The People in the Project: BICY project balanced public input with scientific analysis.

Modeling and Cost-benefit Analysis of Bicycle Infrastructure in the BICY Project

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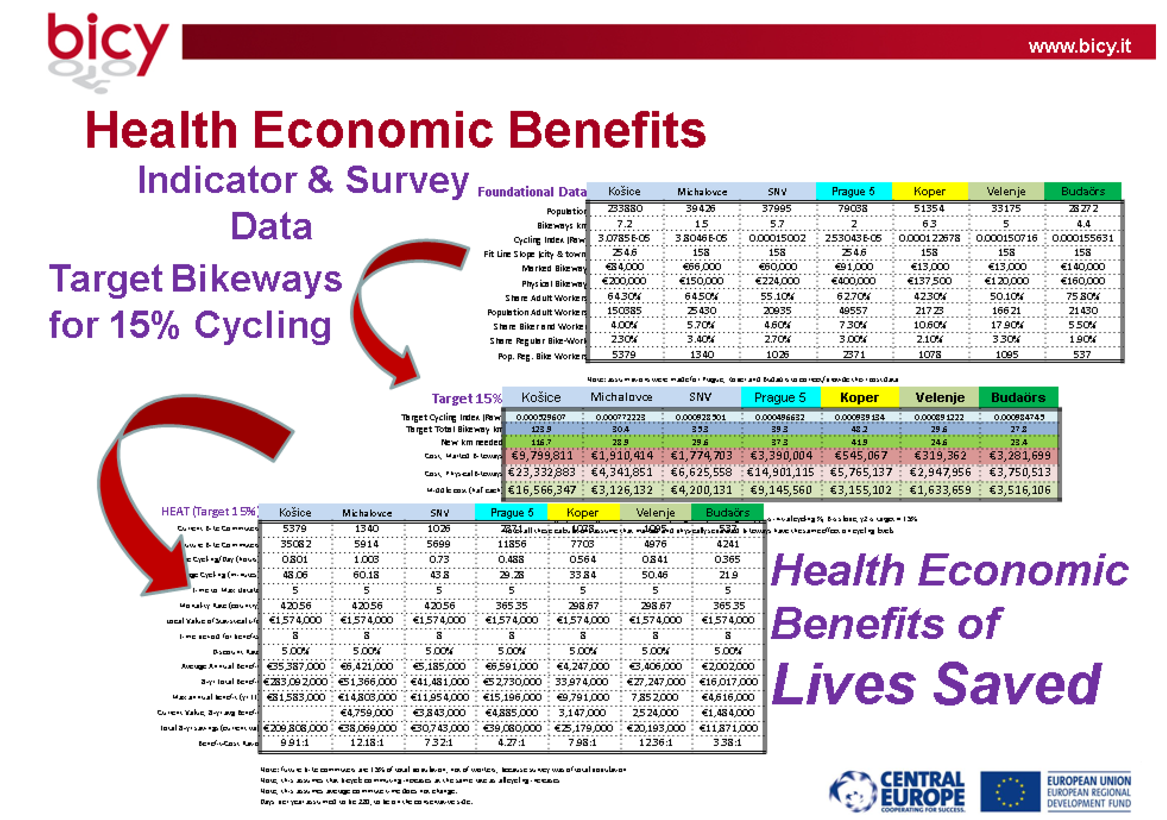


How do we show whether investments in a bicycle network/bicycle infrastructure, are worth it?

One approach: make the financial projection and look at the "balance sheet".

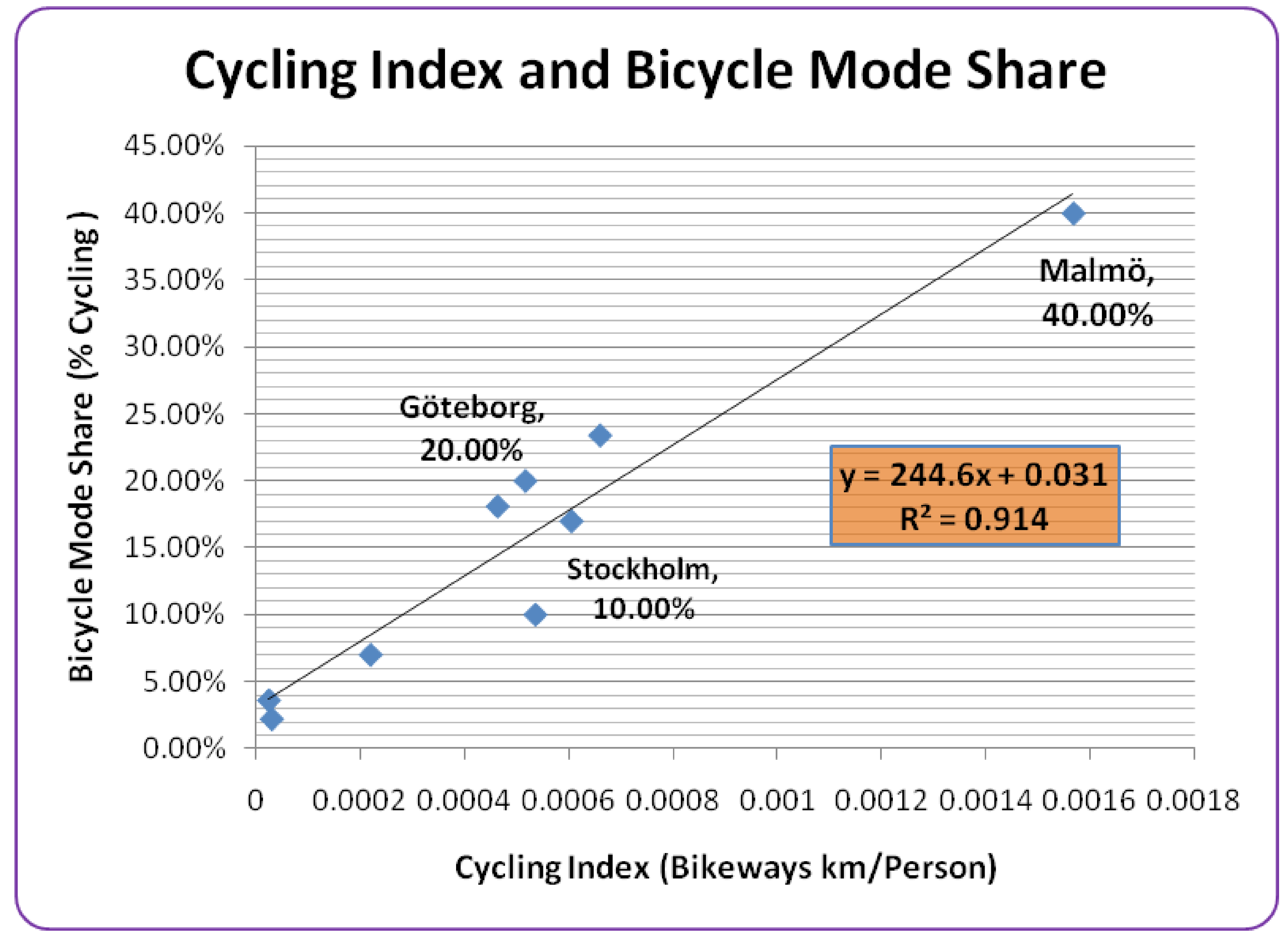
We can estimate the increase in bicycling with models based on numerical data, and public input; then estimate the expected results including the economic benefits.

ABSTRACT

The BICY Project, an EU-funded effort to increase bicycling in Central Europe, conducted a transnational, detailed mobility survey (7 countries, 7 languages, 14 cities, target n>=1500 per city) in an effort to understand the factors which increase the use of bicycling, walking and public transport. Models were generated using the survey and background data. The models were then used to estimate the behavior changes expected from investment in bicycle infrastructure. From these estimates, cost-benefit analysis was conducted for both carbon emissions and health effects. The Health Economic Assessment Tool (HEAT) was employed across five scenarios, predicting a substantial reduction in all-cause mortality equated to a many-times return on investment using standardized estimates of the economic value of life. The transferability of the model and method to the United States is explored.

Health Impact Assessment relies on our ability to predict and assess the impacts of major planning decisions [1]. Without robust and validated tools to understand impacts, the democratic process of decision making is weakened. Although the benefits of bicycling are widely understood on an intuitive level, with ever-growing examples of successful bicycling environments; the ability to evaluate and quantify those benefits (and drawbacks) in the economic arena, and to possess predictive methods for the outcome (amount of new bicycling) expected from an investment, has been a barrier to implementing bicycle facilities and related improvements.

Linear Model



The strongest models found were simple linear models, such as that shown here for larger cities (graph, above). This version emphasizes Swedish cities, where even a city with very high levels of bicycling falls right on the line, with simple explanations available for deviations. The "R-square" value being near 1.0 indicates an extremely strong linear relationship. This was found even in the highest bicycling cities, up to the 50% level (e.g., Groningen). Although the sample size was small (14 cities), the data was collected in a very uniform manner for a diversity of international cities, rare for bicycle study. The potential to grow this pool of data exists because the BICY Survey Methodology provides a rapid method for generating this same uniform data in any city; it can be gathered even by community volunteers in under a week, helping bring our understanding of bicycling out of the dark ages; many cities have no data.

Health Economic Assessment Tool

New research [2]-[5] formed the basis for a succession of versions of the Health Economic Assessment Tool (HEAT), produced by the World Health Organization (WHO) of Europe beginning in 2007 and continuing to the present day. The tool is available as an online web interface [6] which seeks to be "as easy as possible to use" with accompanying Methodology and User Guide [7] and home websites [8]. The HEAT team was very responsive to inquiries and provided a special unpublished Excel version of HEAT to assist the BICY Project in its analyses. The HEAT tool predicts the effects on all-cause mortality for persons ages 20-60, based on changes in the rates of walking and bicycling, in combination with a relative Risk (RR) which for bicycling was taken as 0.72 [5]. Subsequently it produces a cost-benefit estimate over time, depending on a wide array of inputs. This prediction method requires preliminary predictions for anticipated changes in rates of walking and/or bicycling. Papers and reports using this tool for the BICY project are also available online [9].

Can we apply these methods within the USA? The HEAT team represents with certainty that they can be applied here. HEAT has been used in studies within the USA [10]. In addition, a recent look at the correlation of infrastructure to bicycling levels found a linear relationship [12].

RESULTS

Total Savings by City and Scenario

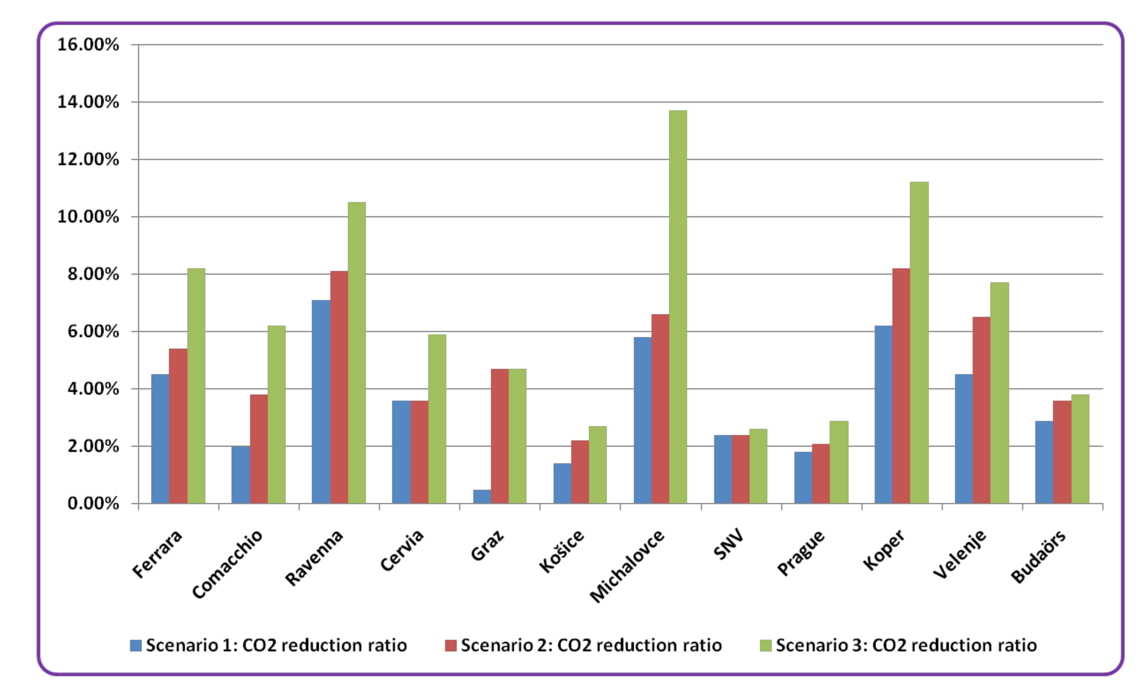
	SCENARIO A 15 BY 2015	SCENARIO B 15 BY 2020	SCENARIO C 20 BY 2015	SCENARIO D 20 BY 2020	SCENARIO E MAX/25 YEAR
Košice	€338,259,000	€210,429,000	€448,688,000	€279,125,000	€888,579,000
Michalovce	€51,116,000	€31,799,000	€67,453,000	€41,962,000	€204,882,000
SNV	€51,352,000	€31,946,000	€68,202,000	€42,428,000	€172,234,000
Prague 5	€81,147,000	€50,818,000	€108,845,000	€67,712,000	€253,643,000
Koper	€17,598,000	€10,948,000	€23,448,000	€14,587,000	€163,906,000
Velenje			€14,714,000	€9,154,000	€155,881,000
Budaörs	€33,437,000	€20,801,000	€44,544,000	€27,710,000	€117,584,000
Ferrara					€216,463,000
Comacchio					€18,476,000
Ravenna					€583,604,000
Cervia					€33,681,000
Graz			511,688,000	298,962,000	€1,923,358,000

Lives Saved Per Year

	SCENARIO A 15 BY 2015	SCENARIO B 15 BY 2020	SCENARIO C 20 BY 2015	SCENARIO D 20 BY 2020	SCENARIO E MAX/25 YEAR
Košice	33.32	33.32	44.2	44.2	31.45
Michalovce	5.03	5.03	6.64	6.64	7.25
SNV	5.06	5.06	6.72	6.72	6.1
Prague 5	7.99	8.05	10.72	10.72	8.98
Koper	1.73	1.73	2.31	2.31	9.85
Velenje			1.45	1.45	5.52
Budaörs	3.29	3.29	4.39	4.39	4.16
Ferrara					7.66
Comacchio					0.65
Ravenna					20.66
Cervia					1.19
Graz			50.4	47.34	68.08

Using the model, various scenarios (e.g., 20% by 2020) were generated; the cost of infrastructure required to see each scenario's target level of bicycling was calculated, along with the estimated new bicyclists. Using the HEAT tool, an estimate of the number of avoided deaths per year due to increased active travel is calculated along with the "economic value" of those lives. As shown in the summary tables above, this relatively narrow view of the benefits still outweighs the costs tremendously. Many other benefits can be examined including many other economic and health benefits, from social cohesion/social isolation and over-all well-being to worker productivity to changes in spending patterns that benefit the local economy. Carbon emissions were relatively robust to estimate with the survey which gives insights into how many car drivers would switch to bicycling (and walking, and public transport).

An average of 3.56% reduction in GHG emissions is projected for baseline Scenario 1. The maximum reduction was nearly 13.7%, for Michalovce in the Košice region, Slovakia, for Scenario 3 (in which protection was provided against weather protection; Michalovce receives more snow than most study areas). Analysis and discussion of the survey scenarios, including public transport, is published [13].



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