

Scenario Planning

Greater Philadelphia Futures Group 05.02.18



Upcoming Schedule

- Today: Scenario Planning
- July: Smart Cities
- October: Globalization
- December: Transportation Technology
- Spring 2019: Start Future Forces 2050
 Update.



Scenario Planning

A structured way of thinking about the future by:

- 1. Identifying what conditions or events are probable.
- 2. Understanding their likely consequences.
- 3. Determining how to respond to or benefit from them.

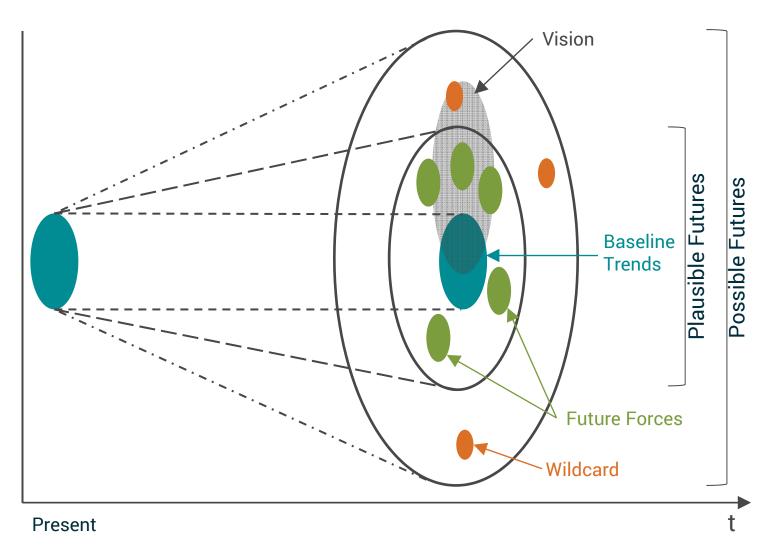


Types of Scenarios

- Normative articulate community values to develop alternative visions for the future.
 - Anticipatory (backcasting) set a long term vision, then identify intermediate steps to achieve it.
- Exploratory start in the present and project into the future using anticipated trends and driving forces.
 - Interactive (war games) play out a set of rules for interaction between variables or actors.
- Predictive Trend, expected probability, or baseline.
 - Event Driven (contingency) consider how specific events would impact a firm or community.



Looking at the Future





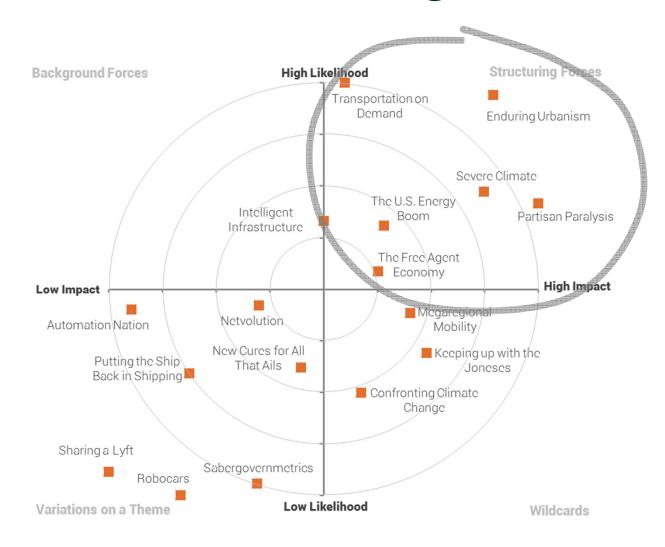
Previous Futures Group Effort



- 1. Brainstorm Future Forces of change
- 2. Vote on their impact and likelihood
- 3. Use Forces to create 4-5 highly differentiated What-If Scenarios
 - a. Create robust visions of the future
 - b. Analyze probable implications
- 4. Identify universal and contingent actions
- 5. Determine leading indicators for each Force
- 6. Create a short, graphic publication, and incorporate into Choices & Voices



Impact-Likelihood Voting





Future Forces (2045)



People and jobs moving to walkable communities is the start of a long-term trend.



Increased outsourcing and automation means individuals must create their own economic opportunities.



Continued rise in atmospheric carbon levels lead to significant disruptions from climate change.



Smartphones, apps, and real-time info help people get around using new and existing transportation modes.



An abundance of domestically produced oil and natural gas keeps the cost of energy low.



Networking Transportation

Cooperative, Partnerships A Tale of Moore Two Regions **Growth** Slower Growth ← → Faster Growth Filling a **TNCs** Take Off Niche Individualistic, Fragmented

Networking Transportation





Thanks!

Brett Fusco

bfusco@dvrprc.org

www.dvrpc.org/connections2045



Scenario Planning Perspectives from Utah

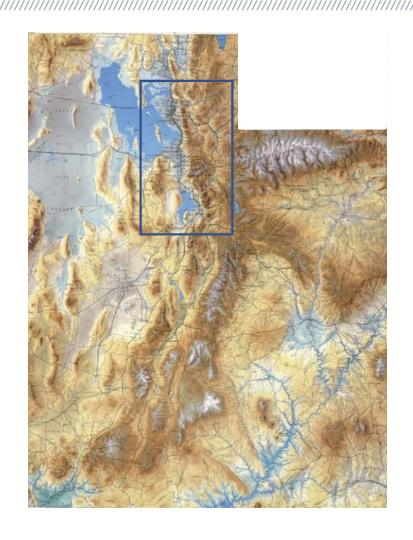
DVRPC Scenario Committee

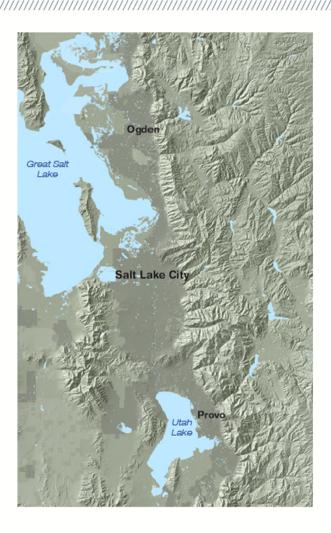
Ted Knowlton, WFRC May 1, 2018





Rapid Growth in a Constrained Geography







West Layton Village Proposal

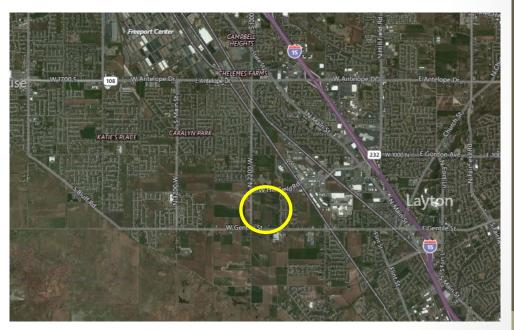
"A vibrant, walkable community that offers a healthy mix of homes, shops, businesses, trails and parks"

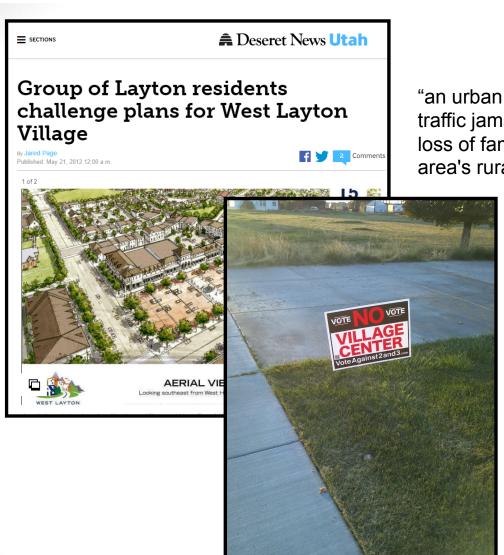












"an urban nightmare of crime, pollution, traffic jams, overburdened schools, the loss of family farms and the end of the area's rural feel"

Referendum Results

• For 48%

• Against: 52%

Traditional Planning Approach

Decide – through analysis and research Educate – the public about the solution

Announce – the plan

Defend - the plan and yourself



West Layton Village Impacts

Discussion that informed voting

	LOCAL	REGIONAL
	Change from the norm	Housing affordability
	Local traffic	Lower driving distances
	School impacts	Cleaner air
	People not like us?	Transit supportiveness
	Places to shop	Less impact on farmland
	Lifecycle housing	Reduced Greenhouse Gases

Utah Faced Serious Challenges in 1997

- A million new residents by 2020
- Air quality problems
- New water sources needed
- Infrastructure needs outstripping resources



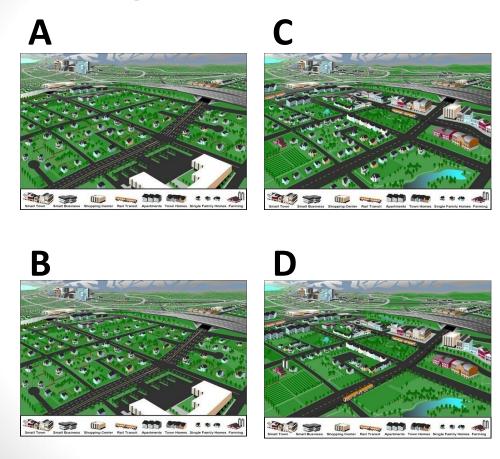


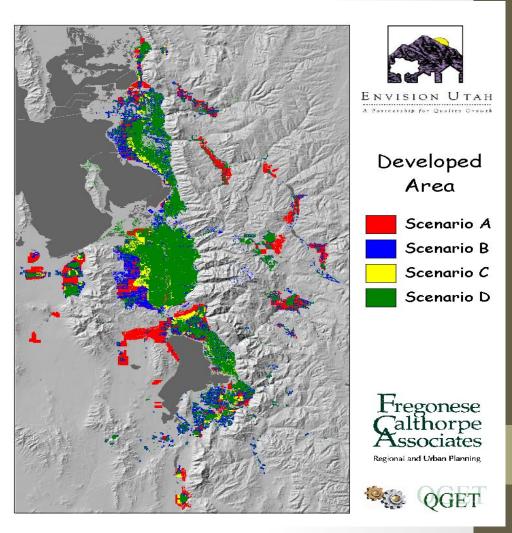
- Founded in 1997
- Nonprofit, nonpartisan, voluntary
- Partnership of business, government, & community

The Premise of Envision Utah

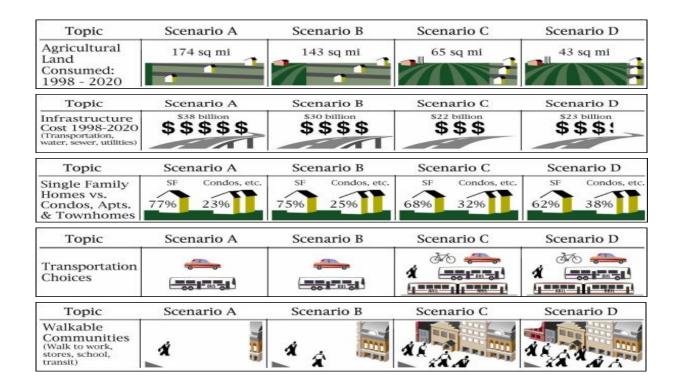
- The "public" has the right to choose its future—public officials should serve that vision
- The "public" will make good choices if presented with real options

Scenarios used to explore longterm, regional implications





Implications of each scenario...



BROAD PUBLIC AWARENESS EFFORTS

Television, Radio and Newspaper



Let's start today creating more regional public transportation choices

that will help maintain quality of life for us, our children and grandchildren

More Choices for people from every walk of life

While most of us will continue to drive automobiles, the region will benefit from a more convenient and reliable public transportation system that will give us all more choices and options, more freedom and nobility, and provide more opportunities for people from every walk of life to mobility, and provide more opportunities for people from every walk of life to age to and from work, shopping and recreation. A system can include com-more bus routes with more frequent service. You'l locally decited officials have developed a long-term region-wisel plan to create a balanced public trans-portation system that will accommodate residents throughout the Greater Wasach Area, but additional flushs and etizien involvement will be necessary.



Opportunities will be lost and expenses will go up it we fall to move forward





relation choices. Development r housing, shopping, work, creation and cultural amenities n economically and aesthetica enhance key sites adjacent to



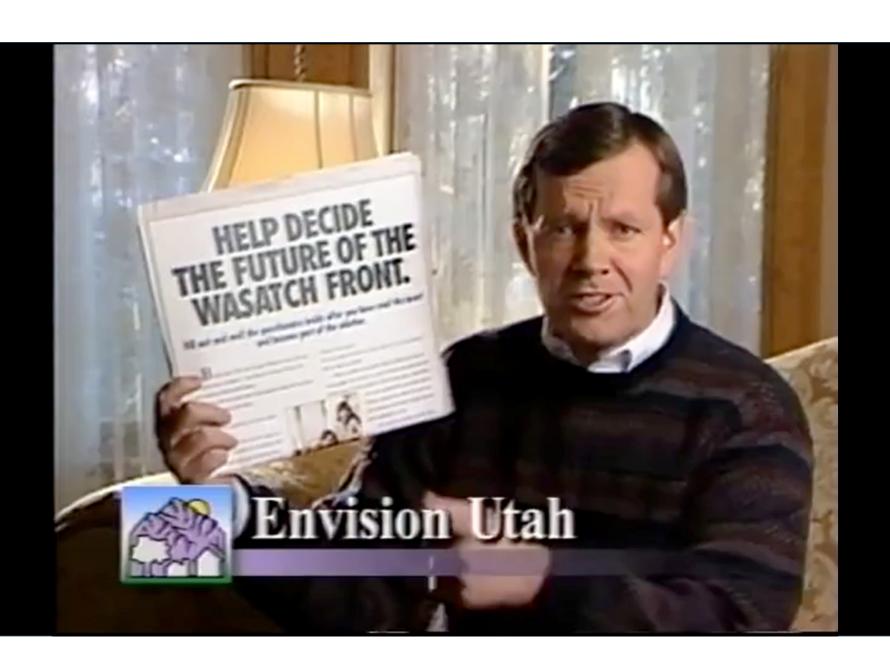


Envision Utah's Quality Growth Strategy through the year 2020

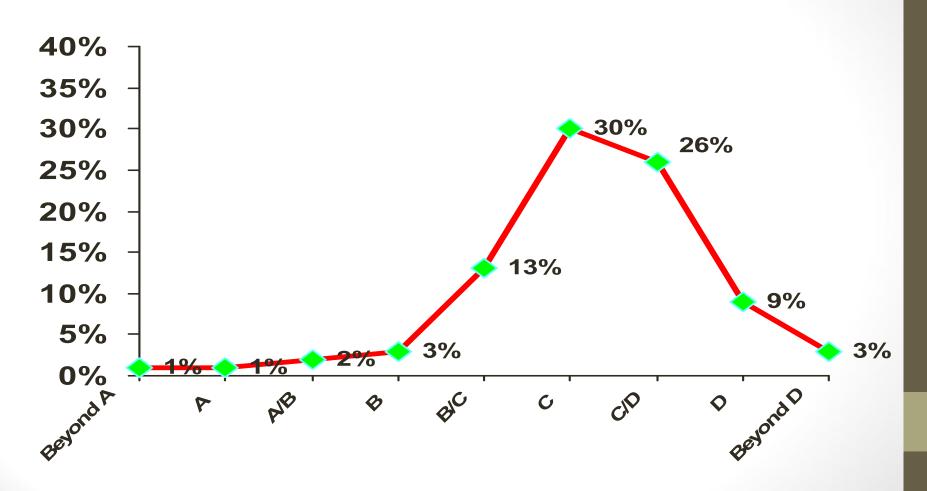




Envision Utah Keeping Utah beautiful, prosperous and neighborly for future generations

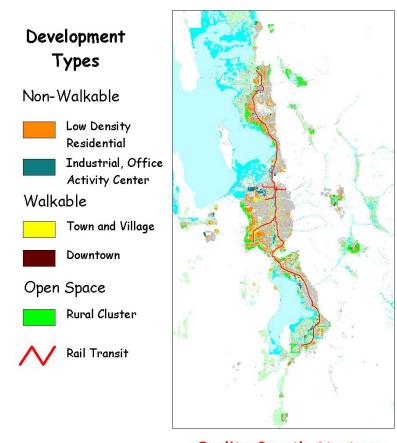


Choosing a Scenario



The Vision: "The Quality Growth Strategy"

- Grow inward
- Protect the Wasatch Back
- Build Rail Transit
- Walkable Communities
- Conserve Critical Lands



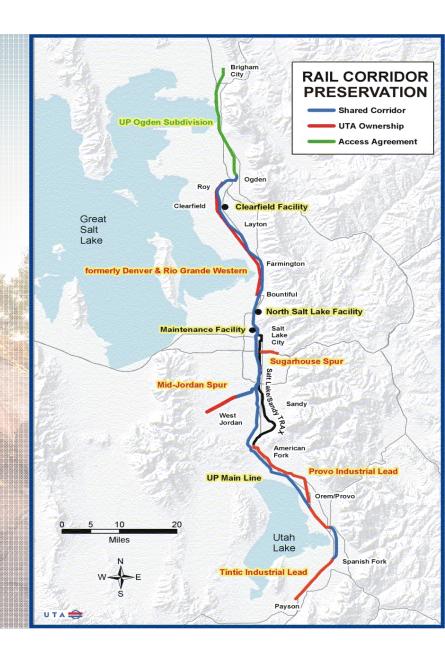


Quality Growth Strategy

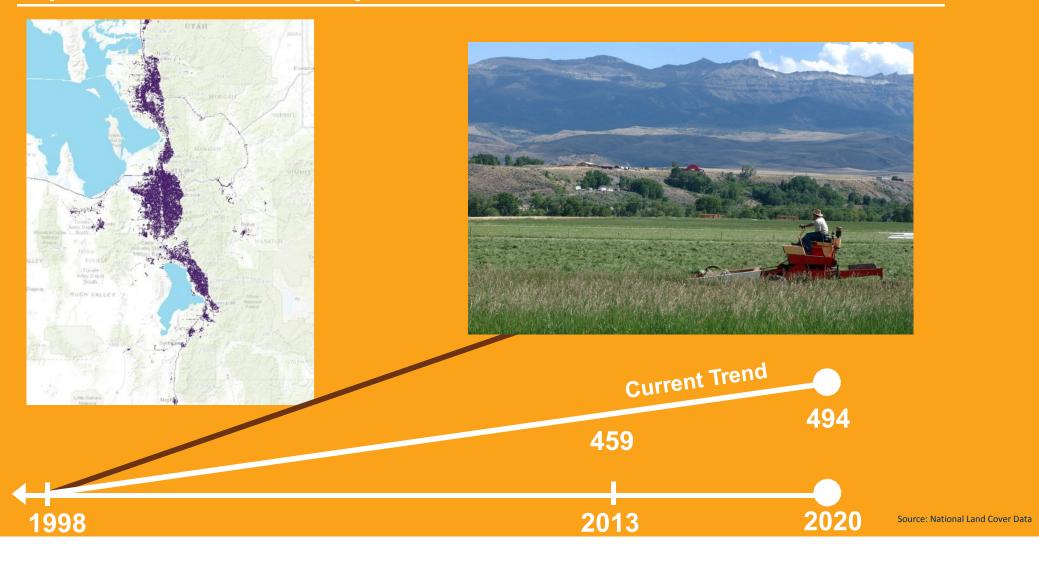


FUTURE TRANSIT

- \$185 million acquisition
- 175 miles of right-of-way
- Nine transit corridors



Square Miles of Developed Land







Neutral



Values



Stakeholders



Scenar ios



Public Input



Vision

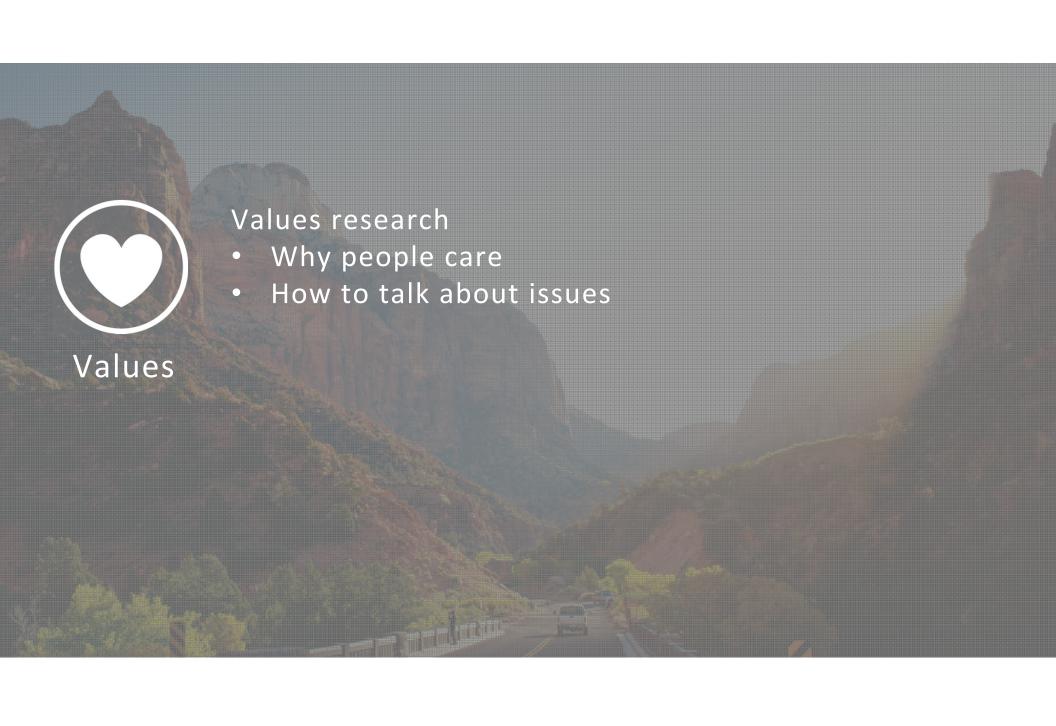
A process to create lasting change



Neutral

Neutral Faciliation Stance:

Present choices and consequences
Empower participants
Stand up for the results of the process





Prominent, Balanced Stakeholders





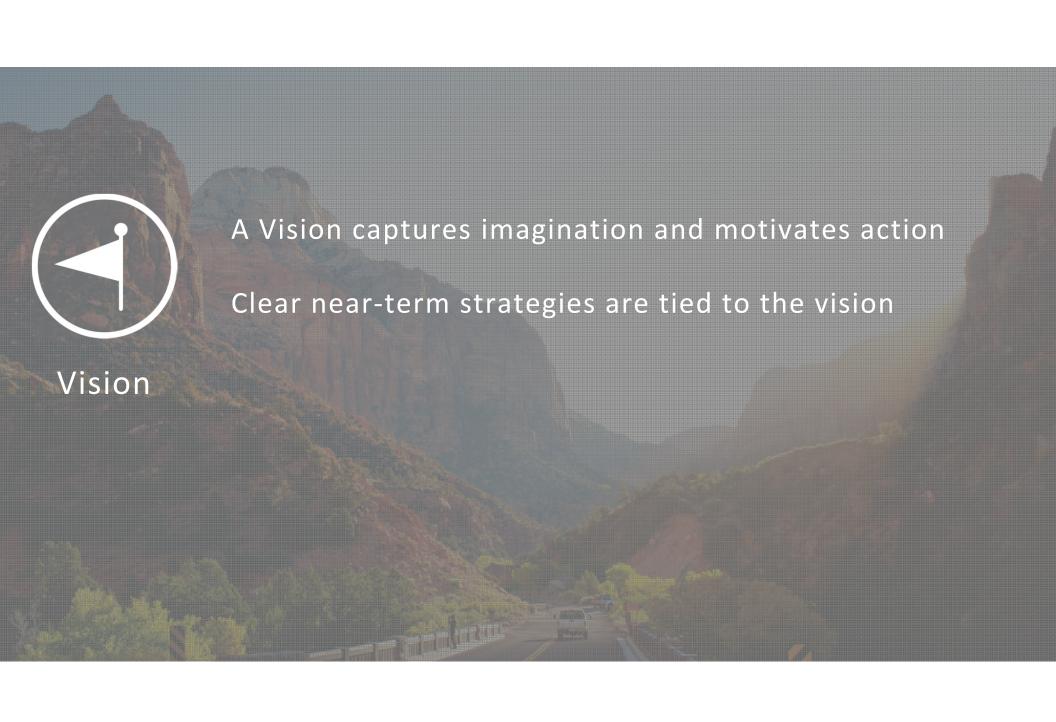
A process to create lasting change



Use scenarios to ask important questions.

Model potential choices and their outcomes.









Neutral



Values



Stakeholders



Scenar ios



Public Input



Vision

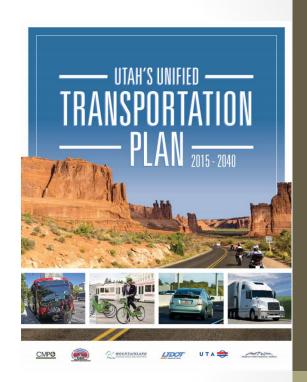
Ongoing Collaboration in Utah

Vertical: commitment to cross-sector collaboration

Horizontal: collaboration at each level of organizations

Emphasize collaboration's benefits

- Stronger messages
- More trust
- Improved connections between visions, plans, and implementation



Scenario Planning in Utah

Motivation

Create a strongly supported regional vision

Bridge local actions with the regional vision





Scenario Planning in Utah

Motivation	Approach
Think regionally	Broad, regional scenarios
Create shared vision	Trust the public
Understand market interactions between infrastructure and development	Use model to forecast development
Explore the fit between Infrastructure and Development	Explore urban design of key corridors
Clarify the gap between the vision and local actions	Refined, small area scenarios





Scenario Planning Perspectives from Utah

DVRPC Scenario Committee

Ted Knowlton, WFRC May 1, 2018



Average Single Family Lot Size



.32 acres



.25 acres

22%
Decrease





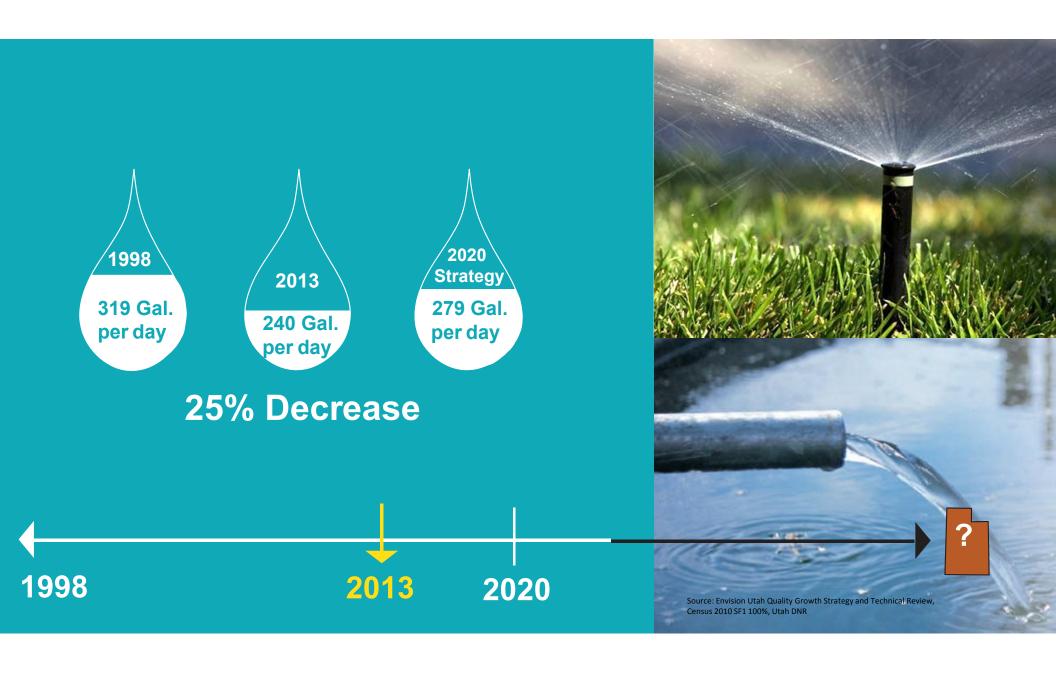
Source: Salt Lake County Assessor 2012, Weber County Assessor 2013, Davis County Assessor 2012, Utah County Assessor 2012, lots <5 acres

Infrastructure Savings

- Capital costs
- Maintenance costs

Because we saved 200 square miles!





Best Practices in Scenario-Building

Uri Avin

Presentation to DVRPC Futures Committee

May 2, 2018

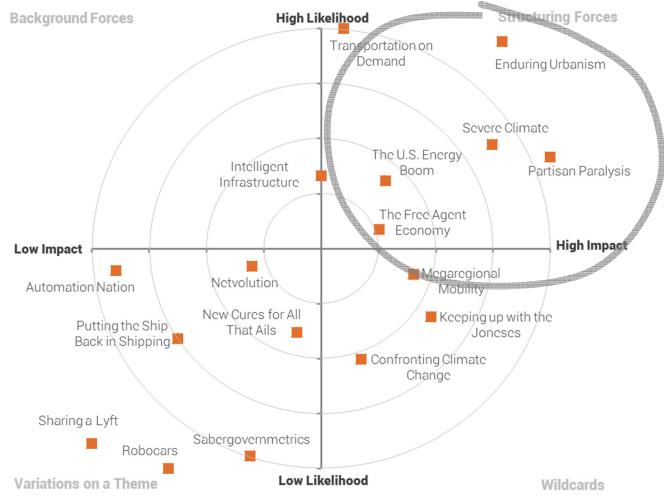


Agenda – Best Practices in Scenario Building

- The DVRPC process generating strategies
- The ARC process combining driving forces for scenarios
- PRESTO process comprehensive modeling
- Tools and models what to use, when and why (if time allows)



DVRP Process: Impact-Likelihood Voting







DVRPC Scenario Assumptions need to fill in the scenario gaps

Enlargement of red box

	Enduring	The Free Agent		Transportation	The U.S.
Factor	Urbanism	Economy	Severe Climate	on Demand	Energy Boom
2045 Population (millions) ^a	6.58 [+17%]	6.44 [+15%]	6.45 [+15%]	6.51 [+16%]	6.48 [+15%]
	Young adults	Population is	Region receives	Technologies	Population and
	(20-34 years	more transitory,	some in-	allow workers to	jobs increase
	old) continue to	as people	migration from	live anywhere	due to the
Demographic Trends	flock to the	constantly move	regions that are	and work	energy hub and
Demographic frends	region, and	in search of	more severely	remotely	economic
	there are fewer	economic	impacted by		growth
	persons per	opportunity	climate change		
	household				
2045 Employment (millions) ^a	3.33 [+13%]	3.29 [+12%]	3.28 [+11%]	3.30 [+12%]	3.33 [+13%]
2045 Income per Capita ^{s,b}	\$39,000 [+44%]	\$36,100 [+33%]	\$35,000 [+29%]	\$37,400 [+38%]	\$39,500 [+46]
Development Patterns	Population grows around dense regional centers but declines slightly in farther-out suburbs	New development centers emerge around universities, which become the creators and incubators of new businesses	More infill development and increased density in regional centers; Movement away from major rivers and floodplains	Mix of infill development that occurs near transit access and regional centers, and more traditional suburban development	Industrial growth reactivates the Delaware River waterfront, and spurs residential growth in areas with easy access to industrial jobs
Travel Demand Shifts	Increase in walking, biking, and transit trips	Fewer 9-to-5 work schedules, which harms transit agencies' ability to effectively deliver service	Slower growth rates in trade and goods movement	New transportation services, such as ride sourcing and micro transit, become major travel providers	Higher growth rates in global trade and goods movement

Table 1. Assumptions Used to Build What-If Scenarios

Factor	Urbaniam	Economy	Severe Climate	on Demand	Energy Boom
2045 Population (millions)*	6.58 [+17%]	8.44 (+15%)	6.45 (+15%)	6.51 (+16%)	6.48 (+15%
	Young adults	Population is	Region receives	Technologies	Population and
	(20-34 years	more transitory.	some in-	allow workers to	jobs increase
	old) continue to	as people	migration from	Eve anywhere	due to the
Demographic Trends	flock to the	constantly move	regions that are	and work	energy hub and
Demographic Trends	region, and	in search of	more severely	remotely	economic
	there are fewer	economic	impacted by		growth
	persons per	opportunity	climate change		
	household				
2045 Employment (millions)*	3.33 [+13%]	3.29 [+12%]	3.28 [+11%]		3.33 +139
2045 Income per Capita**	\$39,000 [+44%]	\$38,100 [+33%]	\$35,000 [+29%]	\$37,400 [+38%]	\$39,500 (+46
	Population	New	More infill	Mix of infill	Industrial
	grows around	development	development	development	growth
	dense regional	centers emerge	and increased	that occurs near	reactivates the
ı	centers but	around	density in	transit access	Delaware filve
	declines slightly	universities,	regional centers;	and regional	waterfront, and
Development Patterns	in farther-out	which become	Movement away	centers, and	spurs
	suburbs	the creators and	from major	more traditional	residential
I		incubators of	rivers and	suburben	growth in area
ı		new businesses	floodplains	development	with easy
ı					access to
					industrial jobs
	Increase in	Fewer 9-to-5	Slower growth	New	Higher growth
ı	walking, biking, and transit trips	work schedules, which harms	rates in trade and goods	transportation services, such	rates in global trade and
	and transit trips		movement		goods
ravel Demand Shifts		transit agencies' ability to	movement	as ride sourcing and micro	goods movement
		effectively		transit, become	movement
		deliver service		major travel	l .
		delives service		major travel	
	Significant push	Strong desire for	Extreme	New	Low energy
	to fully	low-cost options.	weather	technologies.	prices bring
ı	pedestrianize	pushing a move	shortens	such as 30	down the cost
ı	Main Streets,	toward	transportation	printing.	of building and
ı	while adding	Complete	infrastructure	nanotechnology,	maintaining
I	protected bike	Streets	lifespans and	and better asset	transportation
ransportation infrastructure	and pedestrian		Increases	management,	infrastructure
	infrestructure to		maintenance	extend the	
ı	all roads (except		costs	lifespan of	l
I	highways)			transportation	l
I				infrastructure	l
ı				and lower its	l
				costs	
				\$3.80 +33%	\$3.10 (+8%
	\$3.60 [+2694]	\$3.70 [+299c]	\$4.60 [+6194]	40.00 (.00.0)	
Cost/Gallon**					
Cost/Gallon ^{A b} 2045 Average Vehicle Fuel	46 mpg	44 mpg	50 mpg	80 mpg	41 mp
Cost/Gallon ^{A b} 2045 Average Vehicle Fuel	46 mpg (+109%)	44 mpg (+100%)	50 mpg [+127%]	80 mpg [+173%]	41 mp (+889
Cost/Gallon ^{A b} 2045 Average Vehicle Fuel	46 mpg (+109%) Demand	44 mpg (+100%) Demand grows	50 mpg [+127%] The need to	80 mpg [+173%] A significant	41 mg (+869 Fossi fuels
Cost/Gallon ^{A b} 2045 Average Vehicle Fuel	46 mpg (+109%) Demand Increases for	44 mpg (+100%) Demand grows for coworking	50 mpg [+1279] The need to rebuild and	80 mpg [+173%] A significant increase in zero-	41 mg (+889 Fossi fuels remain the
Cost/Gallon ^{A b} 2045 Average Vehicle Fuel	46 mpg (+109%) Demand Increases for new types of	44 mpg (+100%) Demand grows for coworking space; 3-D	50 mpg [+127%] The need to rebuild and make	60 mpg (+173%) A significant increase in zero- car households;	41 mp [+869 Fossil fuels remain the dominant
Cost/Gallon ^{A b} 2045 Average Vehicle Fuel	46 mpg (+109%) Demand increases for new types of housing such as	44 mpg (+100%) Demand grows for coworking space; 3-D printing	50 mpg [+127%] The need to rebuild and make infrastructure	60 mpg [+173%] A significant increase in zero- car households; innovations in	41 mp [+869 Fossil fuels remain the dominant
Cost/Gallon ^{A b} 2045 Average Vehicle Fuel	46 mpg (+100%) Demand increases for new types of housing, such as micro	44 mpg (+200%) Demand grows for coworking space; 3-D printing, automation, and	50 mpg (+127%) The need to rebuild and make infrastructure more resillent.	60 mpg (+17.3%) A significant increase in zero- car households; innovations in alternative	41 mp [+869 Fossil fuels remain the dominant
Cost/Gallon** 2045 Average Vehicle Huel Efficiency*	46 mpg (+109%) Demand increases for new types of housing, such as micro spartments;	44 mpg (+100%) Demand grows for coworking space; 3-0 printing, sutomation, and robotics brings	50 mpg (+127%) The need to rebuild and make infrastructure more resilient limits other	80 mpg (+173%) A significant increase in zero- car households; innovations in alternative energy sources	41 mp [+869 Fossil fuels remain the dominant
Cost/Gallon** 2045 Average Vehicle Fuel Efficiency*	46 mpg (+100%) Demand increases for new types of housing, such as micro spertments; urban schools	44 mpg (+100%) Demand grows for coworking space; 3-D printing, automation, and robotics brings more local	50 mpg [+127k] The need to rebuild and make infrastructure more resilient limits other investments	80 mpg [+173k] A significant increase in zero- car households; innovations in alternative energy sources lead to lower	41 mg [+889 Fossil fuels remain the dominant
Cost/Callon** 2045 Average Vehicle Fuel Efficiency*	46 mpg (+109%) Demand increases for new types of housing such as micro spectments, urban schools slowly close the	44 mpg (+100%) Demand grows for coworking space; 3-0 printing, automation, and robotics brings more local manufacturing	50 mpg [+127%] The need to rebuild and make infrastructure more resilient limits other investments potentially	80 mpg (+173%) A significant increase in zero- car households; innovations in alternative energy sources	41 mg [+889 Fossil fuels remain the dominant
Cost/Callon** 2045 Average Vehicle Fuel Efficiency*	46 mpg (+109%) Demand increases for new types of housing such as micro spartments; urban schools slowly close the quality gap,	44 mpg (+100%) Demand grows for coworking space, 3-0 printing, automation, and robotics brings more local manufacturing back to the	50 mpg (+127%) The need to rebuild and make infrastructure more resillent limits other investments potentially slowing	80 mpg [+173k] A significant increase in zero- car households; innovations in alternative energy sources lead to lower	41 mp [+869 Fossil fuels remain the dominant
2045 Gesotina Cost/Delicen ^{†*} 2045 Average Vehicle Puel Efficiency [*] Miscellaneous	46 mpg [+109%] Demand Increases for new types of housing such as micro spectruments; urban schools slowly close the quality gap, reducing the	44 mpg (+100%) Demand grows for coworking space; 3-0 printing, automation, and robotics brings more local manufacturing	50 mpg (+127%) The need to rebuild and make infrastructure more resilient limits other investments potentially slowing economic	80 mpg [+173k] A significant increase in zero- car households; innovations in alternative energy sources lead to lower	41 mp [+869 Fossil fuels remain the dominant
Cost/Callon** 2045 Average Vehicle Fuel Efficiency*	46 mpg (+109%) Demand increases for new types of housing such as micro spartments; urban schools slowly close the quality gap,	44 mpg (+100%) Demand grows for coworking space, 3-0 printing, automation, and robotics brings more local manufacturing back to the	50 mpg (+127%) The need to rebuild and make infrastructure more resillent limits other investments potentially slowing	80 mpg [+173k] A significant increase in zero- car households; innovations in alternative energy sources lead to lower	41 mp (+86% Fossi fuels remain the

Numbers in parenthisals are comparisons to a 2010 baseline, regional population was 5.62 million; employment was 2.95 million; income per capits was \$27,100, glacoline cost was \$2.05 per gallon; and vehicles sweraged 22 miles per gallon (mg. * in 2010 dollars.

Part II. What-If Scenarios



DVRPC Results – heavy on Transportation

		Enduring	The Free Agent	Severe	Transportation	The U.S. Energy
Factor	2010	Urbanism	Economy	Climate	on Demand	Boom
Percentage of Population <16	19%	18%	18%	19%	19%	20%
Percentage of Population >65	13%	20%	20%	19%	20%	18%
Total Households (millions)	2.13	2.62	2.38	2.32	2.46	2.50
Population per Household	2.64	2.51	2.71	2.78	2.64	2.59
New Footprint Residential Acres Developed, 2010–2045		20,300	64,300	70,100	145,700	226,400
New Footprint Commercial Acres Developed, 2010–2045	-	25,900	52,700	59,000	62,700	95,500
Population in Connections 2040 Centers	23%	25%	24%	23%	23%	20%
Employment in Connections 2040 Centers	22%	23%	23%	23%	22%	21%
Annual Residential Energy Greenhouse Gas Emissions per Household (MTCO ₂ E)	7.6	6.4	6.7	6.5	6.2	7.2
Average Annual Household Residential Energy Costs*	\$2,210	\$1,380	\$1,500	\$1,810	\$1,410	\$1,340
Vehicles per 1,000 Capita	573	518	576	565	395	627
Percent Zero-Car Households	15%	26%	15%	15%	38%	13%
Daily VMT (millions)	107.0	116.1	114.1	109.5	146.4	139.2
Annual VMT per Capita	6,940	6,440	6,470	6,190	8,220	7,840
% VMT through Ride Sourcing/AVs	0%	16%	11%	14%	58%	3%
Average Vehicle Occupancy	1.3	1.6	1.6	1.6	1.8	1.4
Daily VHT (millions)	3.57	3.74	3.66	3.48	4.98	4.68
Average Daily Speed (mph)	30	31	31	32	29	30
Annual Recurring Vehicle Hours of Delay per Capita	22	22	20	21	31	30
Annual Fatal Crashes	326	186	194	176	196	225
Annual Injury Crashes	31,784	16,730	17,410	15,785	17,750	20,240
Daily Gallons of Gasoline (millions)	5.0	2.5	2.6	2.2	2.4	3.4
On-Road Greenhouse Gas Emissions, Tailpipe Only (Annual MTCO ₂ E per Capita)	3.9	1.3	1.3	1.1	1.3	1.8
Daily Linked Transit Trips (millions)	0.8	1.4	1.2	1.2	1.3	0.9
Daily Walking and Biking Trips (millions)	1.5	3.8	2.3	2.3	2.3	1.7
Annual Household Transportation Costs*	\$10,870	\$14,260	\$8,860	\$17,530	\$15,120	\$10,490
Transportation Costs as a % of Income *In 2010 dollars.	15%	15%	10%	20%	16%	11%

"Incorporating" Driving Force Combinations by Analyzing Interactions Between the Scenarios

Table 3. Potential Interactions Between the Future Forces

Force 1	Force 2	Relationship	Interactions Between Them		
Enduring Urbanism (+)	The Free Agent Economy (+)	Strengthens Both	The Free Agent Economy may be a cause of Enduring Urbanism. Together, they may strengthen the region's agglomeration economy.		
Enduring Urbanism (+)	Severe Climate (0)	Mixed Impacts	Severe Climate may reinforce Enduring Urbanism, though it could restrict development of desirable riverfront areas, and add risk to growing development centers.		
			Enduring Urbanism could reduce the risk of Severe Climate.		
Enduring Urbanism (+)	Transportation on Demand (0)	Mixed Impacts	Transportation on Demand provides more travel options that do not require car ownership, which is being sought by some individuals interested in Enduring Urbanism lifestyles.		
			The ability to be car-free or car-lite in more suburban settings could weaken the desire for Enduring Urbanism.		
			 Conversely, Enduring Urbanism preferences for walking and biking could reduce growth in Transportation on Demand. 		
Enduring Urbanism (-)	The U.S. Energy Boom (-)	Weakens Both	The U.S. Energy Boom could worsen air quality and environmental conditions, and low-cost energy generally encourages lower-density development. In sum, this potentially detracts individuals interested in Enduring Urbanism lifestyles, making it less likely to happen.		
			 Ongoing weakness in the energy market combined with ongoing interest in living in walkable centers could strengthen regional movements against increasing regional energy distribution. 		



Your Strongest Contribution to Best Practices: DVRPC Universal Actions

Universal Actions

Update zoning codes to allow for mixed-use infill development.
Build lifelong communities that facilitate aging in place.
Encourage immigrant-friendly policies.
Implement universal pre-kindergarten and other programs to improve k-12 educational outcomes.
Use green infrastructure and stream buffer ordinances to improve water quality and livability.
Promote megaregional collaboration and cooperation.
Create regional or local big data team(s) to centralize and analyze datasets, guide decision making,
and enhance government actions.
Expand regional broadband infrastructure; and internet access and training for low-income
individuals.
Develop the impact economy, which uses a profit motive, public-private partnerships, and nonprofits
to address economic, environmental, and social issues.
Create a modern multimodal transportation system and a regional funding source to help pay for it.
Enhance freight and goods movement.
Carry out Vision Zero plans, which set a goal of no roadway fatalities.
Improve infrastructure resiliency.



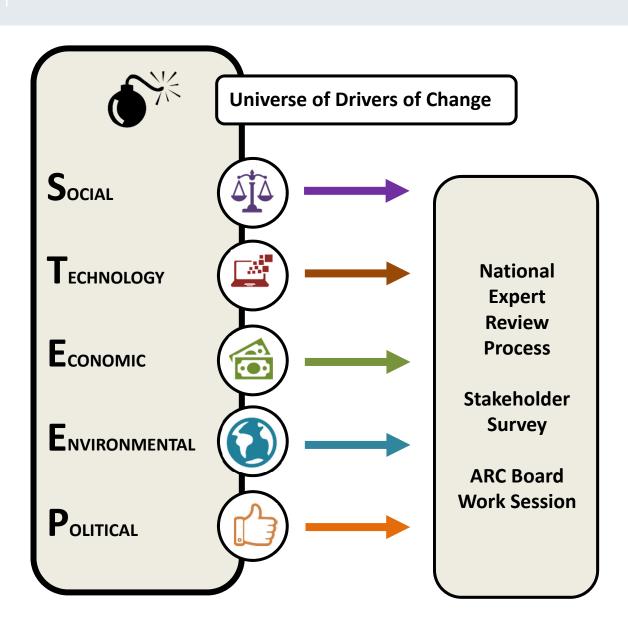
DVRPC Contingent Actions (Partial Table)

Contingent Regional Actions (Re)develop without displacing existing households, allow for more multi-family housing. Thoroughly implement Complete Streets to accommodate all users, including goods movement, along with protected bike lanes, pedestrian-only areas, and shared space/living streets concepts that prioritize bike and pedestrian use, particularly in the region's centers. Expand and increase service frequency throughout the transit system. Retrofit office parks and commercial districts into dense mixed-use communities, update design guidelines with form-based zoning, and relax parking requirements. Protect industrial zones. Expand and support regional business incubators and accelerators, and small business and entrepreneurial training programs. (THE FREE AGENT ECONOMY) Simplify business tax collection, licensing, and permitting, and ensure regulations do not unnecessarily restrict the pop-up economy. Increase transit service during off-peak hours and improve intra-suburban service and service to suburban office parks. Update zoning codes to allow for shared office space and mixed-use buildings. Build more middle-class housing units in urban areas, and foster regional cooperation for reducing poverty and homelessness. Increase interagency and intergovernmental coordination around climate change issues. Pursue climate change adaptation strategies, such as identifying and protecting vulnerable assets, updating building codes and floodplain ordinances for more extreme weather, building levees to protect key development areas, preserving and extending wetlands, increasing water storage, improving emergency preparedness, and developing a flood detour system for freight routes. Continue to reduce greenhouse gas emissions at the regional, local, firm, and household level. Preserve agricultural land and take other measures to increase regional food production. Continue to invest in, and make the region into an alternative energy and clean-technology hub, and accerate the move to lower-carbon electricity production.



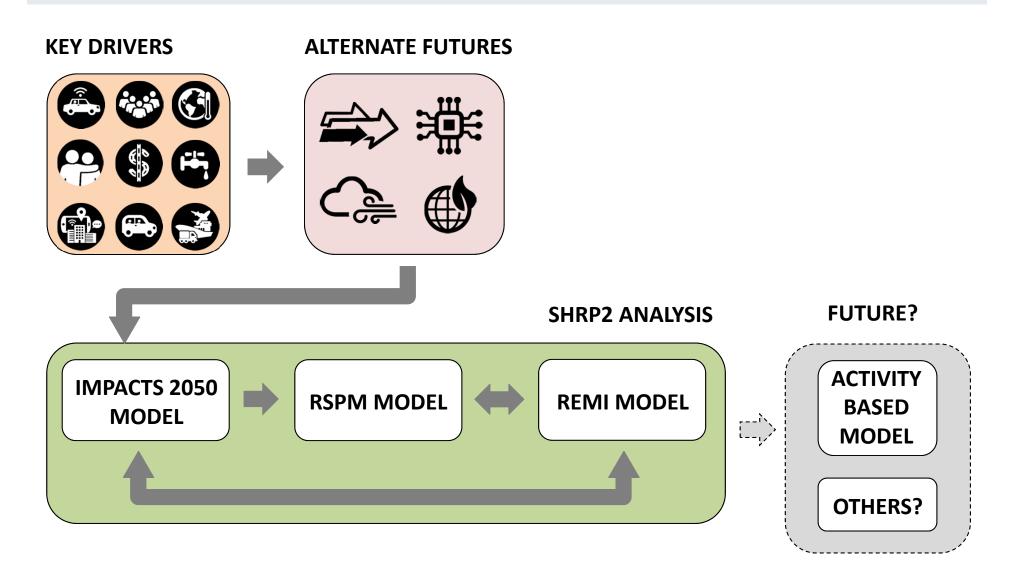


Identifying our region's key drivers of change





Our original modeling intentions





Impacts 2050: 4 Scenarios









Momentum

State of the country in 2050 is recognizable to any planner who had worked in 2010.

Tech Triumphs

By 2050,
technological
innovations
have changed
how we travel,
connect our
world, and
reduce our
carbon footprint.

Global Chaos

The world is a more difficult place to live in 2050 with growing financial instability, and insecurity over food, jobs, oil.

Gentle Footprint

Recovering from droughts and superstorms, the US has taken significant and serious action to mitigate global climate change.



This is what developing alternate futures will feel like at first





This is not a desirable outcome





Key drivers of change for the Atlanta Region



Autonomous Vehicles



Spatial, Racial and Economic Equity



Climate Change Regulations



Aging of the Population



Transportation Finance
Structure



Water Supply



Intelligent
Infrastructure &
Technology



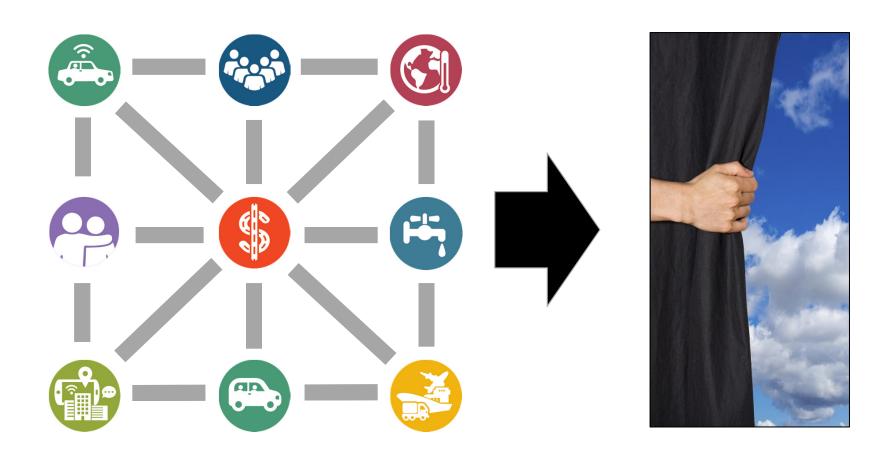
Ridehailing Services



Port Traffic



Drivers woven together to form alternate futures





Four plausible alternate futures for our region





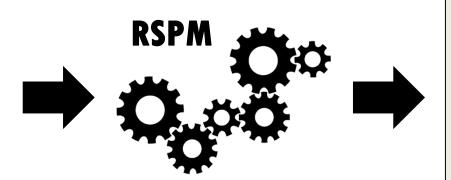
Four plausible alternate futures for our region



Full Steam Ahead most closely mirrors current forecasts and projections; trends that were present in the first two decades of the 21st century continue at a moderately accelerated pace. Full Steam Ahead is "business as usual" – development patterns are driven by current lifestyle preferences and short term financial return on investment, but the region is slow to respond to significant long term shifts in demographics.

Analysis process

324
Alternate
Futures



Annual CO2 Emissions

(total and per capita)

Transit ridership (total and per capita)

Walking/bicycling trips (total and per capita)

Annual hours of delay (per capita)

Vehicle miles traveled (per capita)

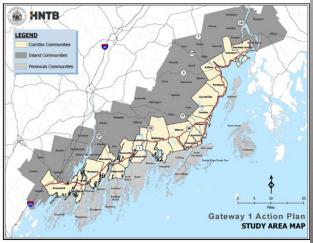
Vehicle operating cost (per capita)

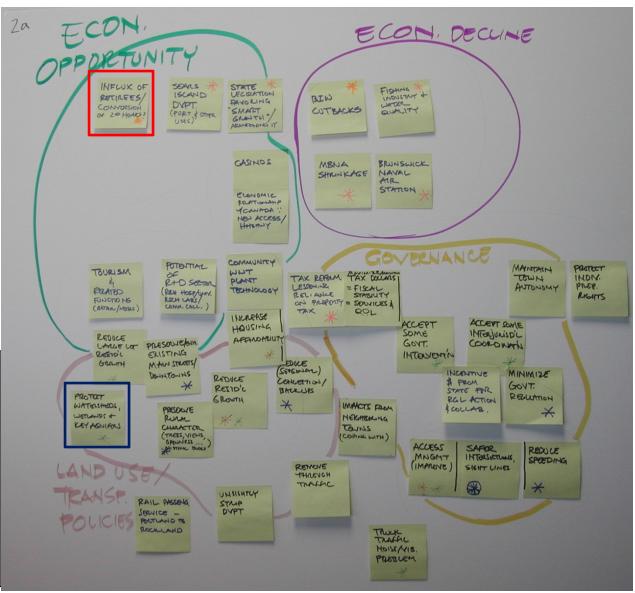
Social cost of transportation (per household)

Coastal Maine: Simple scenario construction method – clustering stickies

Participants move driving forces and values/goals around to form compatible clusters of Trends and Values

NCSG



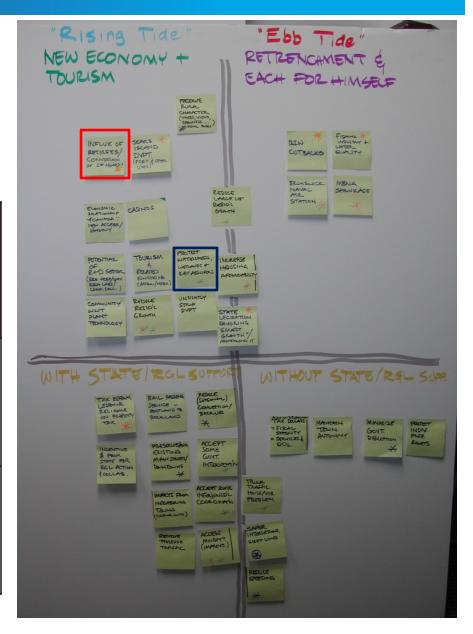


Simple 2 x 2 scenario matrix from stickies

Participants test storylines till the data, trends and values feel consistent and plausible within each scenario and they are well differentiated from each other

NCSG

	Rising Tide New Economy & Tourism	Ebb Tide Retrenchment & Each for Themselves
With State and Regional Support		
Without State and Regional Support		



Networking Transportation

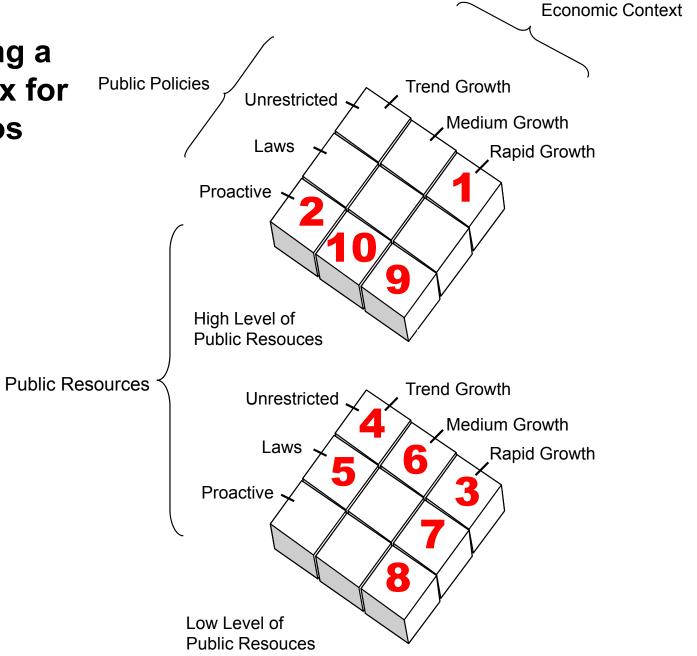
Cooperative, Partnerships A Tale of Moore Two Regions **Growth** Slower Growth ← → Faster Growth Filling a **TNCs** Take Off **Niche** Individualistic, Fragmented

Networking Transportation





La Paz: Deploying a 3D matrix for Scenarios



Source: Carl Steinitz et al, 2009



Contingent Process: Analysis of Driving Forces (Trends and Factors)

Organize analysis of trends by Societal, Technological, Economic, Political, Environmental (STEPE)

Decide which are Givens vs. Indeterminate

Organize Indeterminates by Likelihood and Impact

Use highest likelihood and biggest impact Indeterminates and biggest impact Givens to structure the Driving Forces parts of the Scenarios

The Best Example: Scenario Planning for Freight Transportation Infrastructure Investment, NCHRP Report 750, Volume 1, 2016

NCHRP 20-83(1)

NCSG

- "Critical analysis of driving forces... may effect the US freight transportation system"
- Driving forces
 - Resource availability
 - Global trade
 - Energy cost (level, variability)
 - · Energy sources
 - Environmental awareness
 - · Population dispersion
 - Level of migration; policy
 - · Currency fluctuations

Millions of Markets

- Resource availability (H)
- · Global trade (L)
- ٠..

Global Marketplace

- Resource availability (H)
- · Global trade (H)
- ...

Naftastique

- Resource availability (L)
- Global trade (L)
- ...

One World Order

- Resource availability (L)
- · Global trade (H)
- ...

http://ctl.mit.edu/research/futurefreightflows

Scenarios: Brochures, Videos

Process: Planner & facilitator guides, templates





Key Drivers in the Four Scenarios

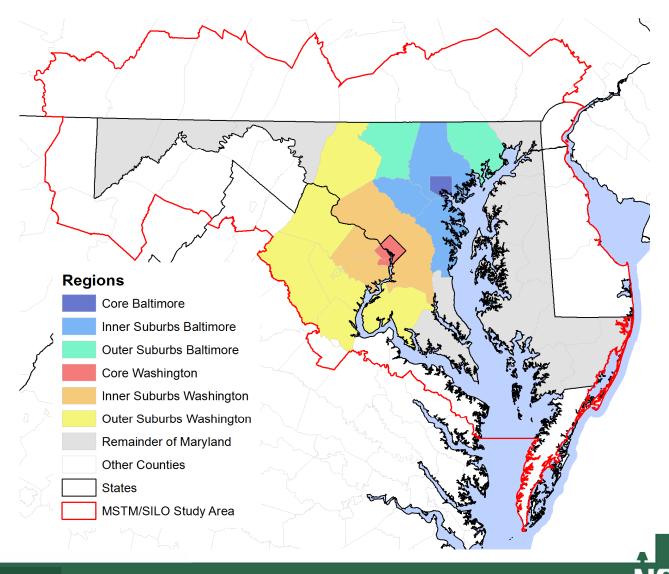






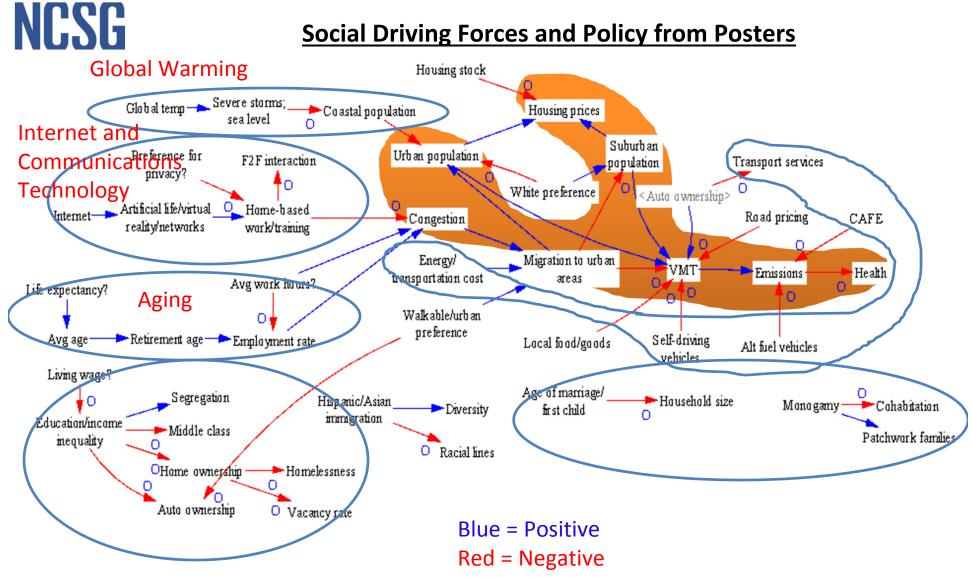
Global Trade	Low	High	High	Low (physical)
Resource Availability	Low	Low	High	High
Energy Cost Level	High	High	Low	Low
Energy Cost Variability	Low	High	High	Low
Level of Environmental Awareness	Same as Today	High	Low	High
Population Dispersion	Growth in SW	Growth in Biggest Cities	Growth in Biggest Cities	Rise in Mid Tiered Cities
Energy Sources	Majority NA	Mix Foreign & Domestic	Majority Foreign	Majority Domestic
Level of Migration	High w/in Bloc, Low between	High	High	Low
Migration Policy	High	High	Low	Low
Currency Fluctuations	Low w/in Bloc	High	Moderate	Low

PRESTO – Modeling a 3D matrix of scenarios



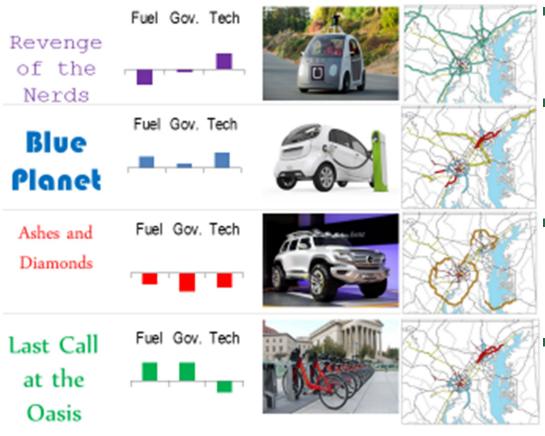
Making the Sausage: Identify Broad Driving Forces

Social Driving Forces and Policy from Posters





PRESTO: Business As Usual and Four Multifaceted Scenarios – one sentence version



- BAU: Continuation of current policies and trends
- Revenge of the Nerds: Strong economic growth, autonomous vehicles, and growing inequality
- The Blue Planet: Strong economic growth, embrace of green technology, and major transit investments
- Ashes and Diamonds: Slow growth, land use deregulation, highway expansion, and limited tech change
- Last Call at the Oasis: Resource scarcity, high fuel prices and slow economic growth



Each Scenario needs a Careful Thumbnail and icon



Revenge of the Nerds (RON)

shows how a combination of low fuel prices, limited government regulation, and rapid technological change profoundly impacts regional development patterns, travel behaviors and the environment. For many, the adoption of autonomous vehicles confers new opportunities and choices in where to live, work and invest. Most strikingly, despite large increases in miles traveled, the increase in road capacity created by vehicle autonomy yields an equally dramatic decrease in road congestion. Transit ridership declines significantly. The widespread decentralization and growth of new housing consumes more farm and forest land, but since suburban development can produce lower nutrient loadings than farming and some best management practices (BMP) are implemented, nutrient runoff is similar to the baseline. Greenhouse gas and local air pollutants increase.



Scenario Inputs Should Push The Envelope

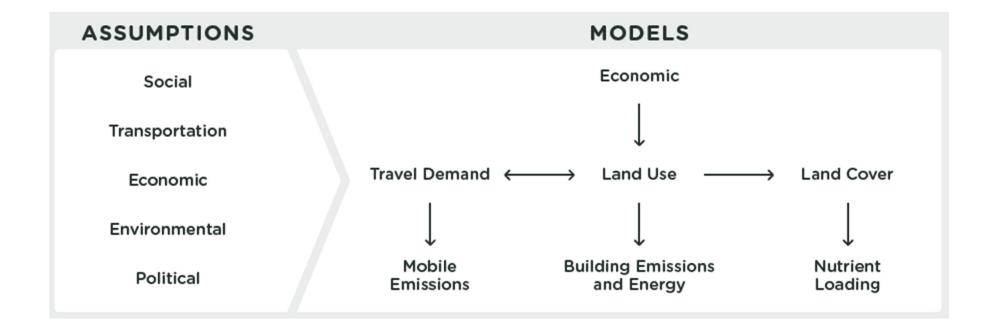
Scenario Inputs Relative to Baseline									
	RON	FFA	BP	LCO					
Mobility									
Vehicle Operating Cost	-75%	-50%	100%	300%					
Zero Emission Vehicle Fleet %	38%	-37%	265%	158%					
Travel Distance Cap	100%	0%	0%	0% 0%					
Value of Time	-50%	0%	0%						
In-Vehicle Time & Operating Cost Coefficient	-50%	0%	0%	0%					
Parking Cost	-50%	0%	0%	0%					
Transportation Network									
Rail Miles	0%	0%	56%	29%					
Rail Stations	0%	0%	65%	45%					
Limited Access Highway Miles	0%	12%	0%	0%					
Highway Lane Capacity	50%	0%	0%	0%					
Employment									
Total Employment	1%	-1%	2%	-1%					
Core Employment	-1%	-4%	4%	1%					
Inner Suburban Employment	2%	-3%	4%	0%					
Outer Suburban Employment	5%	0%	-1%	-6%					
Outside Region Employment	6%	2%	1%	-5%					

Household Location				
Household Distance to Work	100%	0%	0%	0%
Development Capacity	23%	498%	10%	-13%
Core Development Capacity	0%	25%	0%	136%
Inner Suburban Development Capacity	2%	223%	20%	13%
Outer Suburban Development Capacity	24%	587%	11%	-25%
Outside Region Development Capacity	38%	699%	6%	-56%
Energy				
Max HVAC Age	-25%	100%	-50%	-50%
Max Building Renovation Age	-20%	100%	-50%	-50%
Percent of Buildings Renovated Early	25%	-50%	100%	50%
Nutrient Loading				
Nitrogen Loading Rate from Forests	-3%	65%	-17%	-7%
Phosphorous Loading Rate from Forests	-6%	67%	-34%	-11%
Sediment Loading Rate from Forests	-10%	10%	-43%	-21%
Nitrogen Loading Rate from Farms	-16%	48%	-58%	-32%
Phosphorous Loading Rate from Farms	-17%	64%	-57%	-34%
Sediment Loading Rate from Farms	-12%	85%	-53%	-25%
Nitrogen Loading Rate from Development	-13%	66%	-43%	-26%
Phosphorous Loading Rate from Development	-12%	70%	-49%	-25%
Sediment Loading Rate from Development	-20%	100%	-54%	-41%

The lowest numbers are shown in red and the highest in green.

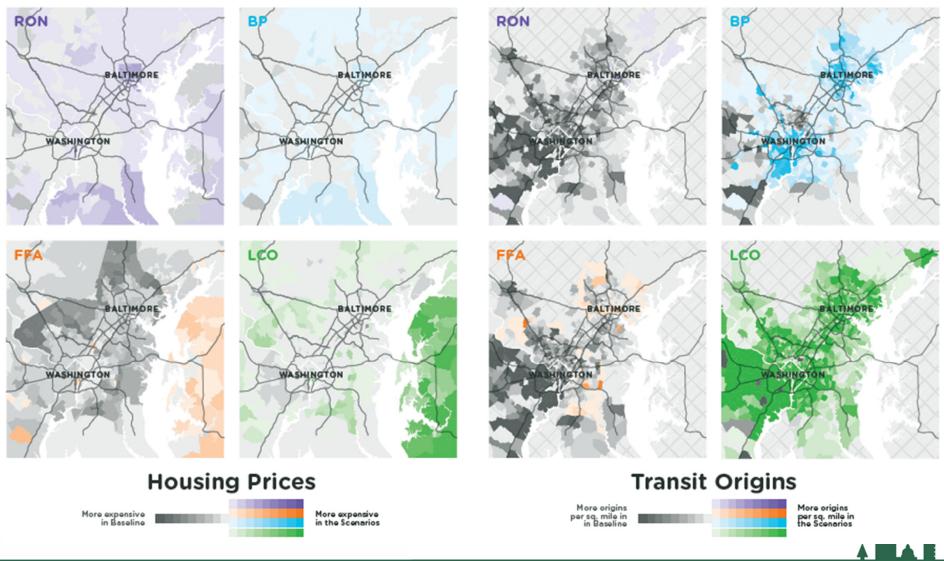


A Range of Models Produce Diverse Indicators





The Models Produce Some Atypical Indicators

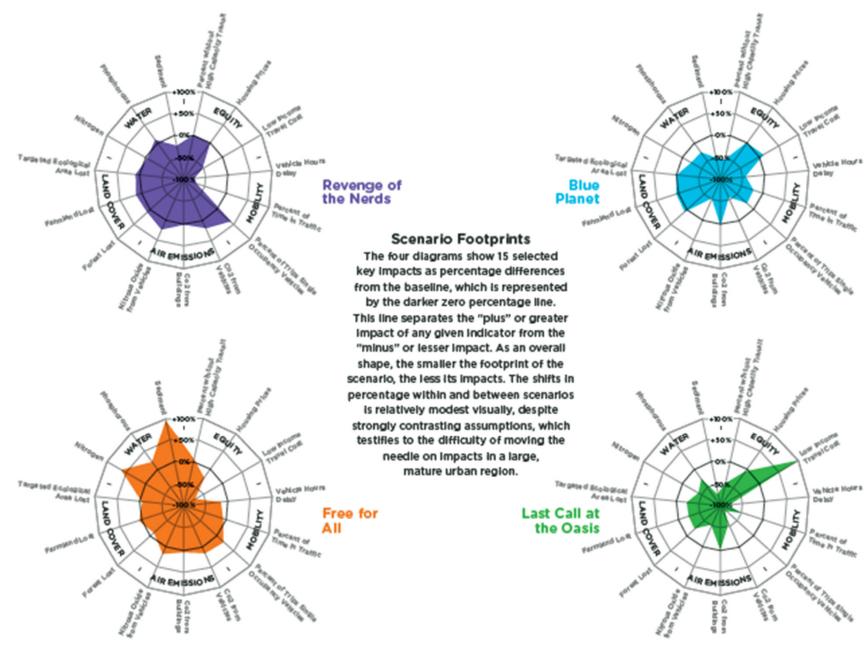




26 Key Indicators selected - Equity highlighted

					Equity				
Impacts					Housing Prices	1%	-23%	0%	-5%
(2040 impacts by scenario vs. baseline)				Share Low Income on High Capacity Transit	-2%	-8%	56%	49%	
	RON	FFA	BP	LCO	Daily Travel Cost for Low Income Persons	-54%	10%	-70%	100%
Total Employment (PRESTO Area)	2%	-2%	3%	-2%	Emissions				
Total Households (PRESTO Area)	7%	-3%	5%	-6%	Vehicle Greenhouse Gases (lbs of CO2EQ)	20%	16%	-56%	-56%
Land Use Change					Nitrous Oxide (lbs)	22%	17%	-55%	-54%
Households in Cores	1%	-17%	1%	-8%	Volatile Organic Compounds (lbs)	8%	12%	-59%	-61%
Households in Inner Suburbs	0%	14%	3%	0%	Building Based Greenhouse Gases (million metric tons)	1%	2%	2%	-2%
Households in Outer Suburbs	17%	-16%	12%	-7%	Building Based Energy Use (MBTU)	1%	1%	4%	-3%
Growth outside the region	14%	-11%	7%	-11%	Nutrient Loading				
Land Cover					New Nitrogen Loading (lbs)	-6%	60%	-24%	-44%
Forest Loss (1,000s acres)	11%	-12%	8%	-24%	New Phosphorous Loading (lbs)	9%	22%	-27%	-27%
Farmland Loss (1,000s acres)	13%	4%	4%	-28%	New Sediment Loading (lbs)	-24%	96%	-52%	-74%
Targeted Ecological Acres Developed Upon	10%	-8%	-2%	-25%				nsit	
Mobility					Reduced set of 15			ity Tra	
Vehicle Hiles Traveled	37%	0%	-15%	-43%		Qn.	Sedin W	Capa	
Vehicle Hours Traveled	-21%	-8%	-30%	-62%	indicators for power	Sphotot	+100% +100%	a signal	
Vehicle Hours Delay	-78%	-16%	-45%	-82%	graphics	Meroon WATE	R +50%	EQUITY ON	Income Nel Cost
Transit Ridership Total	-42%	-26%	21%	70%		Hitrogen WATE	0%	Low	Incomet
Time in Traffic	-72%	-8%	-22%	-53%	Targeted Ecologi	ical -	-50%	1-	Vehicle Hours
Transit Hode Share	-41%	-20%	22%	84%	Area L	OST	-100%		Delay
					Farmland			MOBILITY	Percent of ime in Traffic
						Strost	AIR EMISSION	· Por	.,,,,
						4otes		Les Ponc	L'ATOS

National Center for Smart Growth, University of Maryland



Some Best Practice Highlights

- No need to start from scratch
- Decide on "axes of uncertainty"
- Organize driving forces into coherent scenarios;
- Relate the scenarios to key stakeholder values
- Decide on key outcomes needed (indicators)
- Match the narrative details to the indicators you can produce
- Decide on modeling needs and resources
- Get fresh eyes to critique the scenarios; hone them



Considerations for DVRPC's Next Round

- Clarify main purpose and audience
- Build comprehensive 2 or 3D scenarios
- Push the envelope on assumptions more for more differentiation
- Broaden Indicators e.g. add Land Use model



Best Practices in Scenario-Building

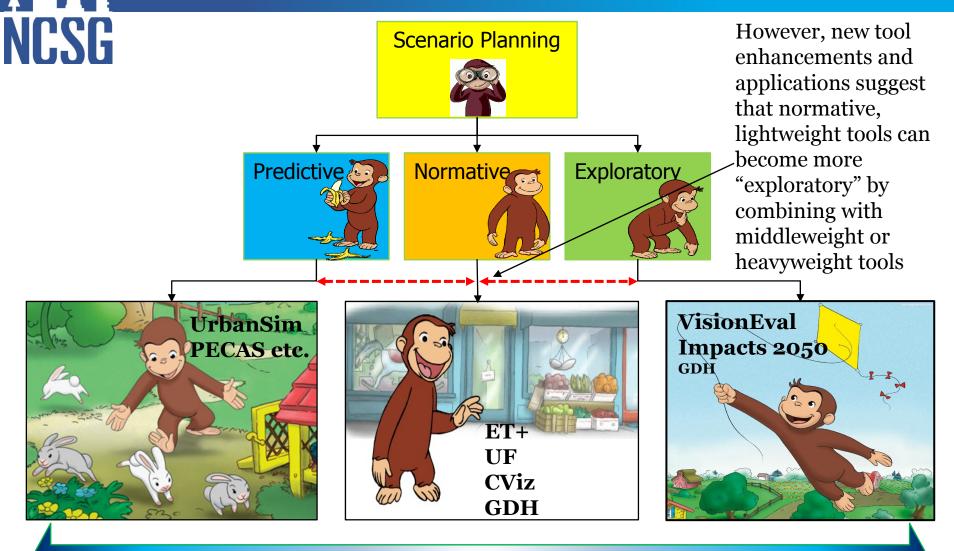
Uri Avin

Presentation to DVRPC

May 2, 2018



The Scenario Planning Approach Relates to Various Tools



Heavyweight

Lightweight

Middleweight



Tool Utility Varies by which Process Steps need Support....

Analyze	Build	Project	Create	Assess	Revise	Target	Execute	Monitor
Current	Scenarios	Baseline	Other Alts	Impacts	Policies,	Desired	Actions,	and
Context		Trends			Actions;	Outcome	Plans	Adjust
					negotiate	negotiate		

Lightweight Tools – INDEX, UF, ET+, CommunityViz, GeodesignHub

Heavyweight Tools – UrbanSim, TRANUS, PECAS etc.

Middleweight Tools – RSPM, Impacts 2050, GeodesignHub etc.



....as well as by Complexity and Ease of Use

Ease of Use

Simple Complex TRA **PEC** NUS AS **IND** UF **URB** SIM Imp. CV 2050 **RSPM** Combos **GeoD**

Span of the Seven Process Steps

Many

Few

GDH has Many Unusual Strengths

Feature	Lightweight Tools			Middleweight Tools/Models			Heavyweight Models		
	ET+	UF	CV	RSPM	2050	Geod	UrbanS	PECAS	SILO
Theory based model									
Generates forecasts									
Validated/calibrated			•						
Generates scenarios					•				
Handles policies & projects							•	•	
Collaboration driven	•	•	•	•					•
Structures negotiations	•	•	•	•					
Range of impacts/indicators							•	•	•
Little data needed									•
Web Based									
Open Access		•	•						

Source: Adapted from Avin et al, NCHRP Project 8-36, Task 117, 2016



Designing a scenario-based study of telernative futires is an ART. I it requires fudgement

It is not a science. altough it depends on science there are no perefect formulae... but there are ultred. There is no unwersal "fool-kit"... but there are "tools" you cannot apy an example... but you can jam example...

Best Practices in Scenario-Building

Uri Avin

Presentation to DVRPC

May 2, 2018

