operating cost impacts on passenger transport operators
- Indicative impacts on freight users / operators
- Impacts on third parties; including indications of impacts on:
 - Greenhouse gas emissions
 - Noise
 - Local air quality
 - Accidents
- Initial and ongoing investment costs based on alignment designs and operating / service specifications; including allowances for:
 - Risk
 - Costs of public financing through taxation
 - Residual values of assets

Impacts not captured

- There are some impacts not captured as part of Phase III Economic and Financial Appraisal that it is recognised would be relevant to decisions on taking HSR forward
 - Non-monetised impacts of HSR interactions with landscape / townscape / environmentally sensitive and important areas
 - Potential Wider Economic Impacts in terms of access to employment, generation of new jobs and improved economic productivity
 - Impacts during construction – requires more detailed design development
 - Views of the public and stakeholders
- The appraisal is “policy neutral” – no emphasis or particular weight is given to aspects of appraisal to reflect any particular policy agenda

Key Assumptions (1)

- Economic parameters overall as per Norwegian appraisal guidance requirements unless improved through securing better data
 - Population growth, GDP growth, discount rates etc.
 - Values of Time and behavioural parameters derived from new HSR surveys for instance
 - Real growth over and above inflation applied to investment costs
- Funding and Delivery Structure
 - Entirely Government funded and financed from tax revenue
 - Rolling stock is leased
 - HSR is public sector managed and operated – no private franchise or infrastructure charging regime

Key Assumptions (2)

- 2 different Passenger Service Scenarios (PSS) tested
 - PSS1: aimed at demand/market capture - Core+Peak services (26 trains/day each way); rail fare 60% of air fare
 - PSS2: commercially oriented operation - Core only services (18 trains/day each way); rail fare = air fare
- Other transport networks
 - No change in provision of infrastructure or operations / service with introduction of HSR
 - Competing Air, Rail, Coach and Car modes are assumed to continue operating largely as now
- Construction start date assumed to be 2017
- HSR Operations start date varies from 2022 to 2027 depending on construction period by alternative

Scenario C/D Economic Core Appraisal Results

Economic Appraisal Scope

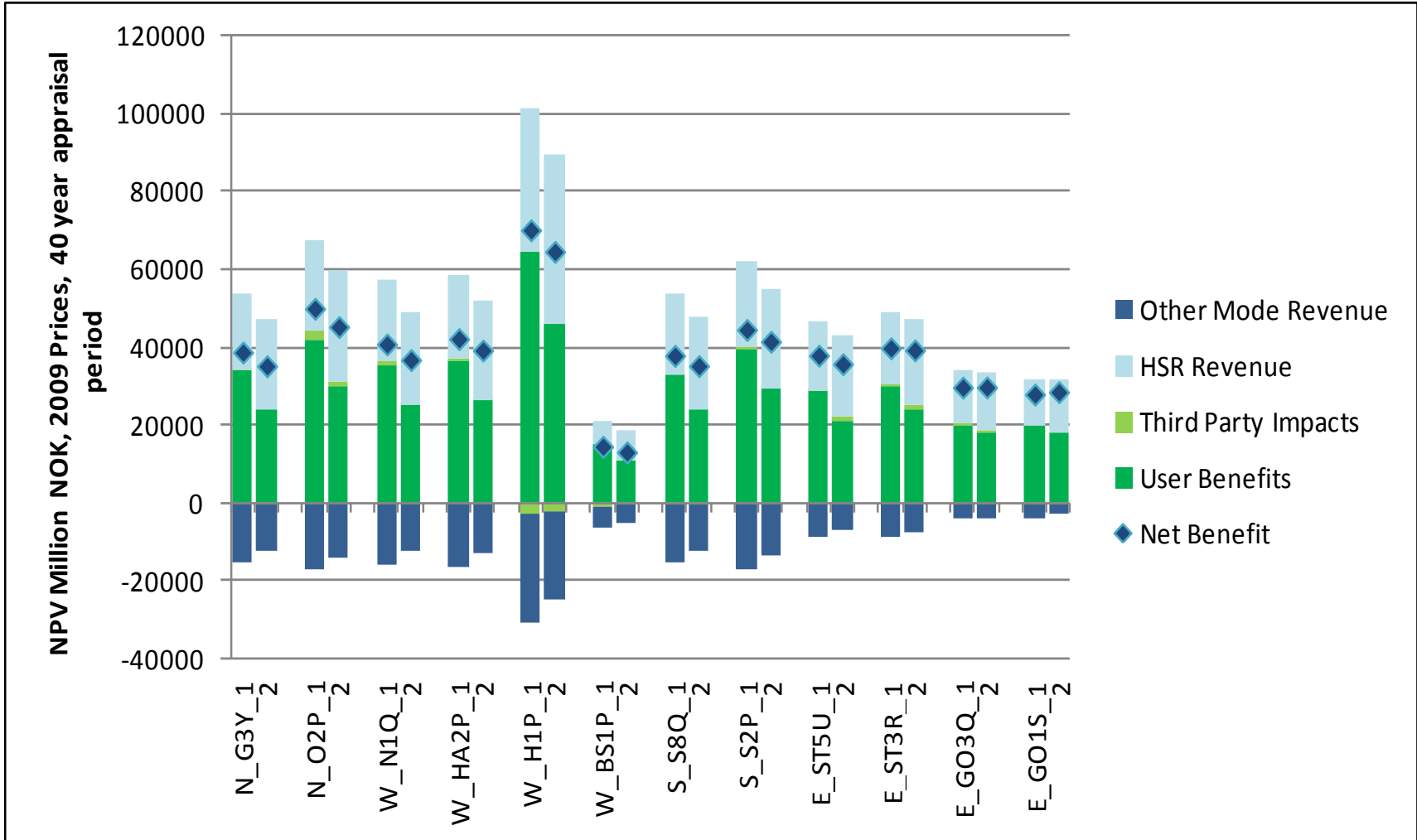
- Appraisal of 12 Scenario C/D alternatives covering 6 routes
- Presentation of results
 - Alternative Approach – 40 years of HSR operation
 - All impacts presented have been discounted at 4.5% and are in NOK millions at 2009 prices unless otherwise stated
- Important to recognise that specification of alternatives (services, stopping patterns etc.) has not been optimized for economic or financial return at this stage
 - Results provide a reasonable basis for comparing alternatives BUT
 - Potential scope to reduce costs and improve benefits / financial returns

C/D Alternatives – User Benefits, Revenues and Third Party Impacts (1)

- Presents net economic and financial benefits excluding the initial and ongoing investment costs
- Benefits and revenues are driven by a combination of:
 - Any door-to-door journey time/cost advantage HSR offers on route, compared air, rail or car
 - Size of the market to which this applies
 - Both aspects vary considerably by corridor / alternative

C/D Alternatives – User Benefits, Revenues and Third Party Impacts (2)

NPV Million NOK, 2009 prices, 2015 discount year, 40 year period (Alternative Approach)

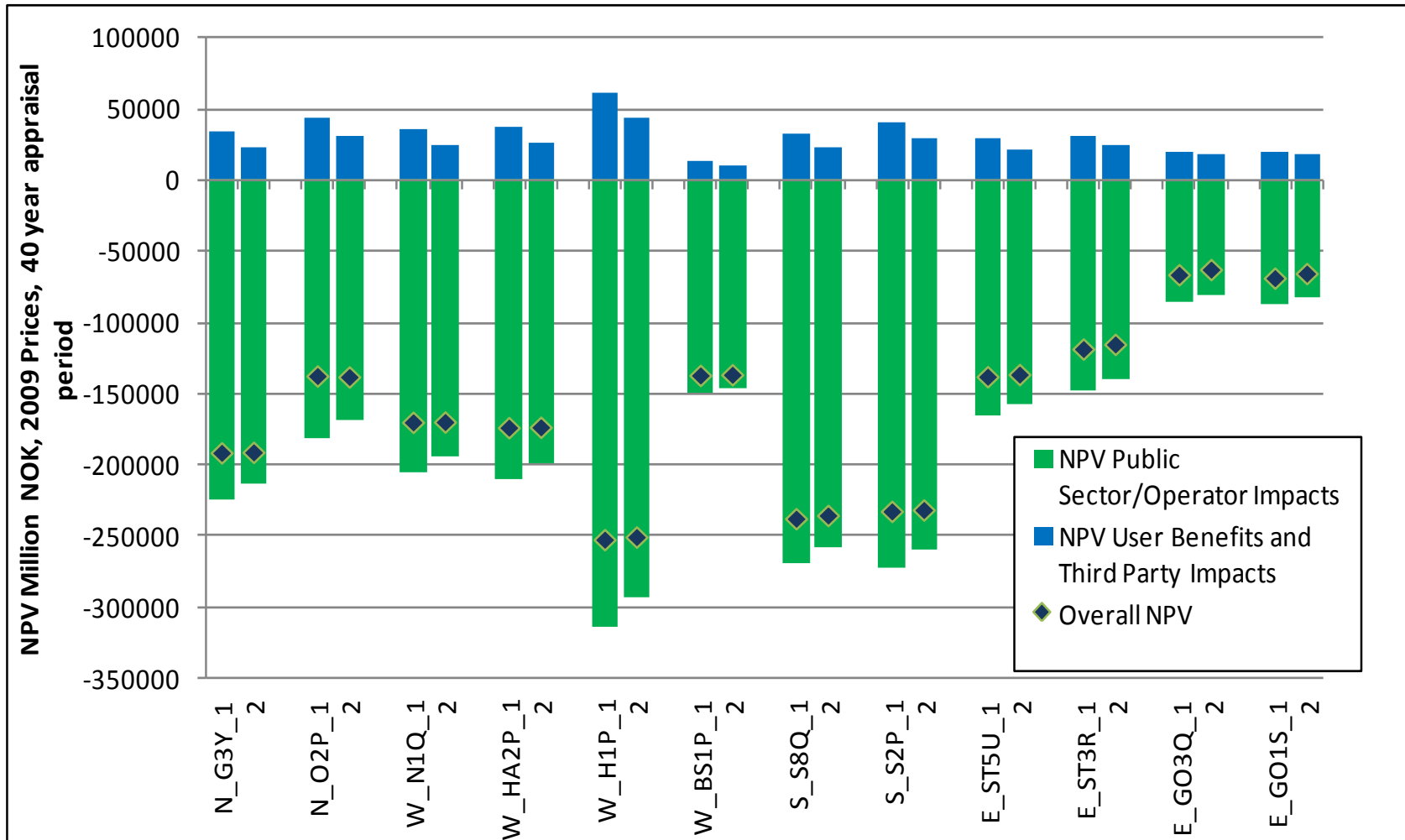


C/D Alternatives – User Benefits, Revenues and Third Party Impacts (3)

- Better performing alternatives have faster and more direct JTs, serving larger longer distance markets
 - greater user benefit and revenue value per longer end-to-end journey
- Better performing single route options by corridor
 - O2P (Osterdalen) in North (NPV 45-50 BnNOK)
 - S2P (direct route) in South (NPV 40-45 BnNOK)
 - HA2P (Hallingdal) in West (NPV 35-45 BnNOK)
 - ST3R (direct to Stockholm) in East (NPV 40 BnNOK)
- H1P best overall (NPV 65-70 BnNOK) BUT not directly comparable as it is serving 3 routes
- Bergen-Stavanger and Gothenberg alternatives are poorer performing
 - BS1P (coastal route) – good benefits per user but small market size
 - Gothenberg – more shorter distance trips and JT competitiveness of HSR against competing modes is less significant
- Freight and 3rd party (carbon / accident) impacts are very small contributors to overall benefits

C/D Alternatives Economic Appraisal Results (1)

NPV Million NOK, 2009 prices, 2015 discount year, 40 year period (Alternative Approach)



Scenario C/D Economic Appraisal Results (2)

- All corridors generate a significant negative economic NPV
 - NPVs ranging from -70 BnNOK to -250 BnNOK (Alternative approach)
 - Costs are approximately 5 to 10 times as large as benefits
 - Reflects large scale of investment required relative to travel market size and associated benefits
- Dominance of initial investment costs on economic appraisal mean “least costly” options perform the “best” (are the least negative) overall
- Impact of different passenger service scenarios
 - Reduction in costs with PSS2 offsets the slightly higher value of benefits+revenue identified with PSS1
 - In overall Economic Appraisal terms, results for PSS1 and PSS2 very similar
 - Expect to see greatest impact of adopting different PSS in Financial Appraisal

Economic Appraisal Sensitivity Tests

- Numerous additional appraisals undertaken to understand the sensitivity to changing assumptions and parameters, including
 - Discount rate tests - 2% and 5.5%
 - Assessment period - 25 and 60 years
 - Adding an indicative allowance of 15% or 30% to illustrate the potential impact of Wider Economic Impacts
 - Competitive response – assumes operators are able to take measures to reduce their costs to match their revenue loss without impacting on the services and costs for remaining passengers (for instance flying smaller planes on the same routes).
- Have little bearing on the overall Economic Appraisal outcomes because investment and renewal costs so significantly outweigh net benefits and revenues.
- BUT do indicate that benefits / revenues presented may be understating what C/D Alternatives could deliver

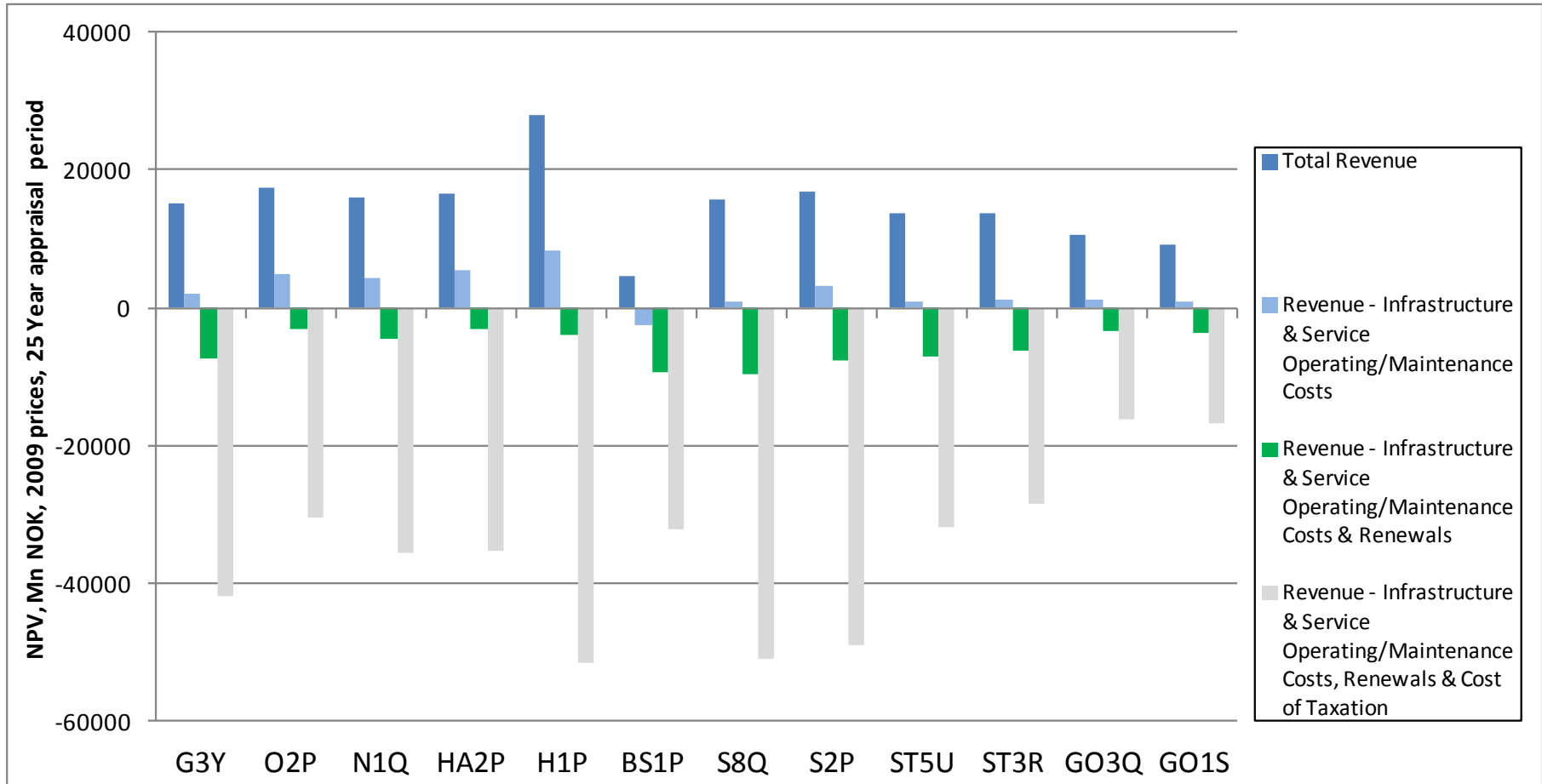
**Scenario C/D Alternatives
Financial Appraisal Results**

Scenario C/D Financial Appraisal - Scope

- Do HSR services have the potential to cover the ongoing cost of operating and maintaining the associated services and infrastructure?
- 3 definitions of ongoing costs considered:
 1. Service (station and train) and infrastructure operating and maintenance costs, including rolling stock lease but excluding capital renewal costs
 2. As 1. plus the cost of renewals
 3. As 2. plus the ongoing cost of tax financing additional public sector costs – assumed to be 20% of the cost of initial capital investment and renewals
- It should be noted that economy wide, indirect considerations such as tax finance (included in 3.), are not usually included in financial appraisals of rail schemes, which typically focus on direct costs associated with rail operations
- Results presented use 4.5% discount rate over a **25 year** period and are for both PSS1 and PSS2.

C/D Financial Appraisal Summary: PSS1

NPV Million NOK, 2009 prices, 2015 discount year, 4.5% discount rate, 25 year period, PSS1

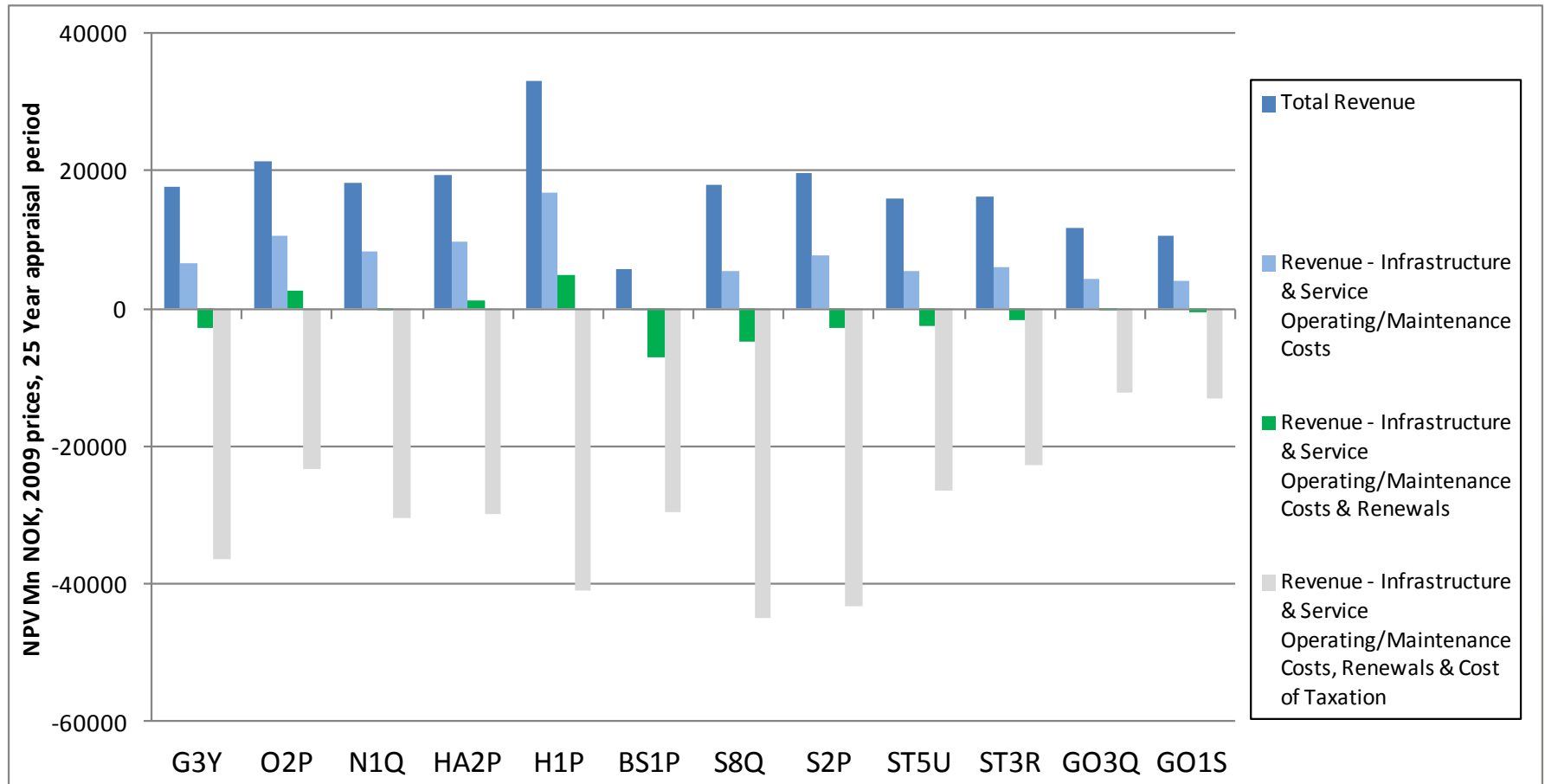


C/D Financial Appraisal Results: PSS1

- Revenue generated by all HSR alternatives, bar BS1P, is sufficient to cover service and infrastructure operating and maintenance costs, **excluding renewals**
- Strong likelihood that HSR services on most routes could operate commercially **if** implementation, renewal and financing costs excluded
- Best performing alternatives serving a single route are:
 - O2P in North
 - HA2P in West
 - S2P in South
 - ST3R in East
- H1P in the West performs most strongly but is exceptional in combining delivery of 3 service routes in a single scheme
- BUT, if renewals are included, no schemes under PSS1 achieve a positive net revenue position – reflects a non-commercially optimized specification of services

C/D Financial Appraisal Summary: PSS2

NPV Million NOK, 2009 prices, 2015 discount year, 4.5% discount rate, 25 year period, PSS2



C/D Financial Appraisal Results: PSS2

- Adopting a more commercially oriented service improves financial performance significantly – increased revenue, reduced cost
- A number of alternatives also cover renewals within a 25 year period
 - O2P in North
 - HA2P and H1P in West
 - Other options close to also covering renewal costs
- Costs are however heavily influenced by cost inflation rates applied – if only the standard rate of inflation is used, under PSS2 most alternatives cover renewals
- As expected, there is no possibility of any alternatives also meeting the cost of tax financing all capital investments

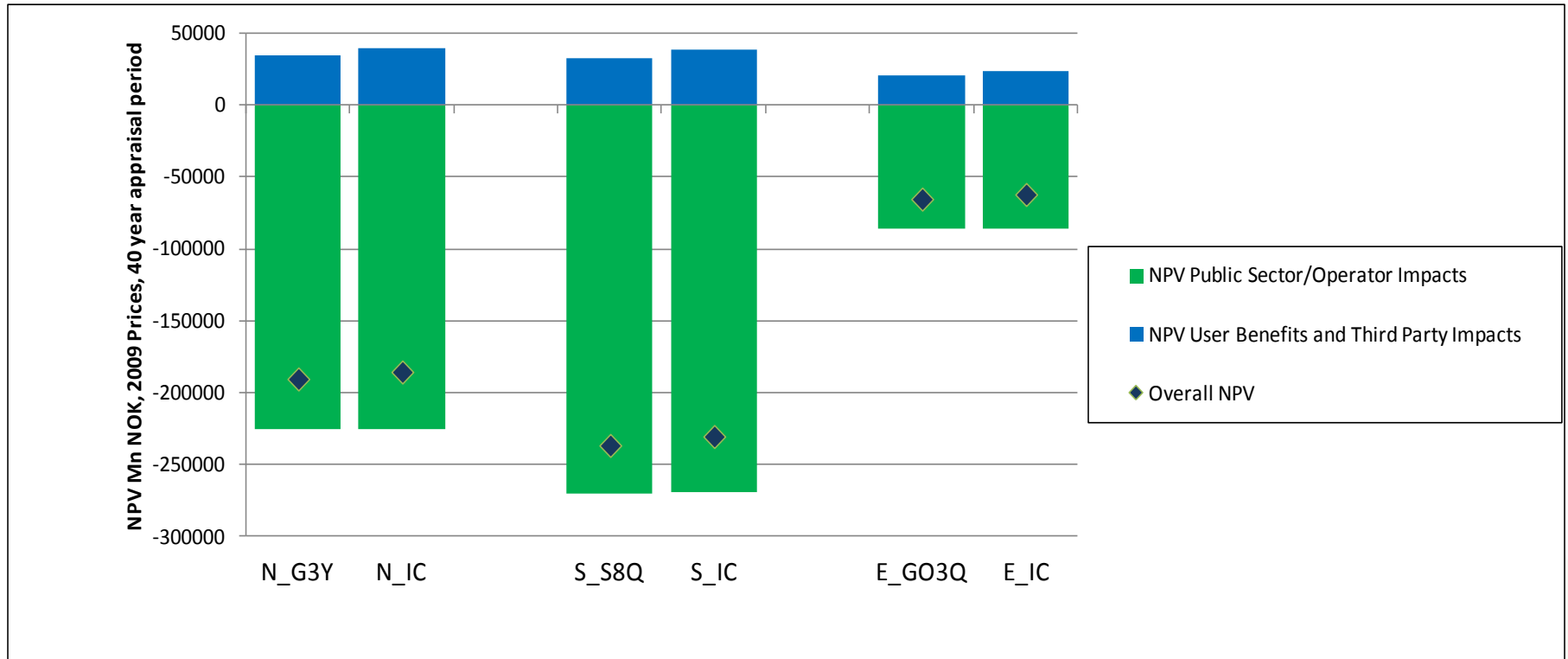
**Scenario C/D Alternatives
IC Scenario Economic and Financial
Appraisal Results**

Inter-City (IC) Scenario Tests

- Significant potential for interaction between HSR and IC lines and services. Separate IC Study is examining IC specific alternatives
- 2 IC Scenarios for HSR examined
 1. HSR delivers IC infrastructure improvements that delivers IC services improvements and associated benefits (and operating costs)
 2. IC project is implemented in advance of HSR,
 - Reduces investment and renewal cost of HSR
 - Start of HSR operation delayed by 2 years
 - A small reduction in HSR user benefits and revenues
- Description of alternatives to which scenarios apply:
 - **North Corridor (variant on G3Y)** - relates to delivery of 250kph upgrade between Oslo and Lillehamer
 - **South Corridor (variant on S8Q)** - relates to delivery of 250kph upgrade between Drammen and Porsgrunn
 - **East Corridor (variant on GO3Q)** - relates to delivery of 250kph upgrade between Ski and approach to Halden

IC Scenario 1: Economic Appraisal Summary

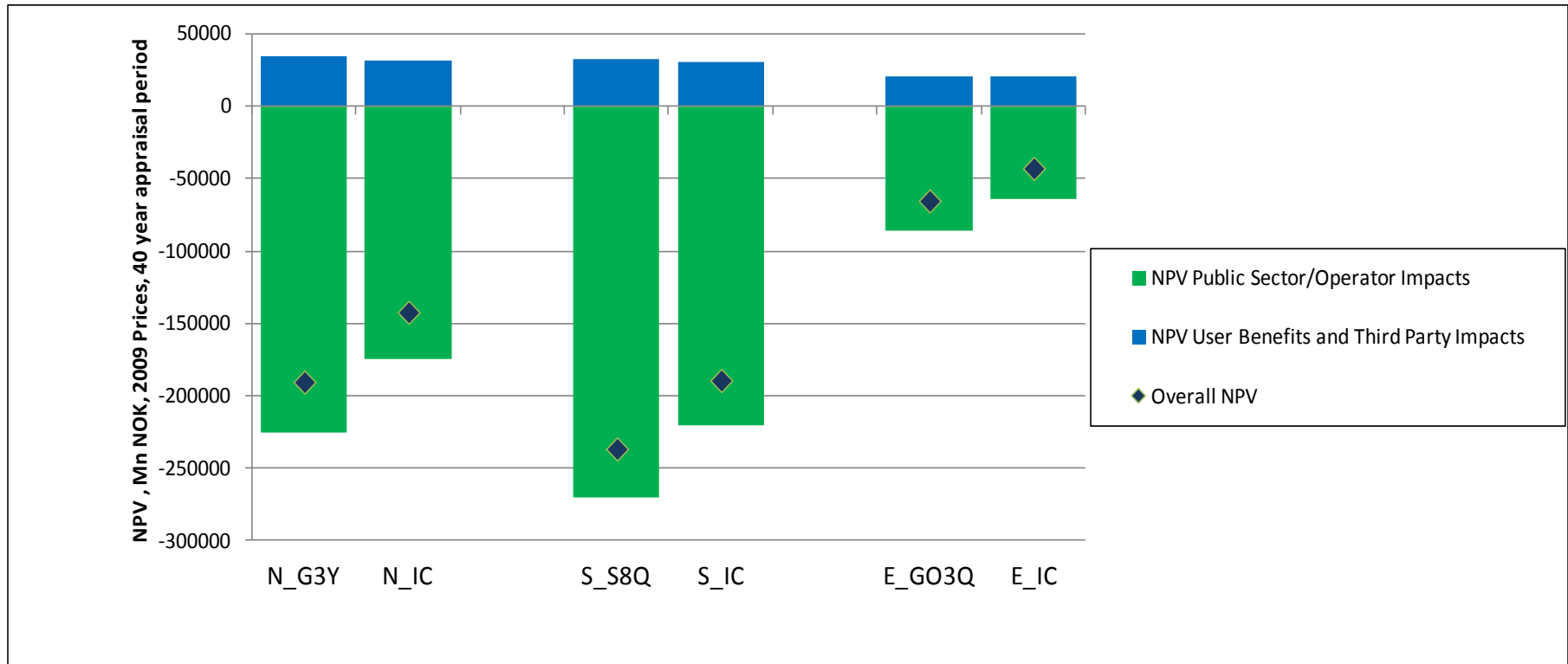
NPV Million NOK, 2009 prices, 2015 discount year, 40 year period (Alternative Approach, PSS1)



- Addition of benefits and net revenues to IC services does enhance overall HSR benefits by around 15%
- Not sufficient to address economic impact of the high investment costs and hence, the impact on the overall economic NPV is small

IC Scenario 2: Economic Appraisal Summary

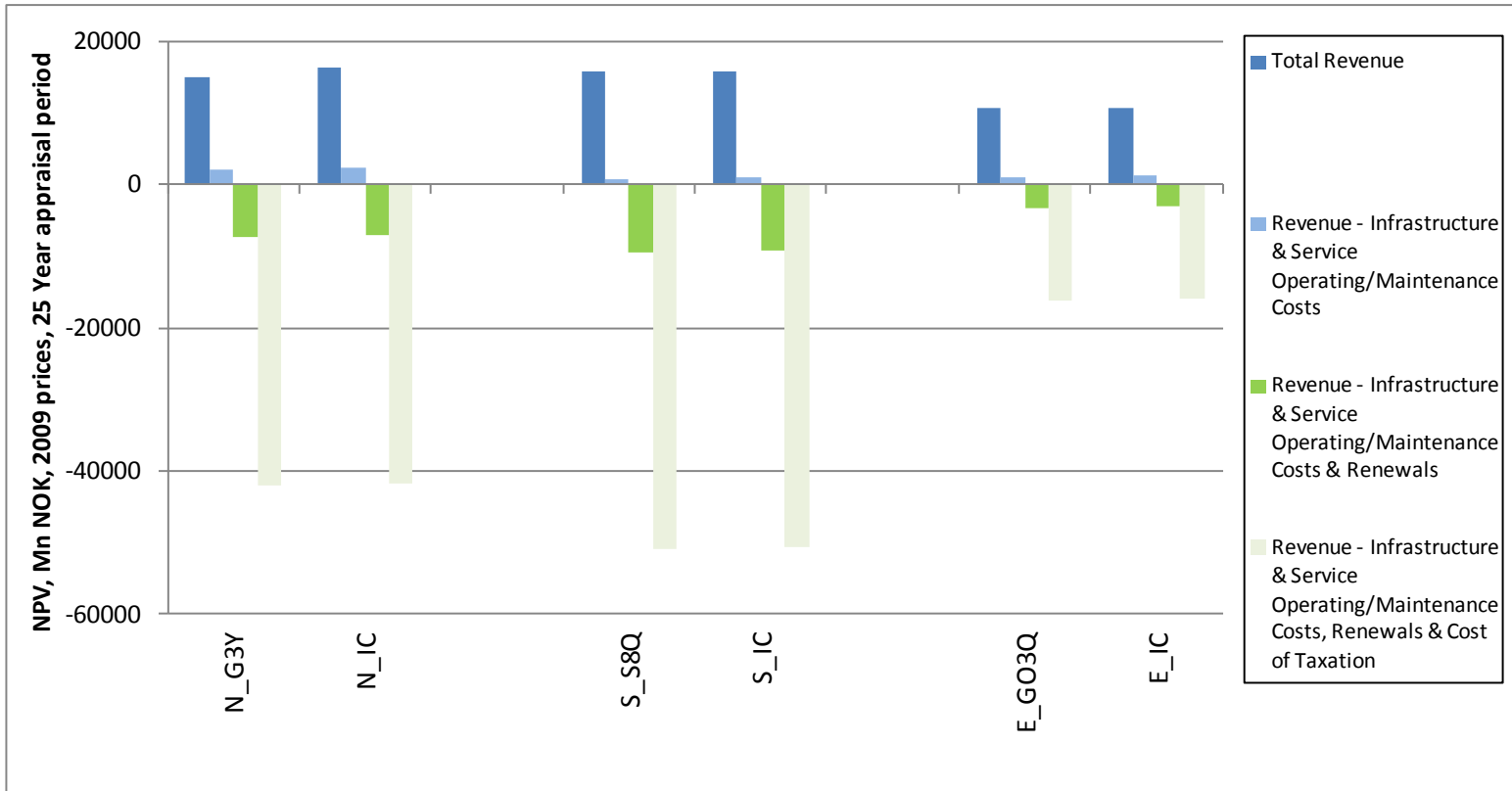
NPV Million NOK, 2009 prices, 2015 discount year, 40 year period (Alternative Approach, PSS1)



- Reduction in costs with IC Scenario 2 has a more significant positive impact on overall economic performance - reduces costs by between 20%-35%.

IC Scenario 1: Financial Appraisal Summary

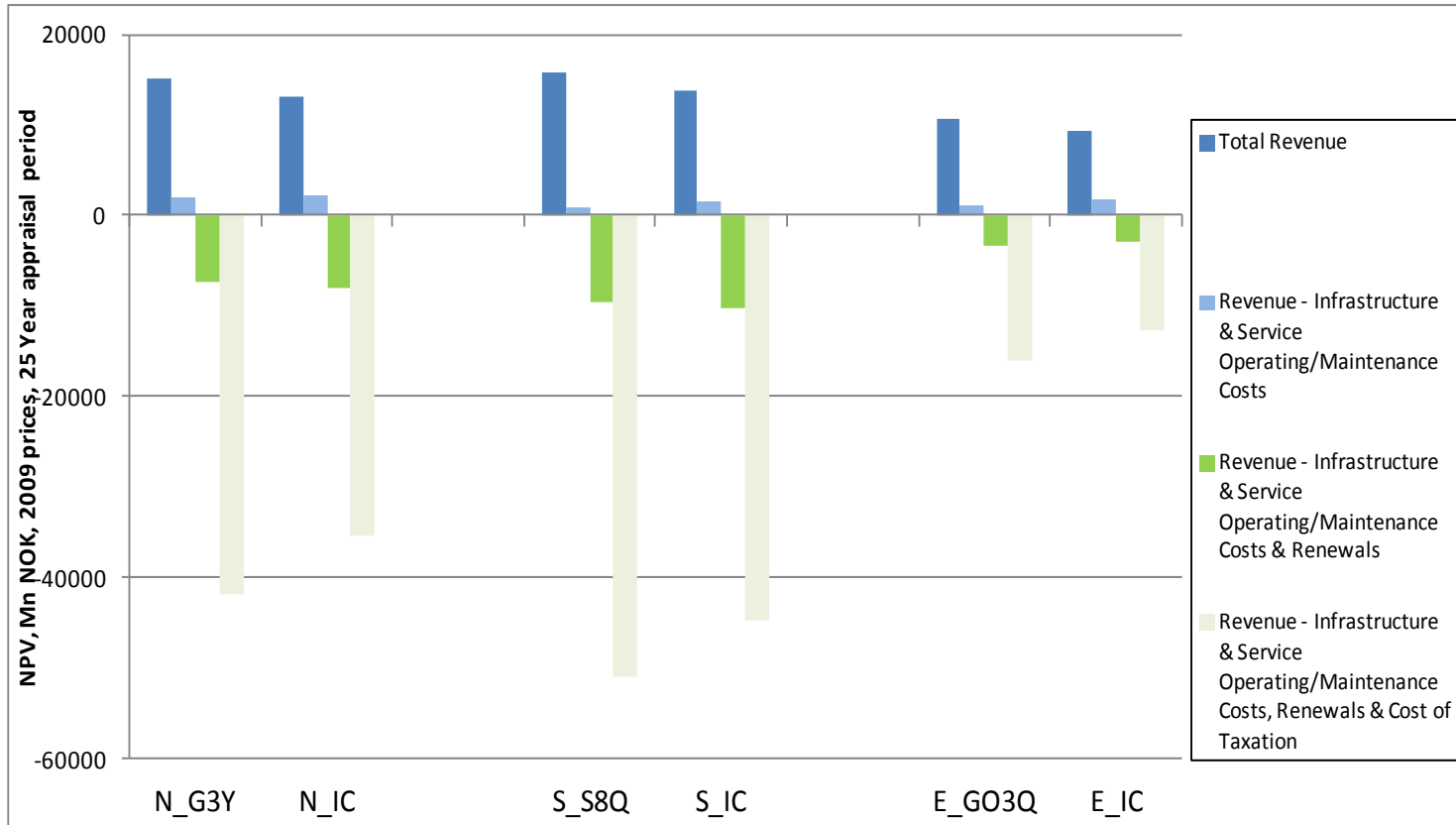
NPV Million NOK, 2009 prices, 2015 discount year, 25 year period (PSS1)



- The additional net revenue delivered by improved IC services does marginally improve financial performance over the core appraisal results; Impact would be similar with PSS2

IC Scenario 2: Financial Appraisal Summary

NPV Million NOK, 2009 prices, 2015 discount year, 25 year period (PSS1)



- Reductions in revenues and delay in when revenues start being realised, mean that the net impact of IC Scenario 2 is to slightly worsen financial performance of the alternatives

Scenario B Economic and Financial Appraisal

Scenario B Economic Appraisal

- Scenario B defined by JBV as:
 - ***‘Delivery of a uniform 20% reduction in travel time, maintaining the current stopping pattern and remaining single track outside of the Inter-City (IC) area’***
- Appraisal approach adopted replicates that used for Scenario C/D as far as possible
- Trips <100km not modelled – addressed using a sensitivity test where benefits and revenues are increased by 50%
 - This then provides a more reasonable basis to compare to Scenario C/D alternatives

Scenario B Alternatives

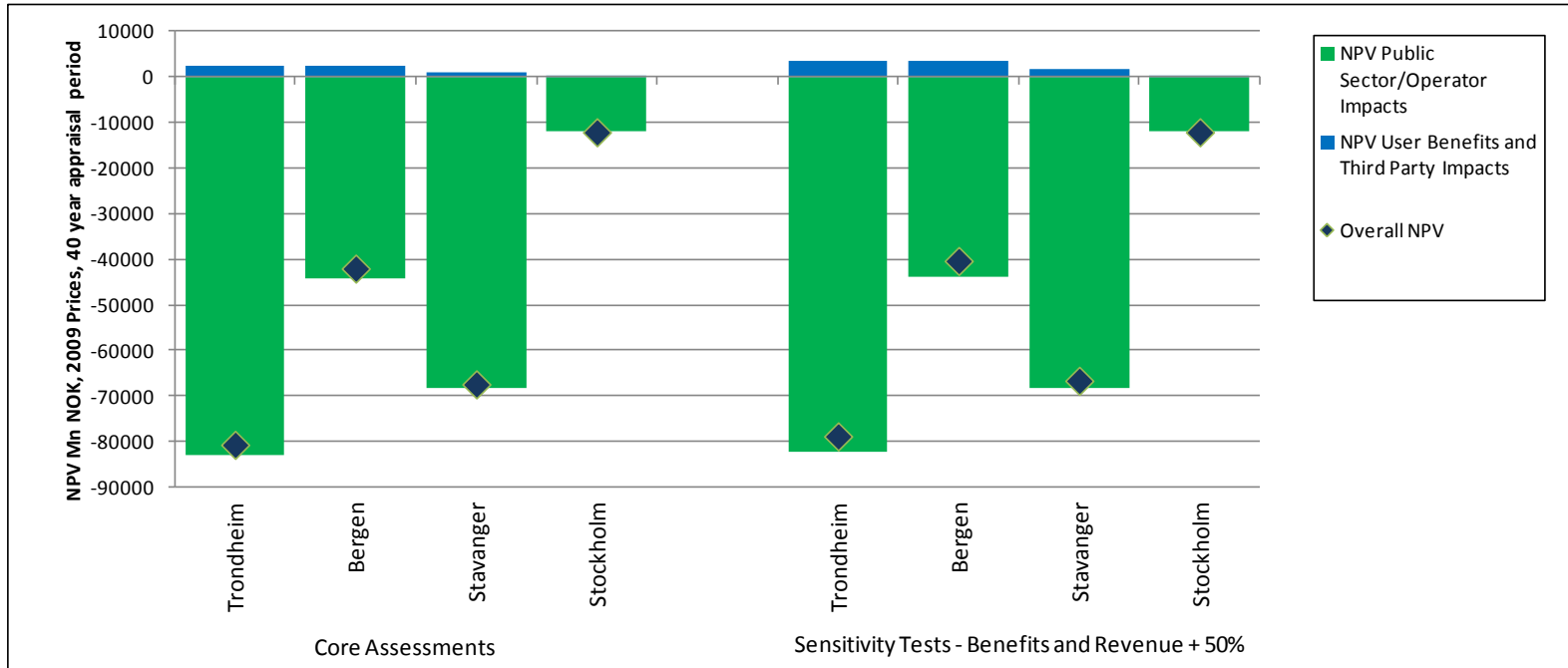
- 4 Scenario B alternatives considered

Corridor	2011 Fastest Journey Time	Scenario B Journey Time	HSR Option Comparison Time
Oslo-Trondheim	6:36	5:16	2:59 (G3:Y)
Oslo-Bergen	6:28	5:10	2:06 (HA2:P)
Oslo - Kristiansand -Stavanger	7:42	6:09	3:31 (S8:Q)
Oslo-Stockholm (Oslo-Charlottenburg)	5:55 (1:43)	5:34 (1:22)	2:56 (ST5:U)

- Journey time improvements significantly less than Scenario C/D

Scen. B Economic Appraisal Results

NPV Million NOK, 2009 prices, 2015 discount year, 40 year period

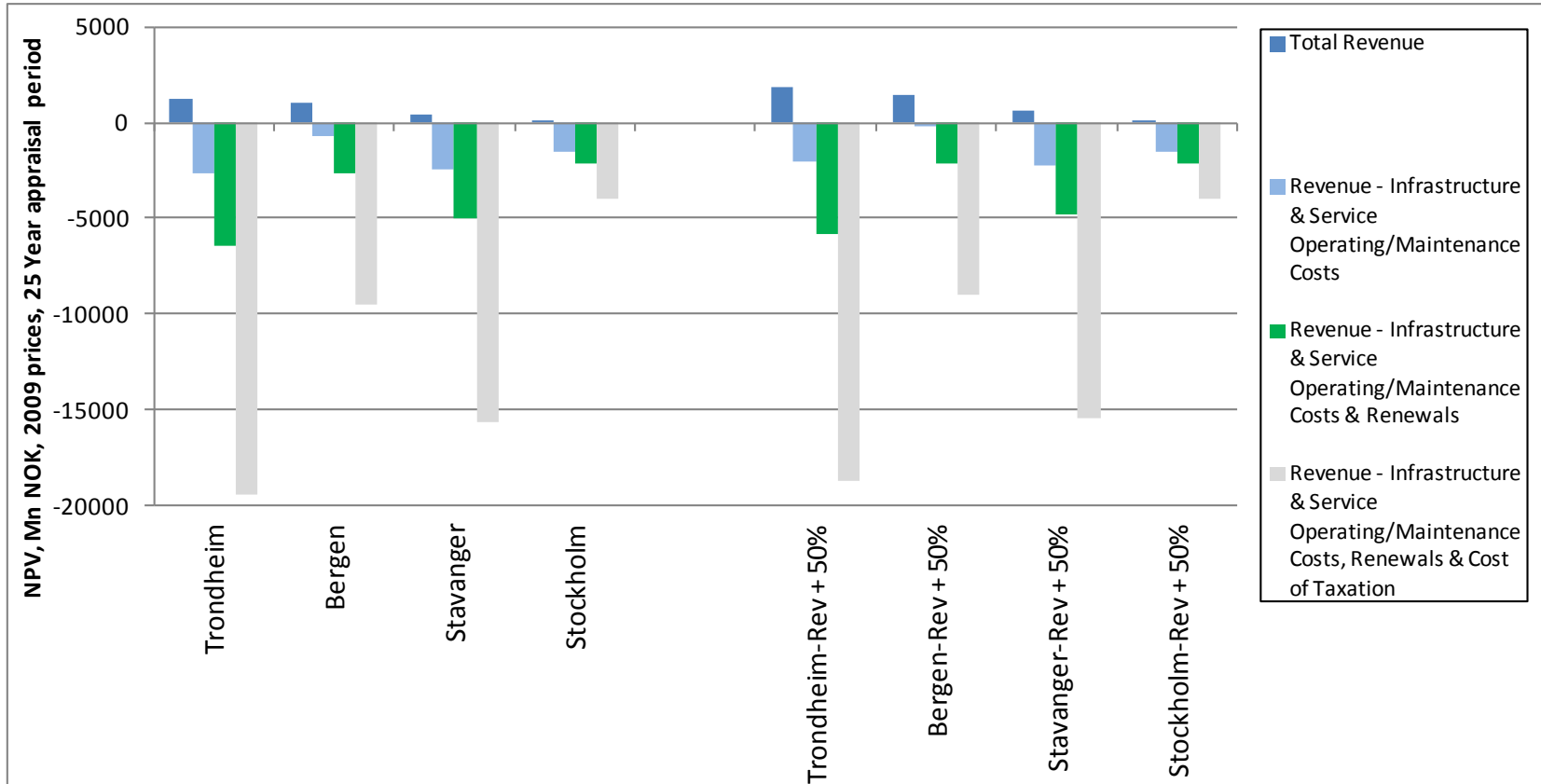


- Scenario B alternatives all deliver very small benefits / revenues in comparison to costs – compare poorly to Scenario C/D

	Corridor	North	West	South	East
Scenario B % of Scenario C/D Cost		c.45%	c.20%	c.25%	c.8%
Scenario B % of Scenario C/D Benefit		c.10%	c.10%	c.5%	<1%

Scen. B Financial Appraisal Summary

NPV Million NOK, 2009 prices, 2015 discount year, 25 year period



- None of the Scenario B alternatives generate sufficient net revenue to cover increased infrastructure operating and maintenance costs, even when renewal costs are excluded.

Some additional considerations

Adjusting supply to demand / optimisation

- There is significant scope to optimise the performance / efficiency of HSR alternatives, particularly in terms of financial performance:
 - Rolling stock type, provision and utilisation
 - Fare strategy and structures (revenue management etc.)
 - Approach and regimes adopted for operations, maintenance and renewal
- Appraisal using PSS2 provides an indication of the potential for optimisation to impact on economic and financial appraisal
 - but need to recognise possible socio-economic benefit trade-off
- There is much greater scope to influence the overall financial appraisal results rather the economic appraisal
- Beyond practical scope to examine these issues in more detail in Phase III given large number of alternatives under consideration
- Appropriate that this be examined further if a limited number of preferred / recommended alternatives is agreed

Consequential impacts, use of residual networks

- There would be implications for other transport providers and networks if HSR is introduced
 - Additional transport infrastructure HSR might provide could result in significant revision to how existing rail lines are utilised in particular
 - Air carriers could respond in a number of ways
- There are a large number of possible views / scenarios for what might occur
- Appropriate that this issue be examined further once a limited number of preferred / recommended alternatives for more detailed consideration is agreed

Potential for Freight market benefits

- Phase II established that the total “high speed” (above 250 kph) freight market was too small to warrant further consideration
- In Phase III market for railfreight between 120 and 250 kph assessed using, modelling, consultation and international benchmarking
- Forecast freight volumes (with GDP growth) resulting from higher speeds (50%) and lower rail operating costs (21% - 28%) are small (about 3 trains per day on busiest route)
- BUT on some routes HSR freight demand is likely to be under-estimated
- Greatest scope to deliver freight benefits via HSR likely to be through:
 - optimisation of alignments to better target freight
 - opportunities that HSR creates for use of the residual network by freight
- Nevertheless, freight’s contribution to the economic and financial case is still likely to be small when compared to passenger related benefits / revenues

Overall conclusions

Overall Appraisal Conclusions

Scenario C/D Alternatives

- **User benefits/revenue are mainly driven by achieving significant JT improvements on longer distance routes**
 - Scope limited as competing offer by air is actually quite reasonable
- **Achieving overall economic viability (a positive NPV) unlikely to be achievable**
 - Scale of estimated costs relative to the size of market available from which to derive benefits / revenues
 - **Renewal costs are very significant** reflecting the scale of infrastructure being implemented and assumptions on adoption of “recommended practice” renewal regimes
- **Financially, with most alternatives there is strong potential for commercial stand-alone HSR service operations**
- **Certain alternatives additionally show potential to cover O&M costs plus renewals over 25 years with a commercially oriented service specification (PSS2): O2P, HA2P, H1P**
- **Enhanced financial performance** might be at the expense of overall demand / access to services / social benefits i.e. **worse overall Socio-Economic performance**
- **Inter-City scenario tests suggest there could be improvements in HSR Economic and Financial Case from IC line/service integration**

Overall Appraisal Conclusions

Scenario B Alternatives

- Investment **costs remain high for achieving much smaller improvements** in journey time than Scenario C/D
- Consequently economic **ratio of benefits to costs and financial appraisal performance is very poor in comparison to Scenario C/D**
- **Not a step change in travel offer** to compete with other modes that HSR could be

Other considerations

- Recognised that **there is significant scope to optimise overall HSR financial performance in particular** through:
 - Rolling stock type, provision and utilisation
 - Fare strategy and revenue/yield management
 - Regimes adopted to operations, maintenance and renewal
 - Optimisation of JT versus cost of alignment
 - Savings or additional revenue with respect to residual networks
- Need to also bear in mind that there are also benefits/impacts and other considerations that the economic and financial appraisals do not capture

Thanks for listening

Questions?