

Structural models for NBN deployment

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Presentation at the
Eleventh ACCC Regulatory Conference
“Market Structure Revisited”

Surfers Paradise
29-30 July 2010

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1. The economics of NGA

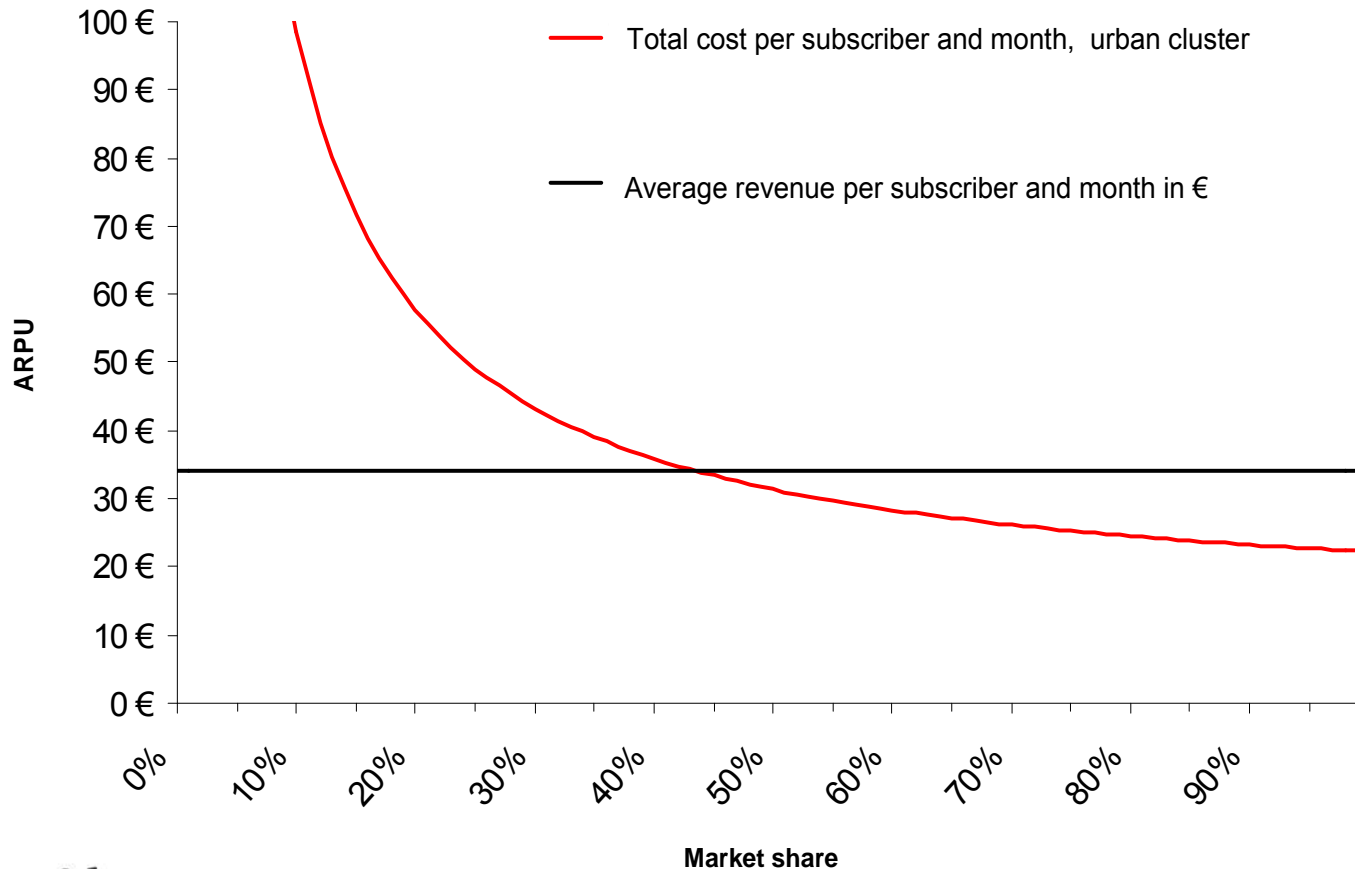
1.1 Profitability and replicability of NGA

- Generic bottom-up cost modelling approach; total cost of NGA services under efficient network cost conditions
- Long-term consideration, but no time dimension
- Steady state, no migration
- Advanced broadband market assumption (80% of all subscribers receive double and triple play services)
- FTTC (VDSL), and FTTH (PON and P2P) NGA-technology considered
- Detailed modelling of access, reasonable assumptions for concentration and backbone network
- Critical market share for profitability (<100%) and replicability (<50%)
- Results for 8 clusters of similar density
- Results for 6 European countries: DE, FR, SE, PT, ES, IT

1. The economics of NGA

1.1 Profitability and replicability of NGA

Determination of the critical market share for a single cluster: illustration



1. The economics of NGA

1.1 Profitability and replicability of NGA

- Investments of rolling out fibre networks are high
 - 1,000 – 2,000 Euro per household in densely populated areas
 - FTTH five times higher than VDSL
 - P-2-P architecture less than 10 % more than PON

Investment per home connected (in Euro), market share 50%, urban cluster, stand alone first mover **

Network Type	Country [in €]					
	DE	FR	SE	PT	ES	IT
VDSL	457	n.v.	352	218	254	433
PON	2,039	1,580	1,238	1,411	1,771	1,110
P2P	2,111 (54%)	2,025	1,333	1,548	1,882	1,160

** Based on the investment of the urban cluster and a market share of 50%. If other market shares are used, it is mentioned in brackets.

n.v. – not viable

1. The economics of NGA

1.1 Profitability and replicability of NGA

- In no country is FTTC/FTTH roll-out profitable for all homes
 - 25 % FTTH viable in France
 - 72 % VDSL viable in Germany
- Profitable investments in NGA require substantial market shares

Viability of NGA roll-out for incumbents across countries and technologies

Network Type	Country					
	DE	FR	SE	PT	ES	IT
VDSL	71.5%	n.r.	18.3%	39.0%	67.4%	100.0%
PON	25.1%	25.2%	18.3%	19.2%	12.2%	17.6%
P2P	13.7%	18.6%	18.3%	19.2%	12.2%	12.6%

n.r. – not realisable

1.1 Profitability and replicability of NGA

Viability (<100%) and replicability (<50%)

PON - DE									
Cases		First Mover Cases		Second Mover Cases					
Cluster	Accumulated Customer Base	Stand Alone	Incumbent	80%	20%	SLU + 80%	SLU + 80%	SLU + 20%	SLU + 20%
				Infrastructure Sharing	Infrastructure Sharing	Dark Fibre and Infrastructure Sharing		Dark Fibre and Infrastructure Sharing	
Dense Urban	0,3%	33%	30%	35%	38%	8%	8%	20%	20%
Urban	2,4%	48%	44%	50%	55%	11%	11%	30%	30%
Less Urban	13,7%	65%	60%	65%	73%	12%	12%	33%	33%
Dense Suburban	18,5%	69%	63%	69%	78%	17%	17%	38%	38%
Suburban	25,1%	83%	77%	83%	94%	22%	21%	50%	49%
Less Suburban	37,4%	n.v.	n.v.	n.v.	n.v.	36%	27%	66%	61%
Dense Rural	71,5%	n.v.	n.v.	n.v.	n.v.	61%	81%	n.v.	n.v.
Rural	100,0%	n.v.	n.v.	n.v.	n.v.	n.v.	n.v.	n.v.	n.v.

n.v. = not viable

1. The economics of NGA

1.1 Profitability and replicability of NGA

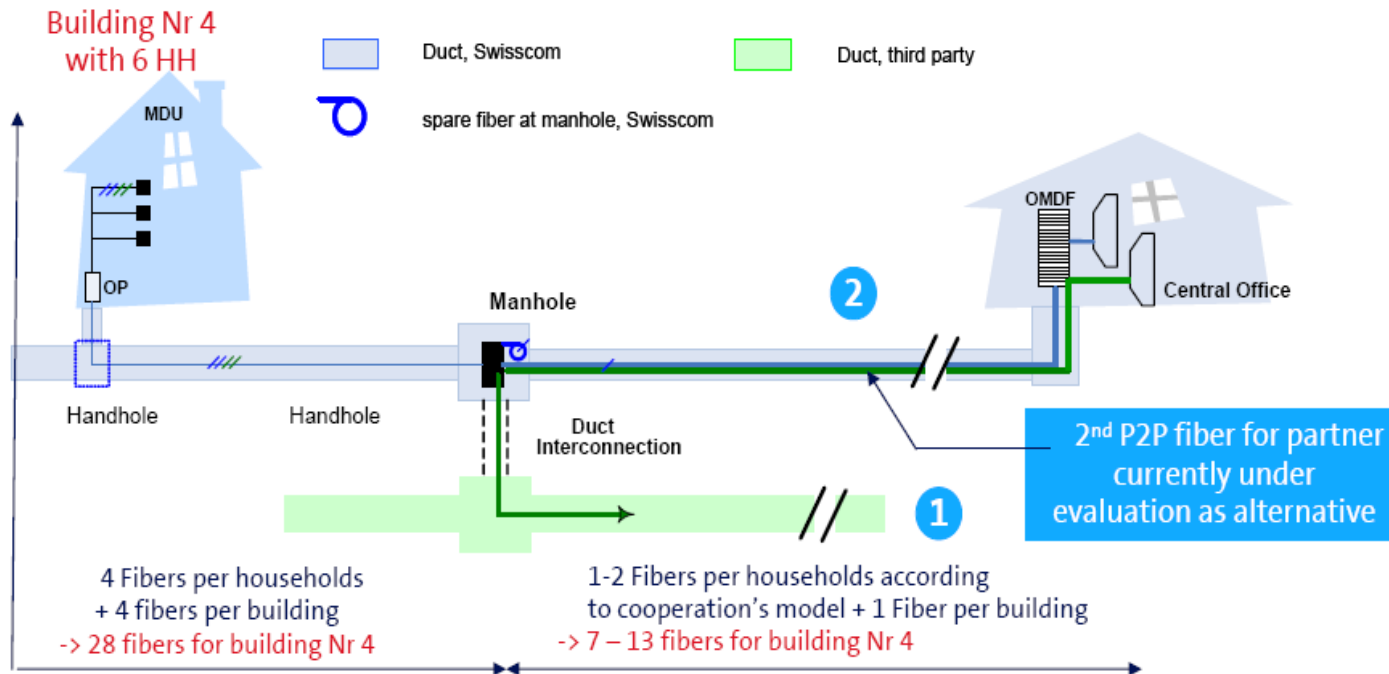
Further modelling results:

- Incumbents are better placed to invest in NGA, but have less incentives to do so (because of cannibalization)
- Replicating the incumbents' VDSL roll-out by alternative operators less viable than current LLU approach
- Incumbents can reduce their own costs by infrastructure sharing and wholesaling
- Competition in NGA requires access remedies like fibre SLU, fibre LLU, duct access, bitstream access

1. The economics of NGA

1.2 The economics of a multi-fibre deployment

Build and share cooperation model of Swisscom

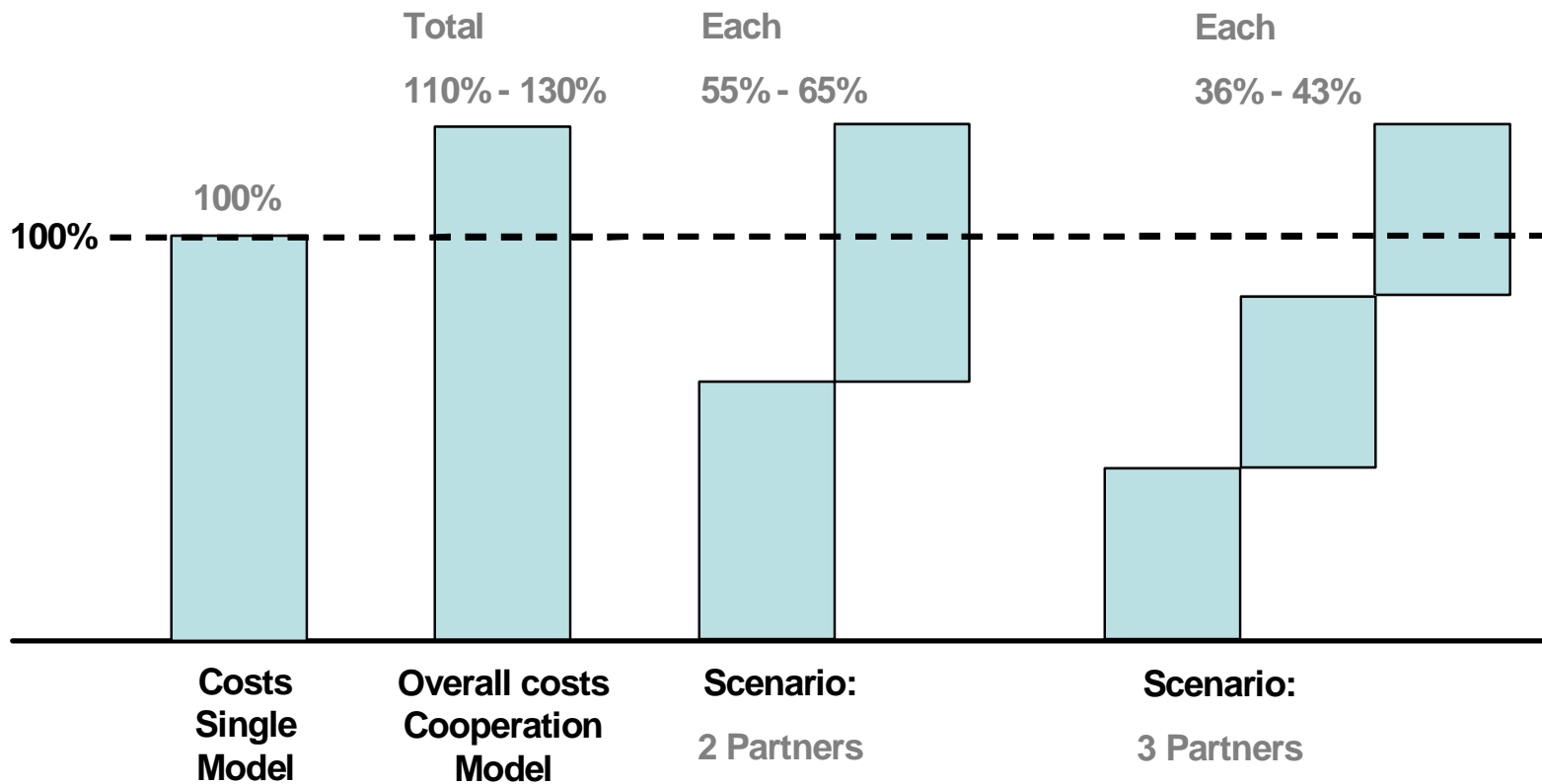


- ① Cooperation up to the manhole (partner with infrastructure)
- ② Cooperation up to the Central office (partner without infrastructure)



1.2 The economics of a multi-fibre deployment

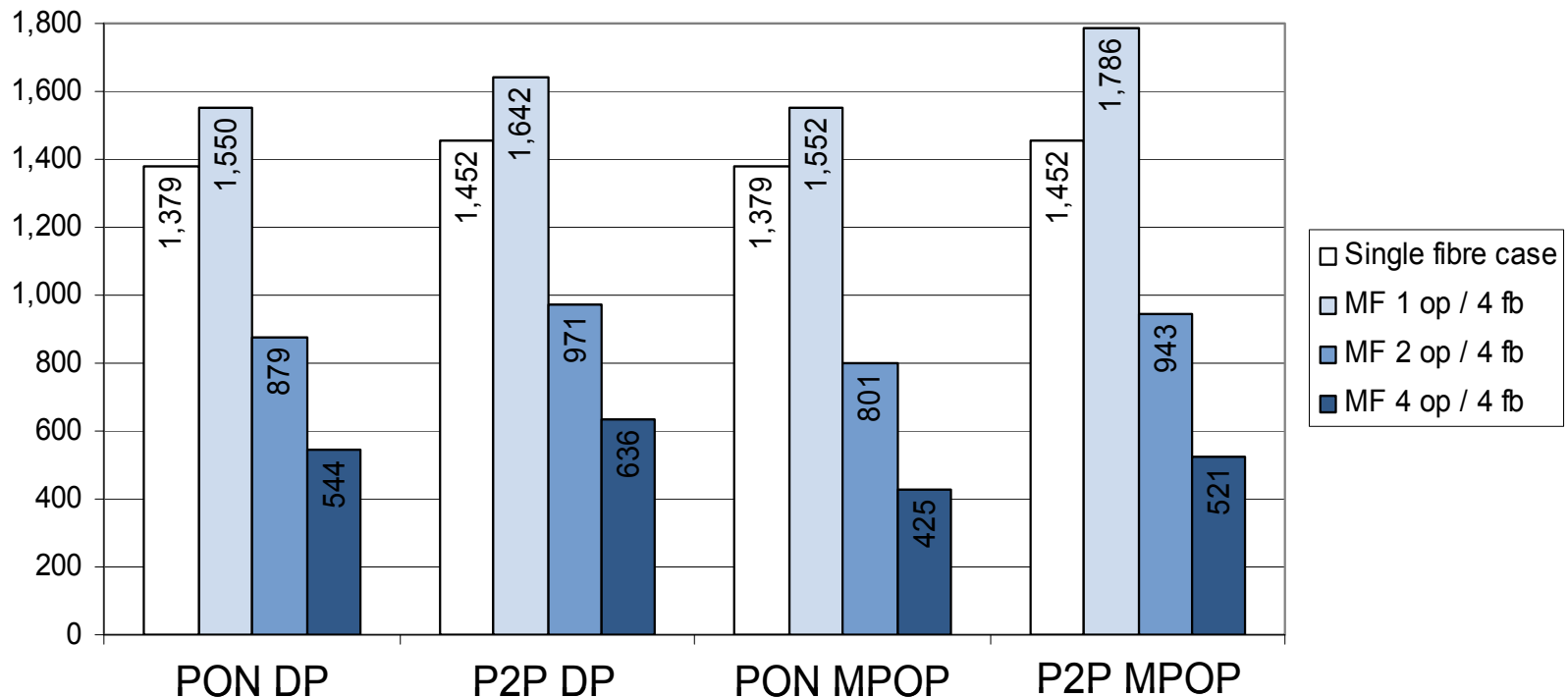
Potential investment cost distribution



1. The economics of NGA

1.2 The economics of a multi-fibre deployment

Average investment per homes passed, based on the four most dense clusters, 50% market share, in €



1. The economics of NGA

1.2 The economics of a multi-fibre deployment

The multi-fibre model has the following advantages:

- a. Model generates competition at the deepest level of the network; relevant model of replicability at lower costs than end-to-end infrastructure duplication.
- b. Altnet has a better end-to-end control over his network infrastructure.
- c. Multi-fibre model allows for a competitive scenario where the user can get different services from different operators.
- d. Multi-fibre approach potentially can contribute to solve the termination monopoly problem.
- e. In cases or scenarios where the multi-fibre approach actually has achieved effective competition, regulation becomes obsolete.

1. The economics of NGA

1.2 The economics of a multi-fibre deployment

Besides the additional investment a multi-fibre approach has some further relevant disadvantages:

- a. Significant higher requirements of sunk investment generate a significantly higher barrier to entry.
- b. Number of competitors determined by the market in the unbundling model. In a multi-fibre model unconstrained by regulation, the maximum number of competitors is determined ex ante by the investor and his decision on the number of fibres to be deployed.
- c. Depending on the distribution of market shares, the multi-fibre model can cause significant asymmetries in per line costs and therefore in competition which can result in unsustainability of competition.

1. The economics of NGA

1.2 The economics of a multi-fibre deployment

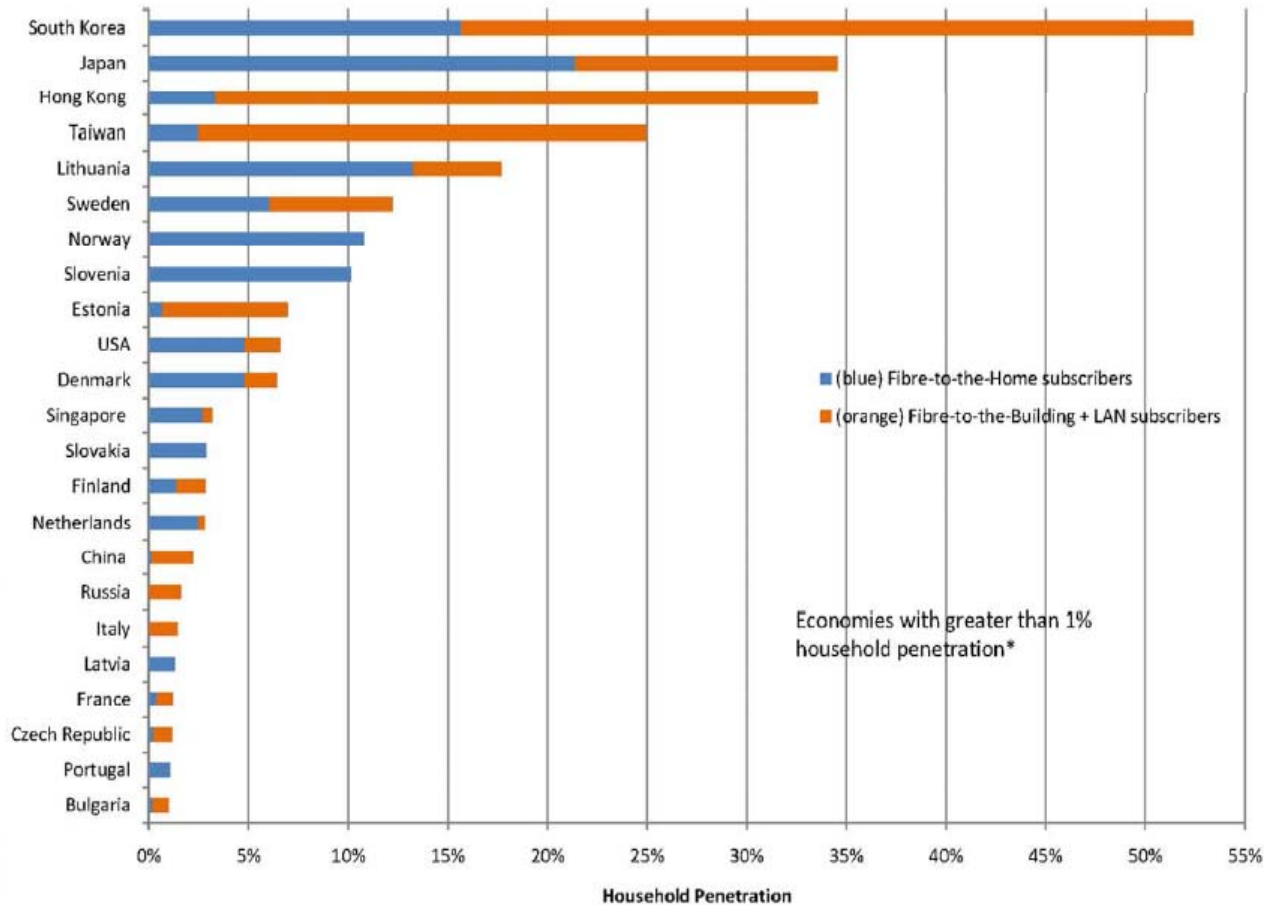
Cost per line in single fibre and multi-fibre network

Single fibre + unbundling	Incumbent	Market share	100%	80%	60%	50%	40%
		Cost per line	10	10	10	10	10
	Altnet	Market share	0%	20%	40%	50%	60%
		Cost per line	0	10	10	10	10
Multi-fibre case	Incumbent	Market share	100%	80%	60%	50%	40%
		Cost per line	6	7.50	10	12	15
	Altnet	Market share	0	20%	40%	50%	60%
		Cost per line	∞	30	15	12	10
<p>Assumptions:</p> <ul style="list-style-type: none"> (1) Only shared investment considered (80% - 85% of total invest) (2) Two cooperation partners considered (3) Investment multi-fibre model = 120% investment of single fibre model (4) Sharing rule: 50:50 (5) Numbers are for illustration purposes only 							

2. The European approach

2.1 Market development

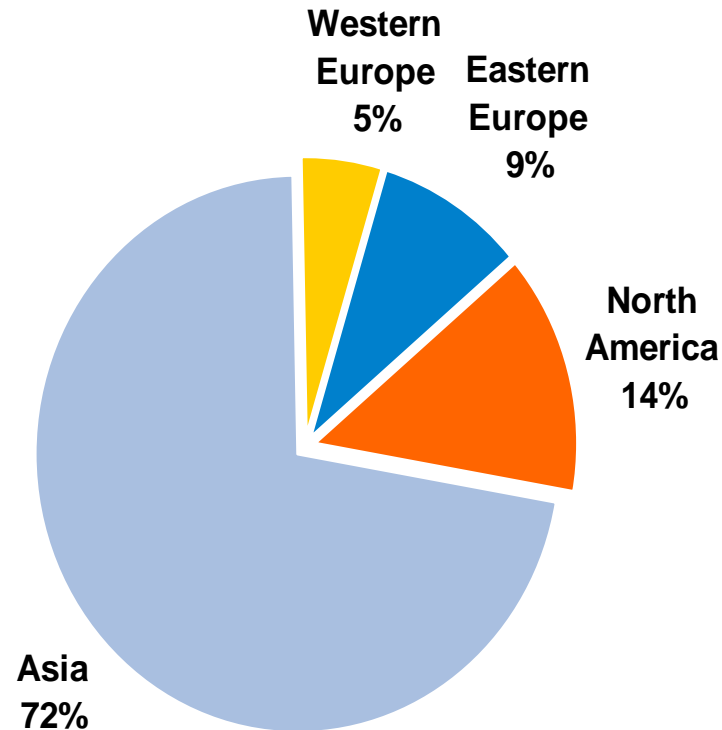
Economies with the highest penetration of Fibre-to-the-Home/Building + LAN



2. The European approach

2.1 Market development

FTTH/B subscriber distribution around the world at the end of 2009



2. The European approach

2.1 Market development

FTTx subscribers by geographical areas at the end of 2009

	FTTH/B	VDSL	FTTLA	FTTx+LAN	Total FTTx	Total Broadband (*)
Western Europe	2 048 900	1 733 200	31 000	0	3 813 100	150 128 000
Eastern & Central Europe	3 552 335	39 850	0	180 000	3 772 185	
North America	5 706 500	3 200 000	0	0	8 906 500	100 082 000
Latin America	5 500	0	0	0	5 500	23 351 000
Asia	29 593 300	3 500	0	17 100 000	46 696 800	187 207 000
Middle East & Africa	173 322	20 000	0	0	88 322	11 366 000
TOTAL World	41 083 357	4 996 550	31 000	17 280 000	63 285 907	472 134 000

(*) including DSL, cable modem and FTTx subscribers

2. The European approach

2.1 Market development

- DSL dominant broadband access technology in Europe (80%)
- 1.5% FTTH/B subscribers
- FTTH/B 11 mio. homes passed, but only 1.7 mio. subscribers
- Physical reach of NGA (including cable/DOCSIS 3.0 and VDSL): 40% of broadband subscribers
- FTTH/B investment mainly driven by altnets (only 15.1% of homes passed by incumbents)
- Cumulative investment in FTTH/B will only in 2013 exceed cumulative investment in VDSL

2.2 The European Community approach

2.2.1 Digital Agenda for Europe

- Part of the Europe 2020 strategy launched in March 2010
- Key performance targets for broadband deployment
 - (1) Basic broadband for all by 2013: basic broadband coverage of 100% of EU citizens. (Baseline: Total DSL coverage (as % of the total EU population) was at 93% in December 2008).
 - (2) Fast broadband by 2020: broadband coverage at 30 Mbps or more for 100% of EU citizens. (Baseline: 23% of broadband subscriptions with at least 10 Mbps in January 2010).
 - (3) Ultra-fast broadband by 2020: 50% of European households should have subscriptions above 100 Mbps. (No baseline)
- Ambitious targets, but no implementation plan

2.2 The European Community approach

2.2.2 The NGA Recommendation

- Member States and NRAs have to take utmost account of Recommendation
- Access remedies for various NGA architectures
 - (1) Access to civil engineering infrastructure of the SMP operator
 - (2) Access to the terminating segment in the case of FTTH
 - (3) Unbundled access to the fibre loop in the case of FTTH
 - (4) Access obligations in the case of FTTN
 - (5) Wholesale broadband access
 - (6) Migration

2.2. The European Community approach

2.2.3 State Aid Guidelines (1)

- Competition rules generally critical towards State aid to support private business in Europe
- State aid from Member States has to get permission from the EU Commission
- Guidelines from September 2009 summarize approval policy
- Market economy investor principle
- NGA “white” areas
 - No NGA networks now and not in the next 5 years
 - Public funding as State aid compatible

2.2. The European Community approach

2.2.3 State Aid Guidelines (2)

- NGA “grey” areas
 - One NGA network in place or being deployed within the coming 5 years
 - Public funding if certain conditions are met and under certain conditions
 - Safeguards to minimize the risk of crowding out existing investors and distorting competition
 - Existing NGA network not sufficient to satisfy users’ needs
 - State aid also possible to foster competition and effective network access

2.2. The European Community approach

2.2.3 State Aid Guidelines (3)

- NGA “black” areas
 - More than one NGA network in an area now or in the coming 5 years
 - Public funding incompatible with the rules
- General conditions regarding State aid supported projects
 - Wholesale access
 - Access conditions approved or set by NRA
 - P2P multi-fibre architecture to be supported or an architecture that can be unbundled
- In 2009 12 decisions; 11 found to be compatible. Total amount of aid approved: € 467 mio.

3. The NBN approach in worldwide perspective

3.1 Role of the state

- Radical transformation of the role of the state in the industry
- Government as the investor, financier and network operator
- Organizational model of the industry in the past with one important difference: Focus on infrastructure and wholesale only
- In other parts of the world governments try to reach the same goals with (only) indirect measures
- Australian State full and sole owner of the risk/return profile of the NBN, but no economic or financial compensation for this risk (IRR = risk free rate)
- Rational, if there are significant social returns over and above direct investment returns in the form of productivity gains, improvement of international competitiveness, more innovation, intangibles

3. The NBN approach in worldwide perspective

3.2 Objectives and roll-out plan

- Most ambitious roll-out plan for fibre deployment in the world in terms of targets and speed
- Even less ambitious targets in Europe do not seem achievable
- Australia will have caught up with its most advanced Asian peers in 8 years
- Major strength of the Australian NBN strategy and difference to most other national strategies: Well-defined and coherent implementation plan

3. The NBN approach in worldwide perspective

3.3 Investment and architecture

- Comparison of investment numbers per fibre line
 - Australia: 2,600 €
 - Europe (current projects): 1,500 – 2,500 €
 - Switzerland 100% coverage: 3,500 €
80% coverage: 2,000 €
- FTTH: Most capable and future-proof architecture
- Surprising: PON or Point-to-Point remains management decision of NBN Co
- P2P
 - Most capable and future-proof architecture
 - Easy to unbundle (unlike PON)
- Our model calculation: P2P only requires 6% to 10% more investment than PON
- CBA would reveal dominating benefits of P2P
- Two largest fibre plans of incumbents in Europe (KPN, Swisscom) are rolling-out P2P

3. The NBN approach in worldwide perspective

3.4 Competition and open access

- Debate on incentives to invest and open access
- Fibre NGA will sooner or later dominate current network and the copper network will be phased out
- Limited replicability of NGA networks
- Access only way to get relevant competition
- Inherent concept of NBN based on access
- Access concept (Layer 2), however, also monopolizes major parts of active network components
- Unbundling at a late stage of deployment
- First best: Access seekers can choose between Layer 1 and Layer 2 access immediately

3. The NBN approach in worldwide perspective

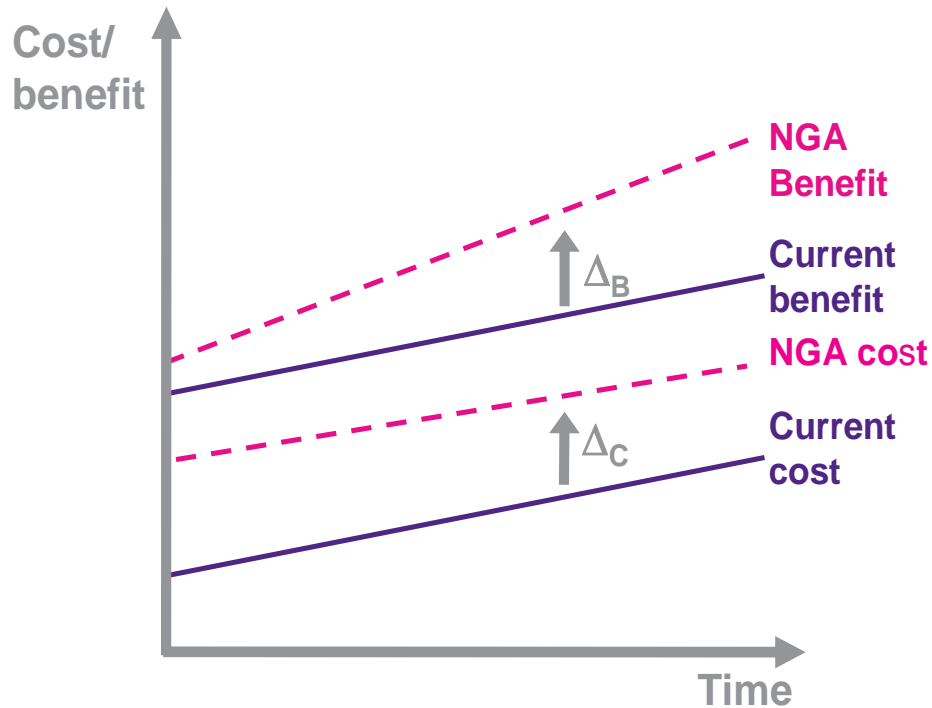
3.5 Cost benefit analysis

- Bandwidth bottleneck will become obvious soon
- Uncertainty about increased willingness to pay for more bandwidth
- Social returns of ultra-fast broadband connectivity (much) larger than cost of building the network
- Only detailed CBA can identify
 - Network coverage on the basis of private returns
 - Network coverage on the basis of social returns
- Broadband networks as general purpose technology definitively generate (significant) positive externalities

3. The NBN approach in worldwide perspective

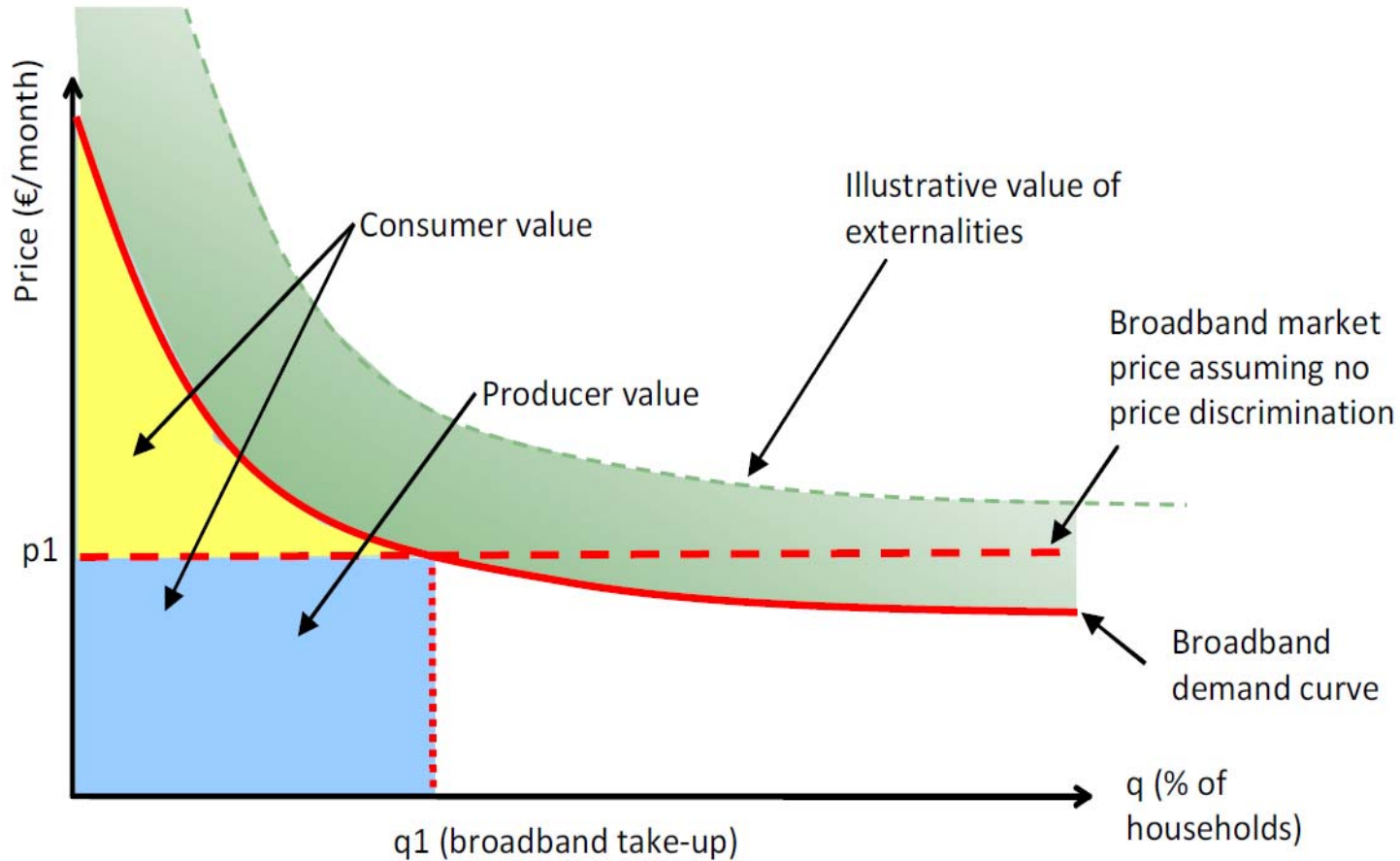
3.5 Cost benefit analysis

Cost and benefits of the NGA



3.5 Cost benefit analysis

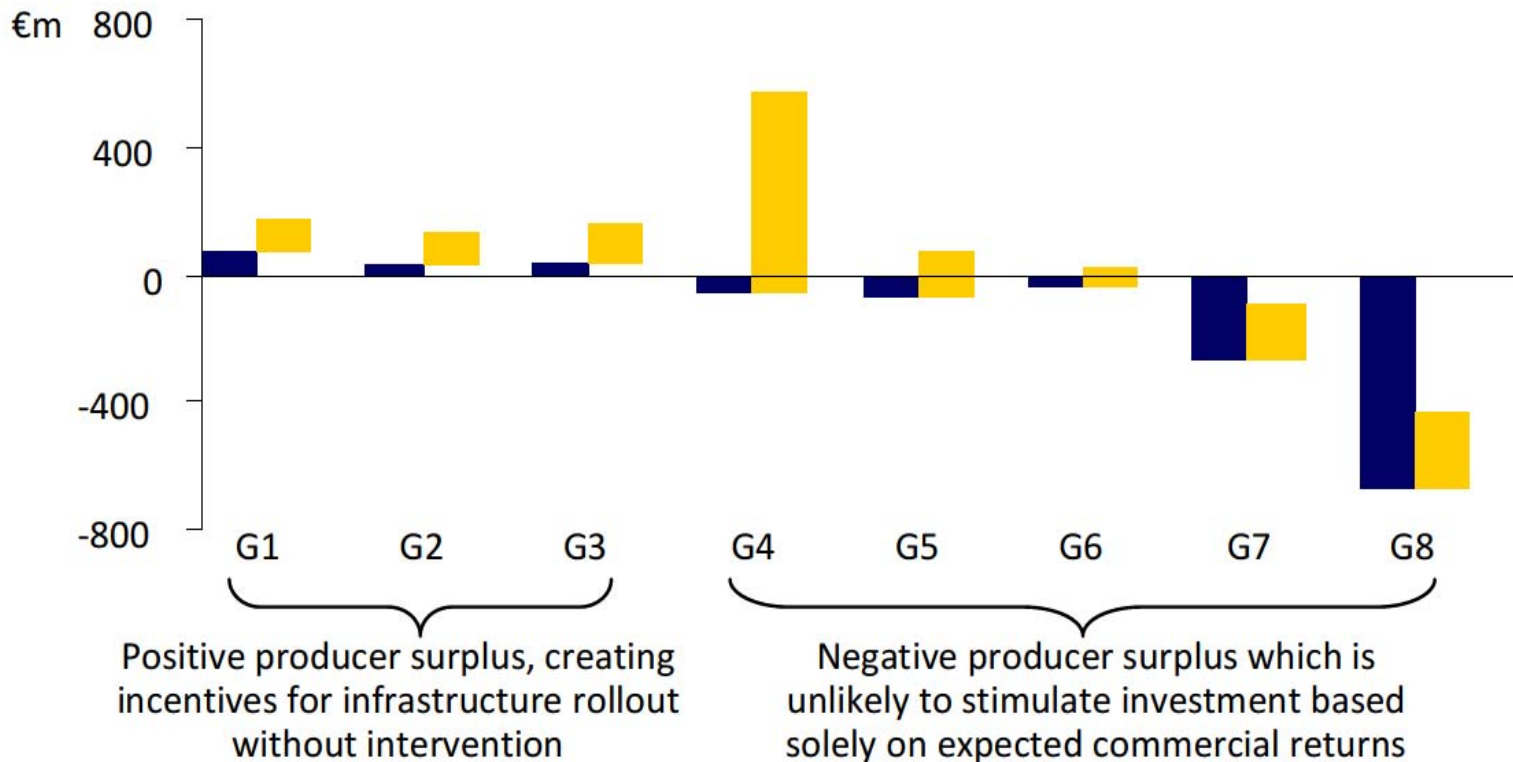
Illustrative value created by broadband



3. The NBN approach in worldwide perspective

3.5 Cost benefit analysis

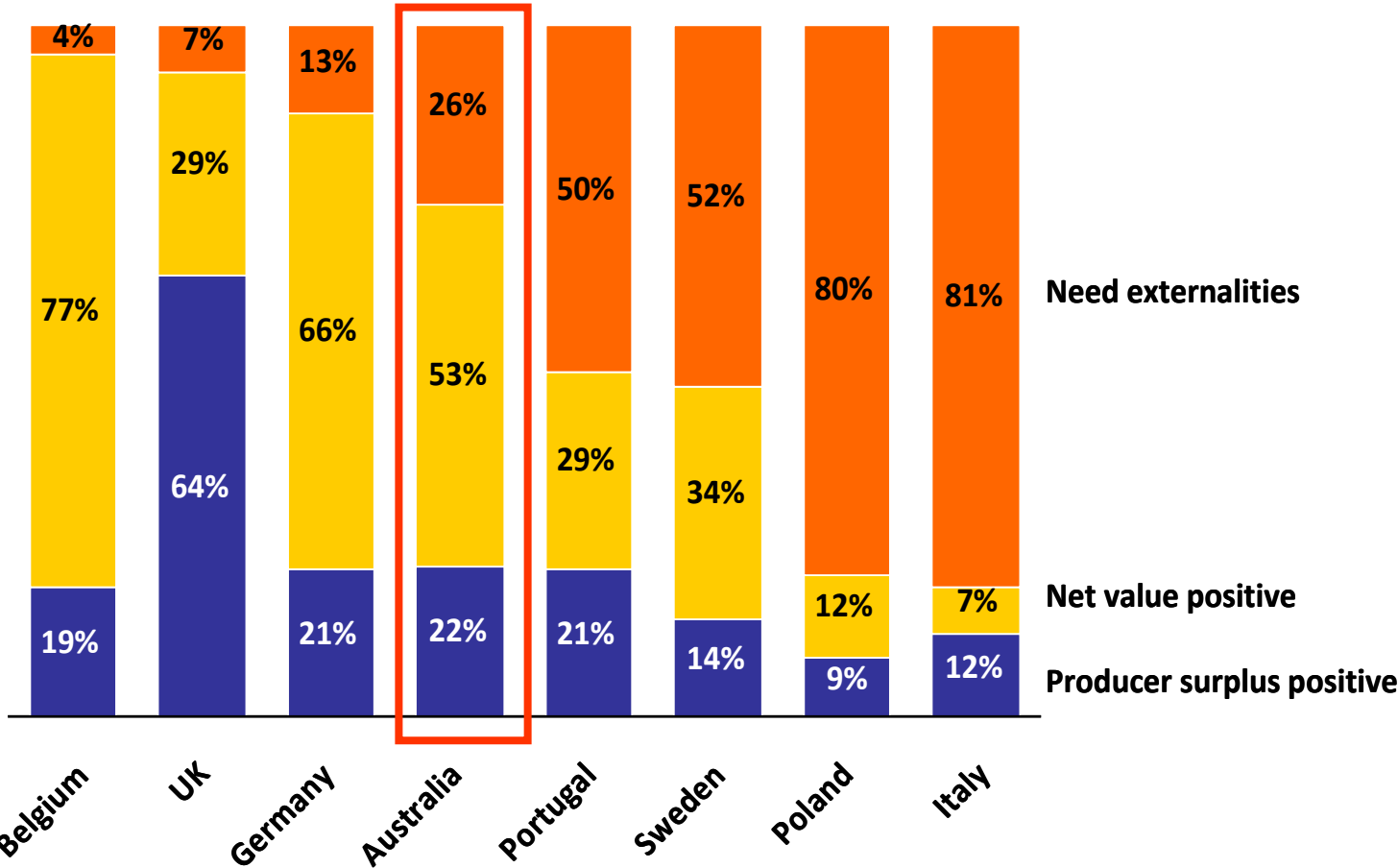
Market incentives to provide high speed broadband for a new monopolist infrastructure provider in Australia (2020)



3. The NBN approach in worldwide perspective

3.5 Cost benefit analysis

Case for super fast broadband (percent of population), 2020

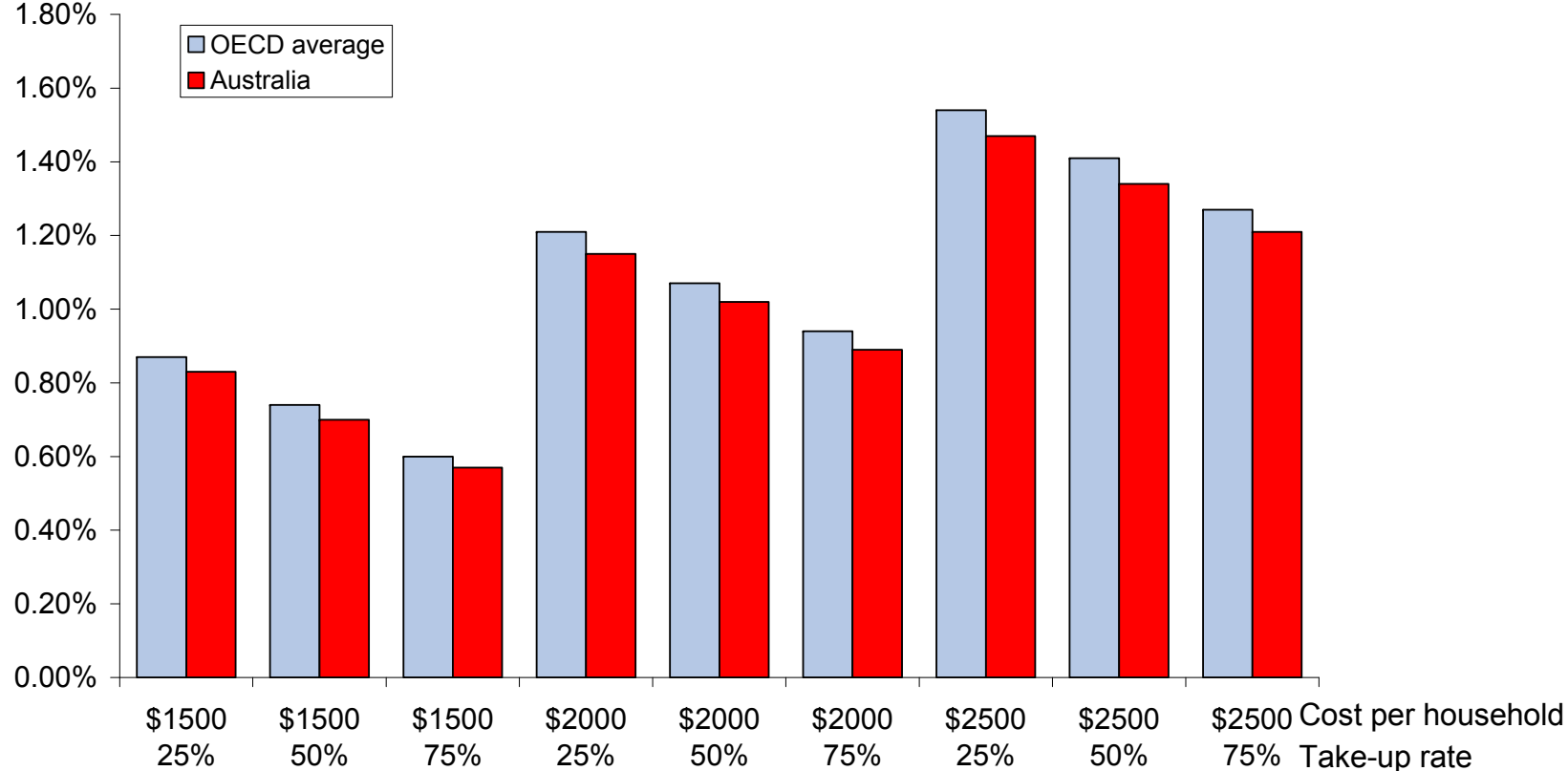


3. The NBN approach in worldwide perspective

3.5 Cost benefit analysis

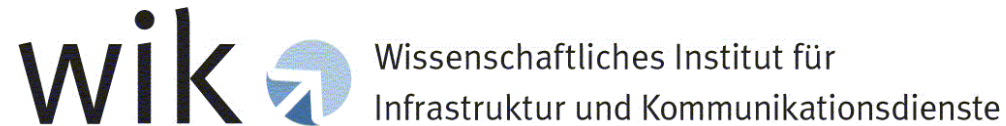
Necessary savings to spending in health, transportation, education and electricity

Necessary 10 year cost savings



4. Demand as a success factor for ultra-fast broadband

- Most national broadband plans focus on supply side
- Network roll-out mainly has to be supply-driven
- Speed of take-up of NGA and penetration decides on profitability (50% to 100%)
- Stakeholders should have any interest that private, business and public users become NGA subscribers
- Take-up of users can be incentivised by
 - tax credits
 - direct subsidies
 - framework for user contributions for investment in unprofitable areas



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