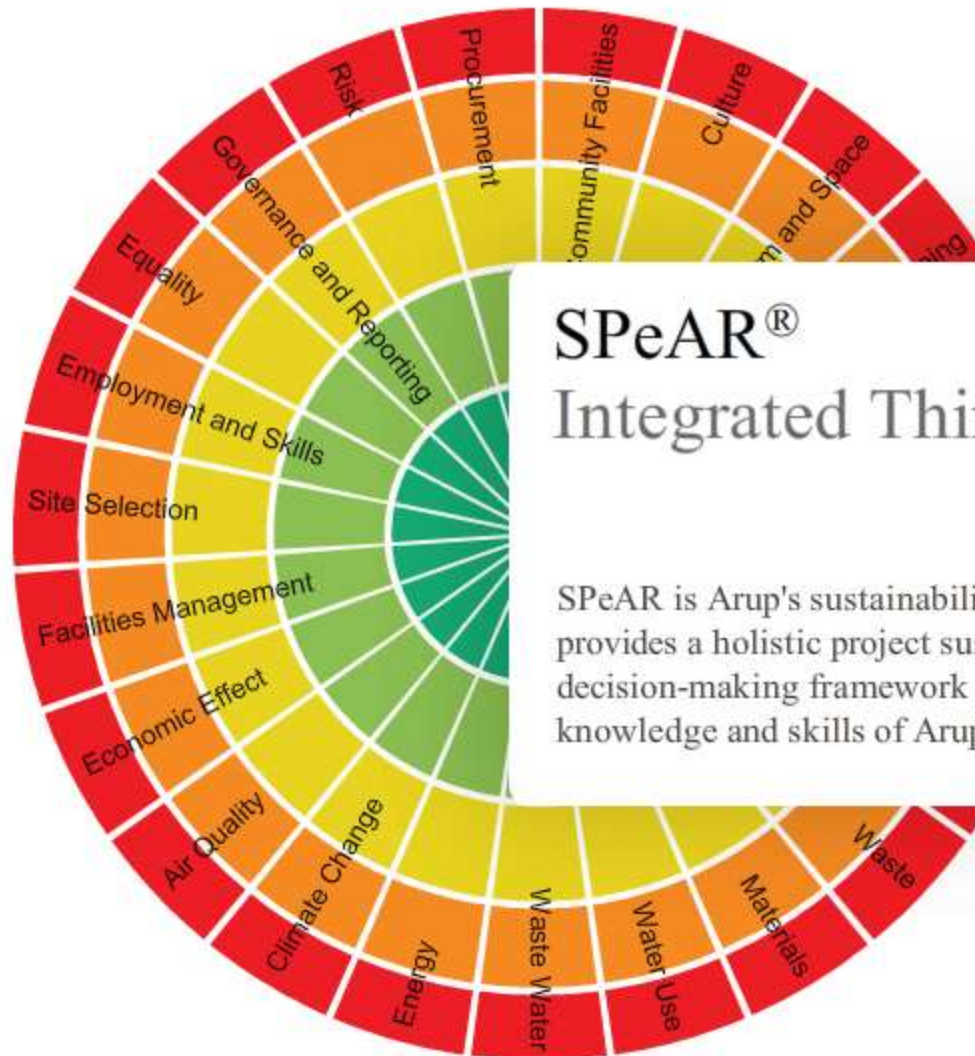


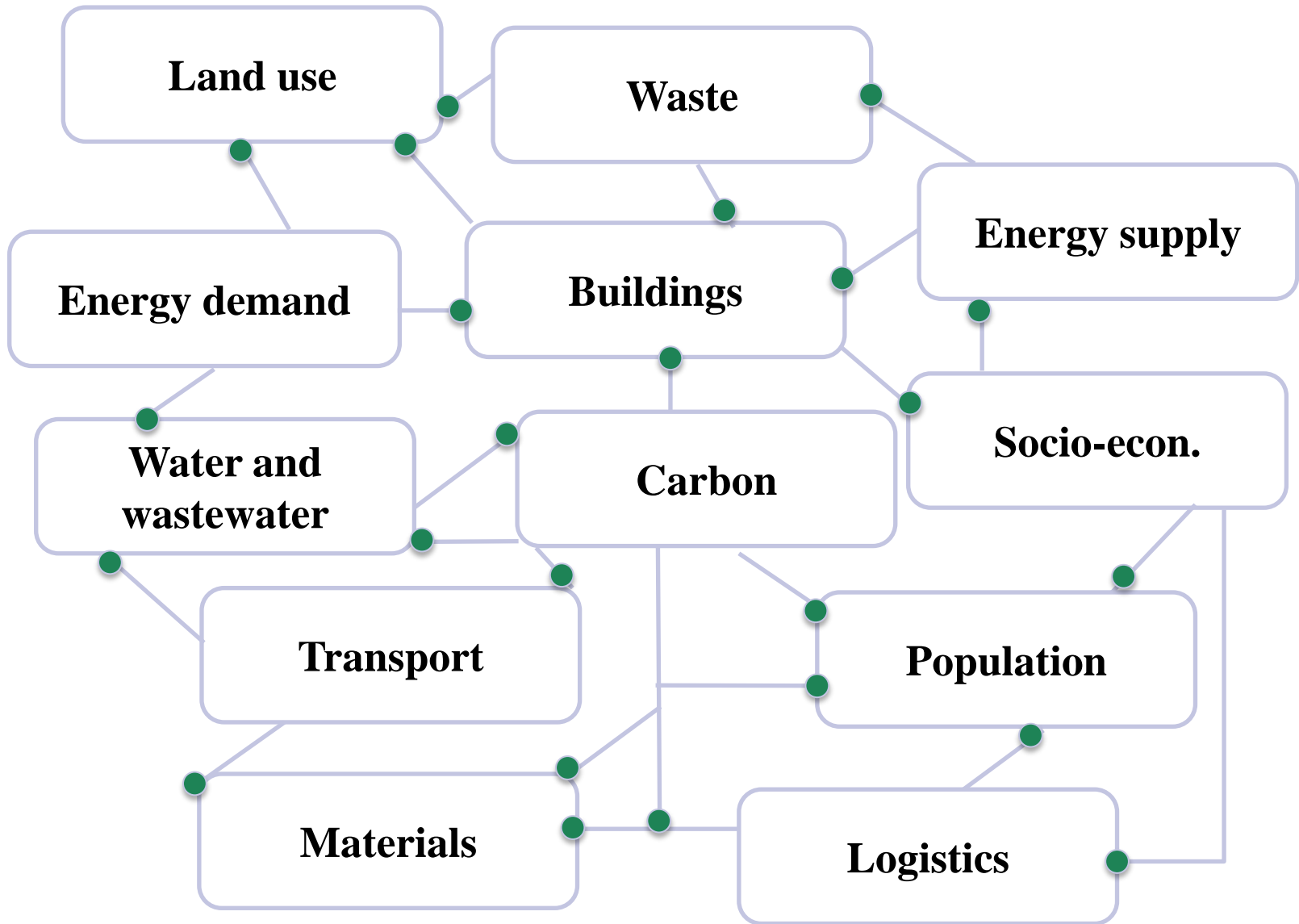
# Integrated Resource Management (IRM)



## SPeAR<sup>®</sup> Integrated Thinking

SPeAR is Arup's sustainability appraisal tool. It provides a holistic project sustainability decision-making framework and access to the knowledge and skills of Arup's global experts.

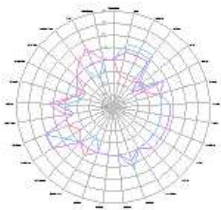
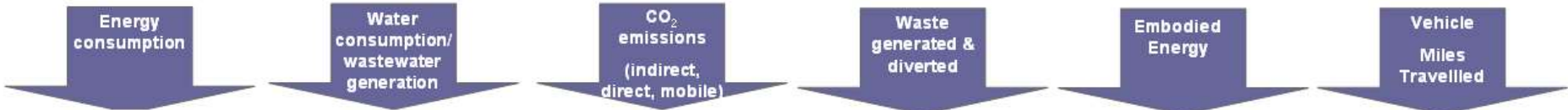
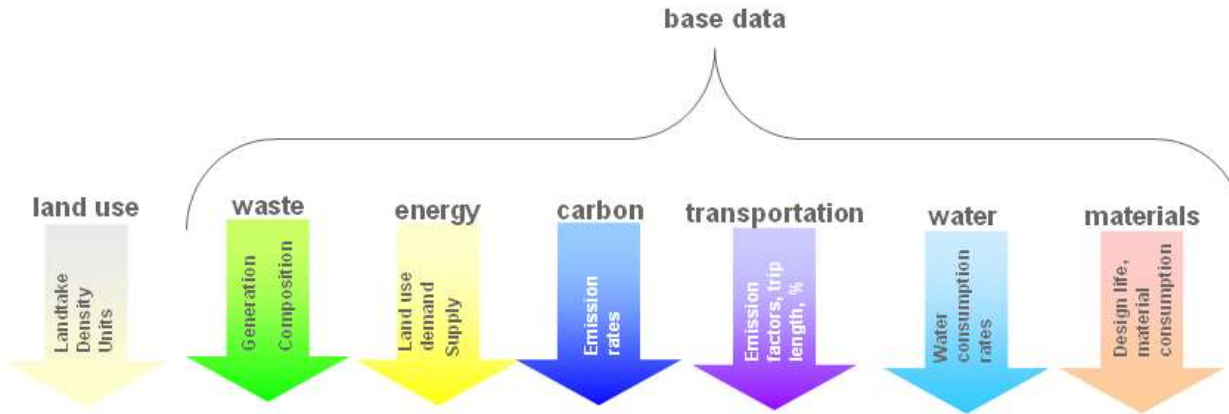
Sustainable Project Appraisal Routine



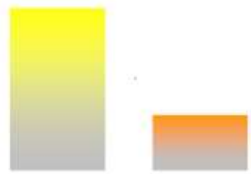
# Integrated Resource Management

**A holistic quantitative** model for improved understanding of urban systems and **the impact of decisions**

# Integrated Resource Management



compare baseline and design with standard values



compare baseline with design



compare alternatives



compare results with comparable everyday items

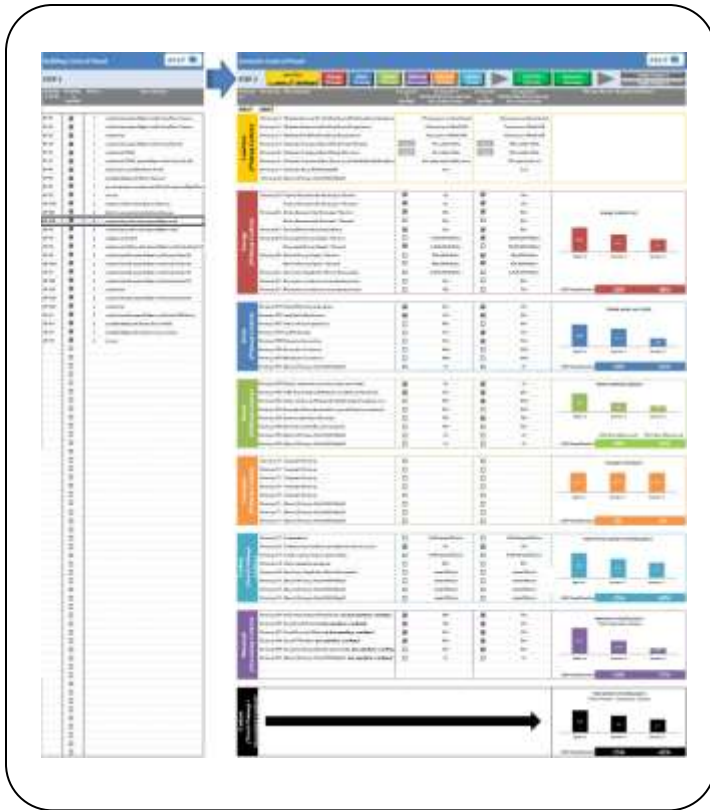
# Waterfront Toronto Carbon Tool



- 32 hectares
- 6,000 new residential units
- 9.3 hectares of parks and public space
- Home of Toronto 2015 Pan/Parapan American Games Athletes' Village

# Waterfront Toronto Tool

## Control Panel



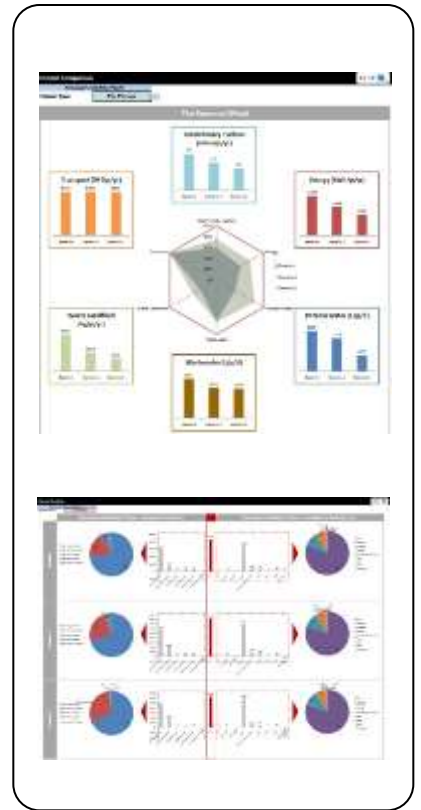
## Baseline Inputs

- Land/Bdgs
- Energy
- Water
- Waste
- Transport
- Carbon
- Materials

## Calculations

- Land/Bdgs
- Energy
- Water
- Waste
- Transport
- Carbon
- Materials

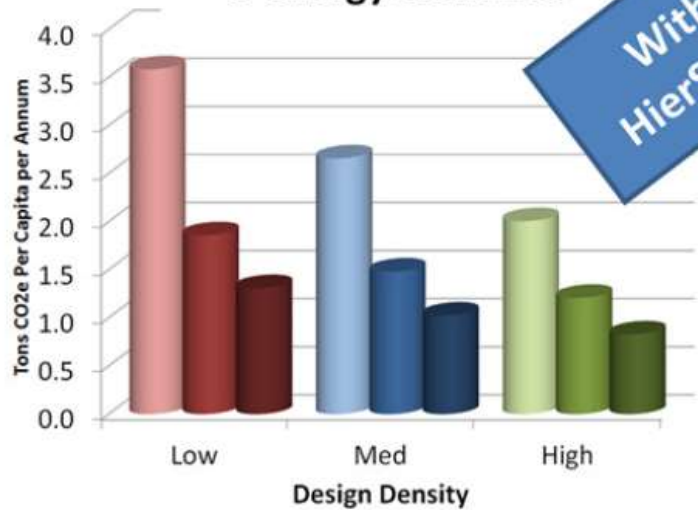
## Output



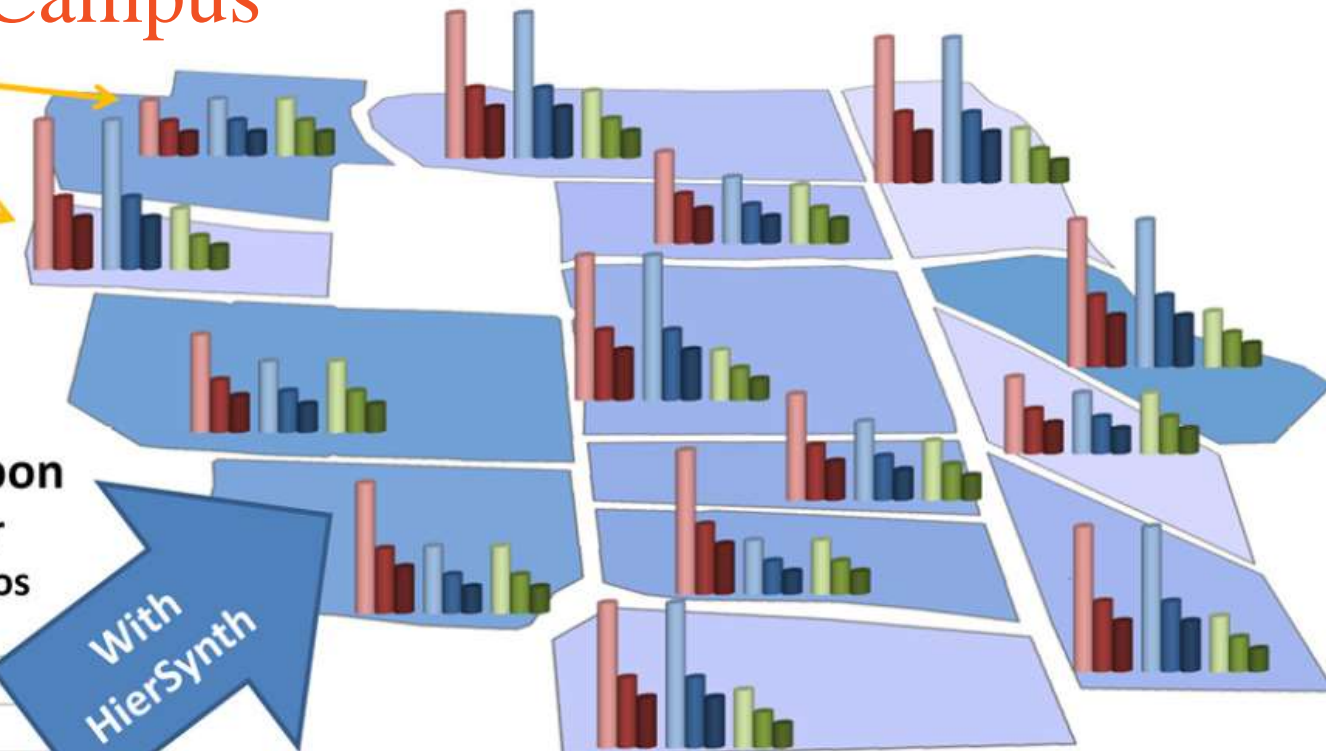
# Confidential Campus

New District vs  
Redevelop

Per Capita Carbon  
3 designs under  
3 energy scenarios

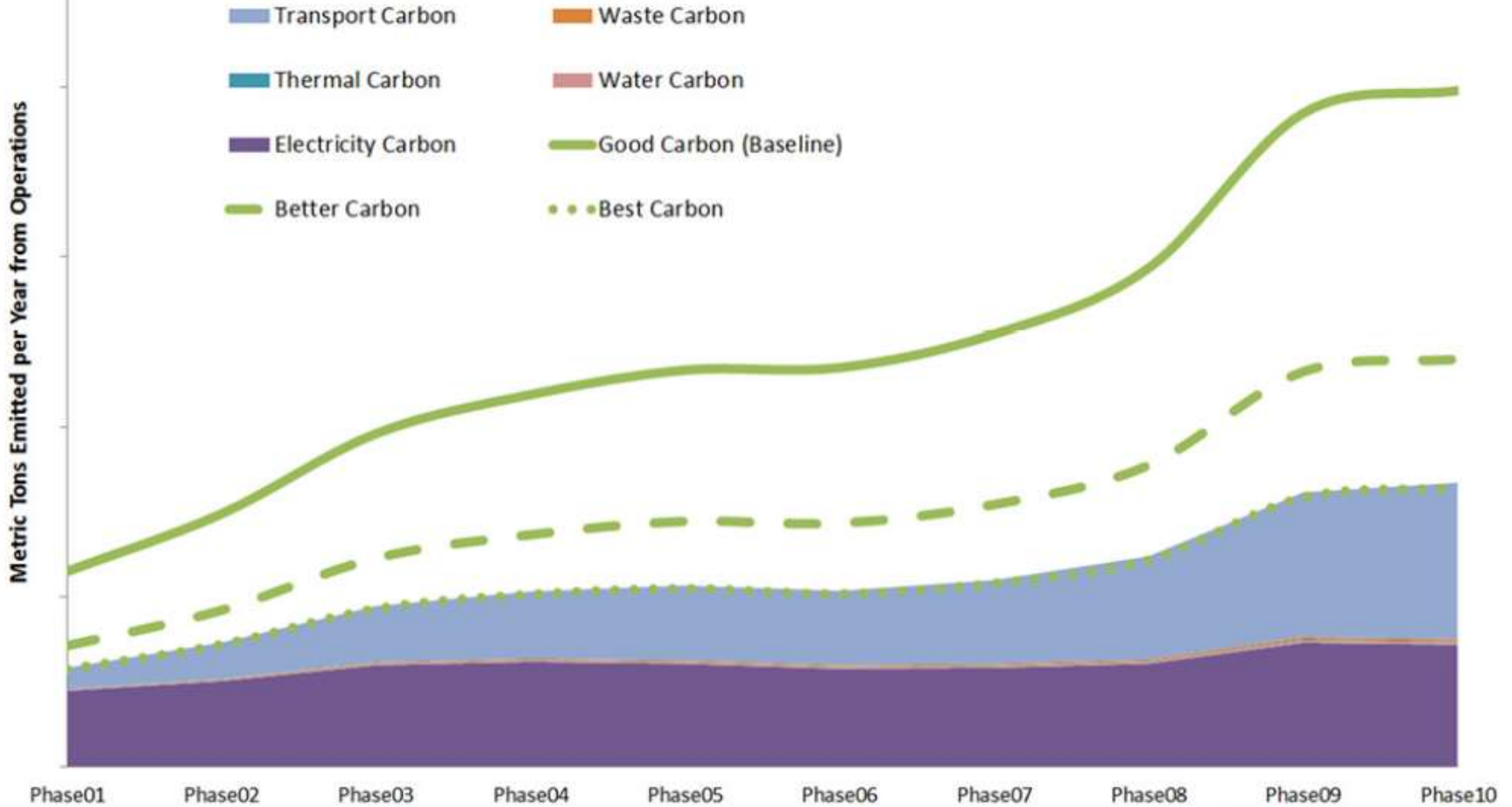


With HierSynth





# Land Use 3 - Annual Operational Carbon

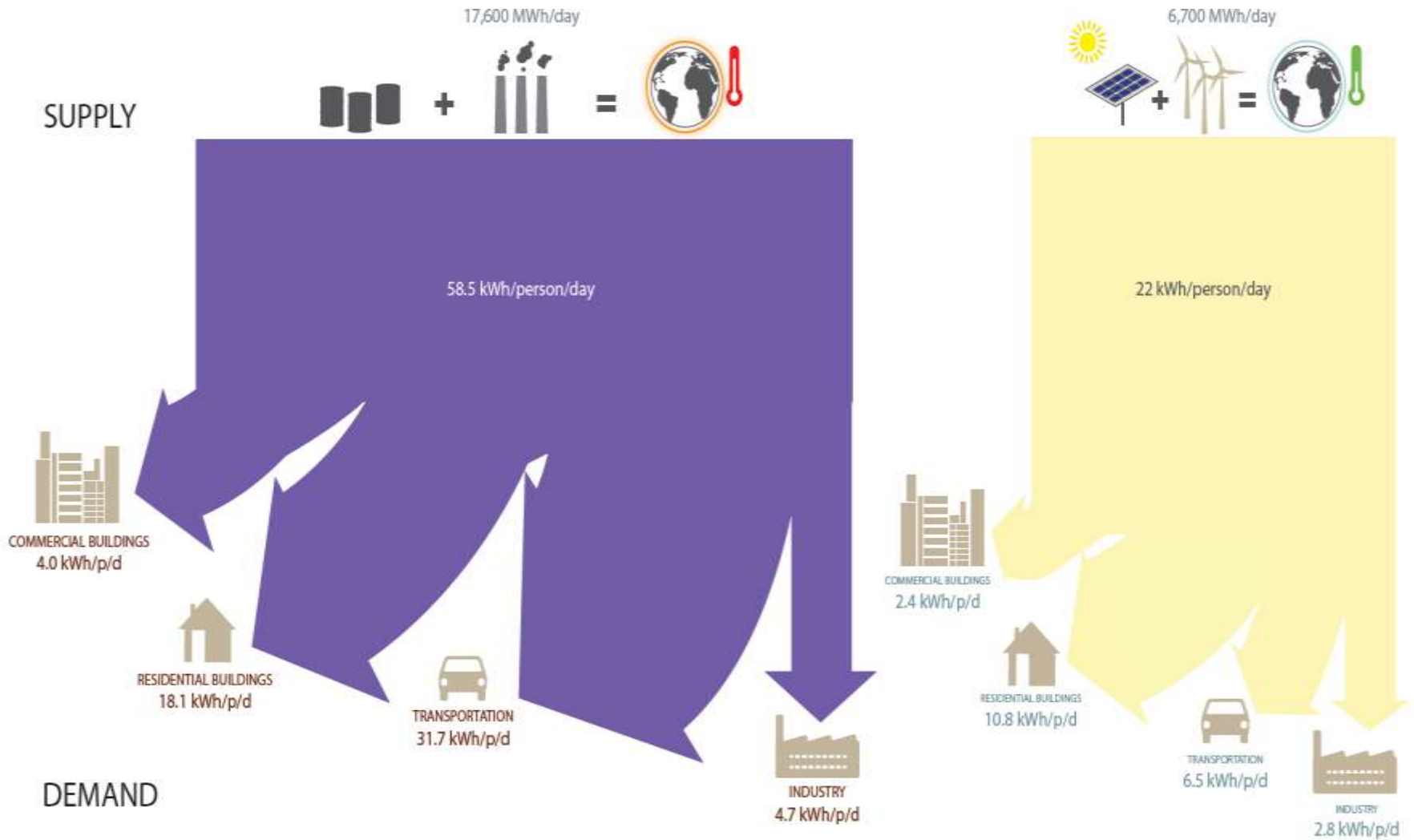


Increasing Development GFA  
Changing Analysis Assumptions  
(building regs, appliance efficiency)

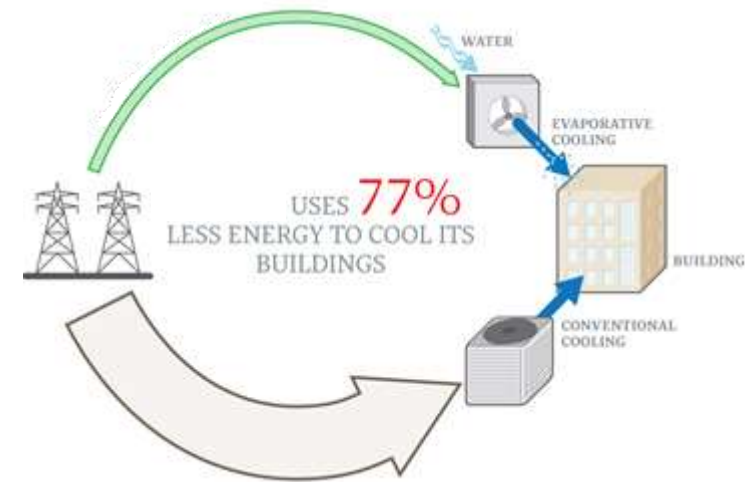
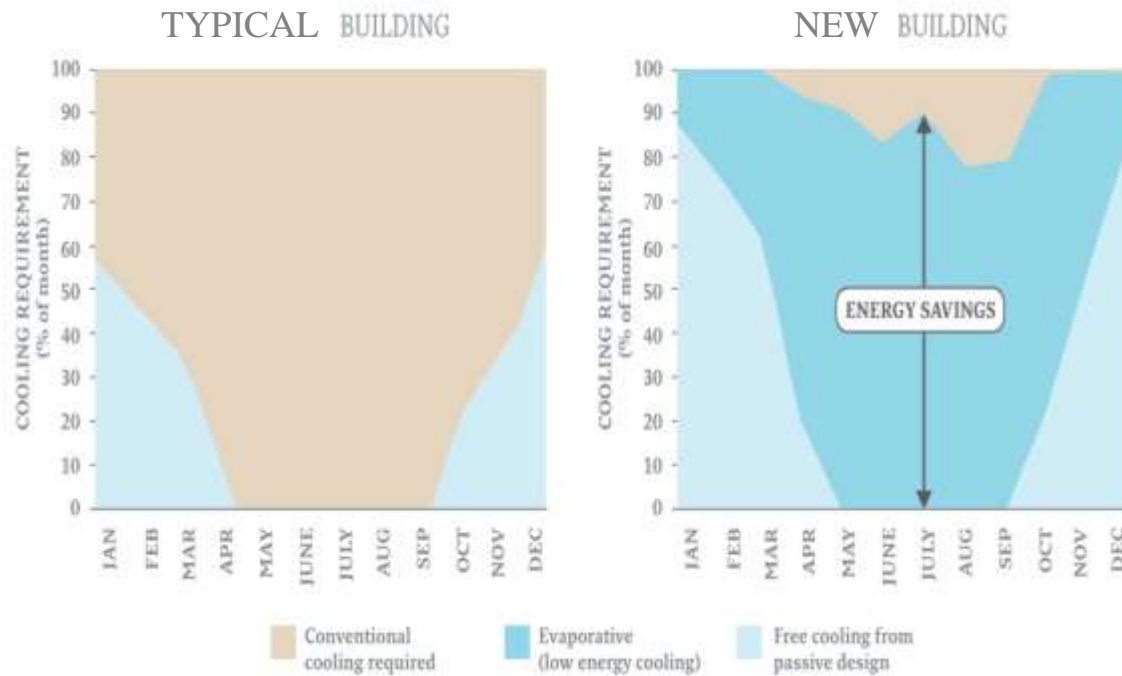
# KA-Care City for Atomic and Renewable Energy



# Energy reduction

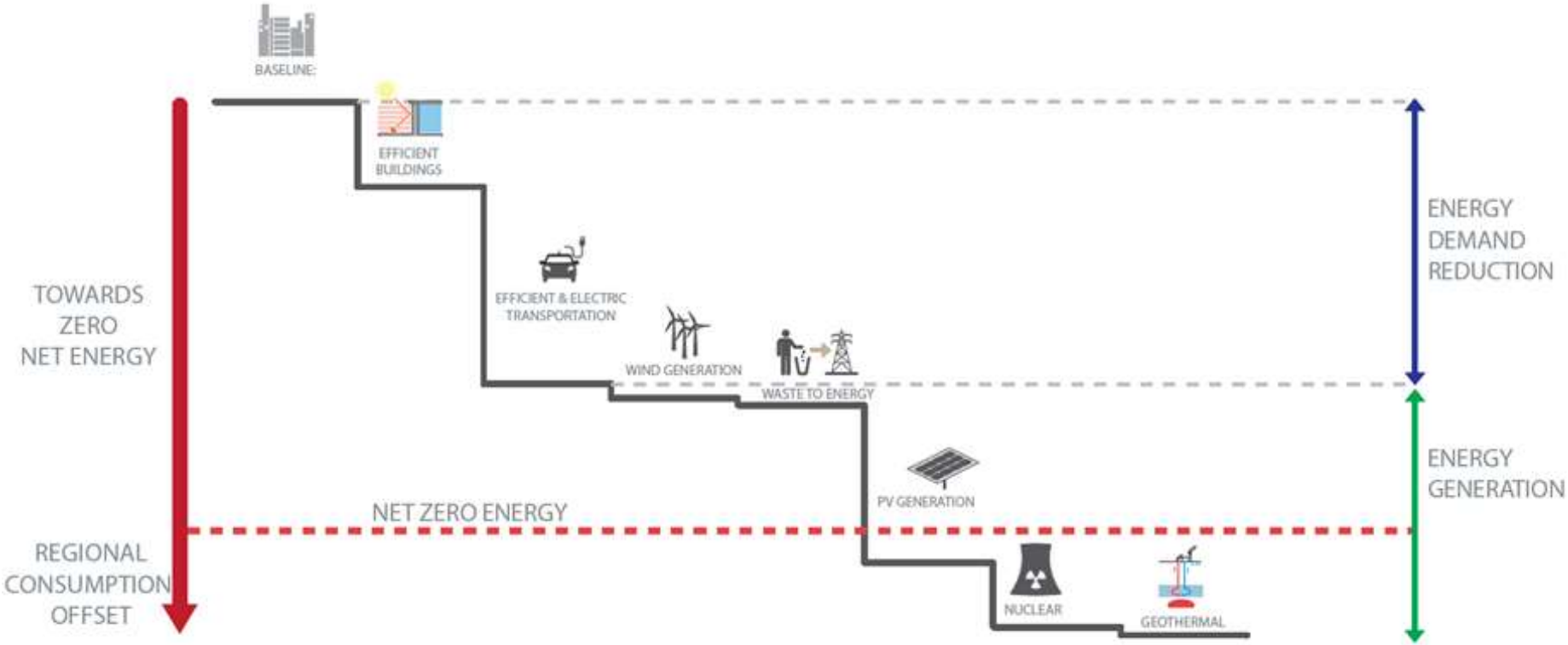


# Energy reduction – cooling strategy

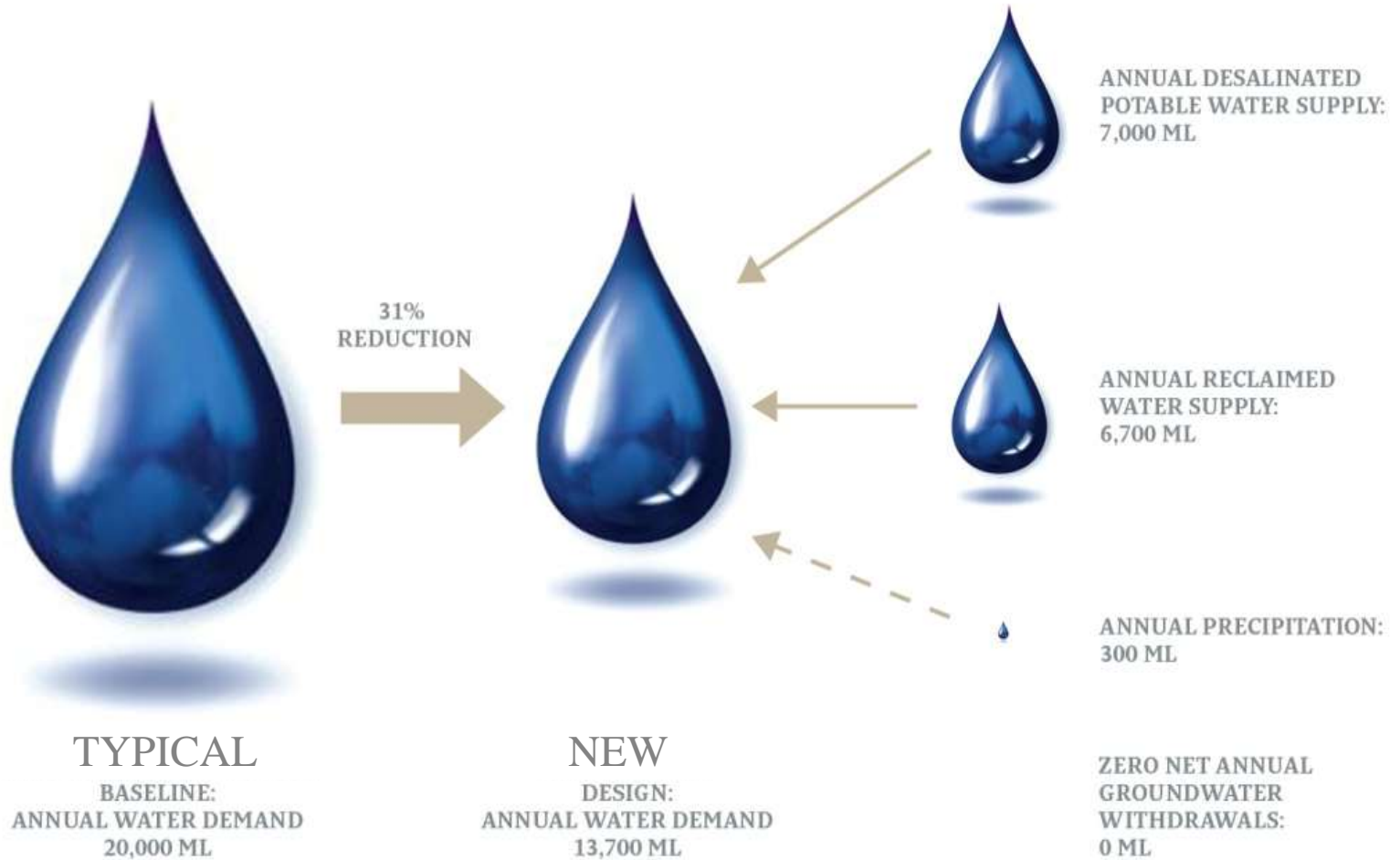


Low energy cooling strategies achieves a **77%** energy saving  
**Chillers only needed for 10% of year**

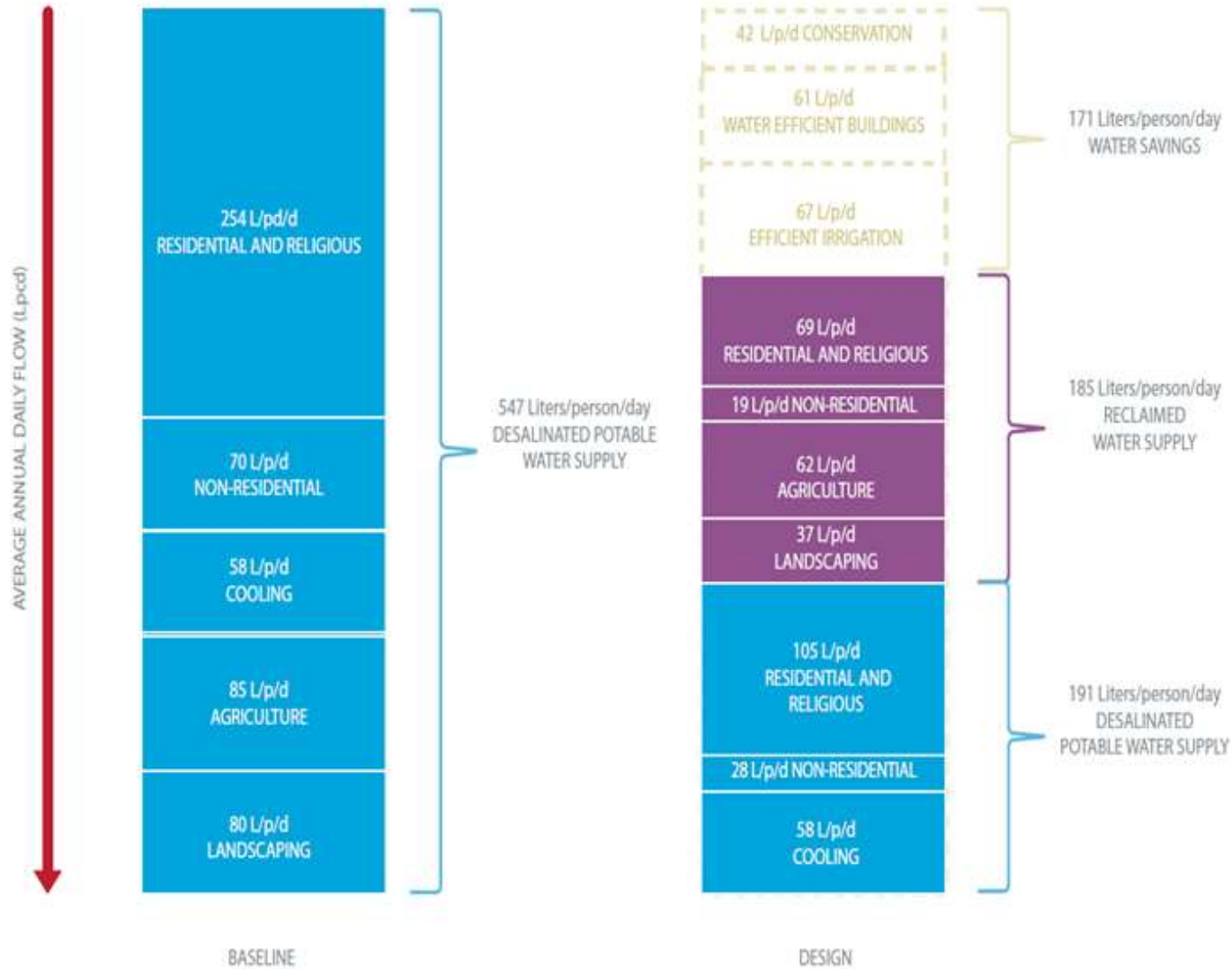
# Energy story



# Water reduction



# Minimizing imported potable water



# Water Neutral Design

edited by: Vincent Lee

Dec 29 2008

Estimates water usage and the impacts of various strategies (Conservation, Efficiency and Reuse) for site developments at the master planning level

**APPL. SCALE**  Precinct  Building  Multi-Unit  Campus  Light Rail  City  Region

**APPL. PHASE**  Planning  Concept  Schematic  Design Dev  Const. Admin  Post-Const.

**APPL. REGION**  America  Australia  Europe  East Asia **UNITS**  Imperial  Metric

**TOOL TYPE**  Excel  Java - Macro  Software  HTML App  Database  Web Interface  Other

**TOPIC AREAS**  App & Reg  Codes  Economy  Energy  Land & Foot  Occup. Comfort  Materials  Society  Transport  Waste  Water



**APPROXIMATE USE TIME**  Min.  Hour  Day  Week  Month

**USER PROFILE**  Generalist  Specialist

**QUALITY ASSURANCE PROCESS**  None  Peer Review  Formal Approval

**SUMMARY**

To develop water management strategies for master planning and conceptual level by estimating baseline demands (through a conventional design), demands from water efficient building and landscape designs, harvested rainwater, reclaimed water and reduced potable water supply. The tool is intended for master planning purposes only, and shall be used as a basis for schematic design or design development. Peak demand is not accounted for in modelling the baseline case. The underlying concept of this tool is: 1) The buildings will be designed (at a minimum) to meet LEED requirements for water efficiency; 2) The landscaping will be designed to use water efficient irrigation or no irrigation; 3) The rainwater will be reused for irrigation and other non-potable uses; and 4) The wastewater from the buildings will be reclaimed for non-potable and even potable uses.



**INPUTS** Climate Data, Land Use, Master Plan Program, Landscape Demands, Conservation Measures, Building Efficiency Reductions, Landscape Efficiency Reductions, Stormwater Runoff Estimation, Rainwater Harvesting Sizing, Percent Wastewater Reuse

**OUTPUTS** Summary Sheet, Various Graphs and Charts

BENEFITS	ROOM FOR IMPROVEMENT	LIMITATIONS
<ul style="list-style-type: none"> <li>Comprehensive water management tool</li> <li>Provides quick assessment of various strategies to move towards a Water Neutral Development</li> <li>Powerful visual output</li> <li>User-Friendly</li> </ul>	<ul style="list-style-type: none"> <li>The software could have estimates of capital costs or operational cost savings</li> <li>More comprehensive estimates for wastewater generated</li> <li>Baseline criteria could be refined to include more recent data and international demands</li> <li>Combine with "Water Demands for Master Plans" Tool developed by RRJ in SF</li> </ul>	<ul style="list-style-type: none"> <li>Not for use for buildings</li> <li>Not for use on projects beyond concept planning or schematic design</li> </ul>

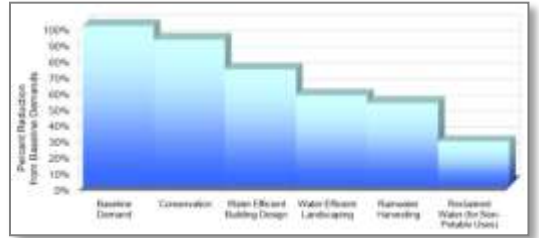
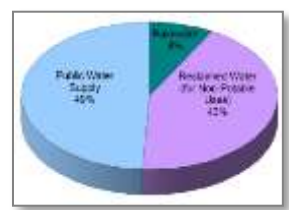
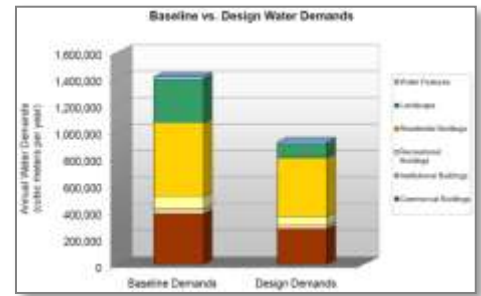
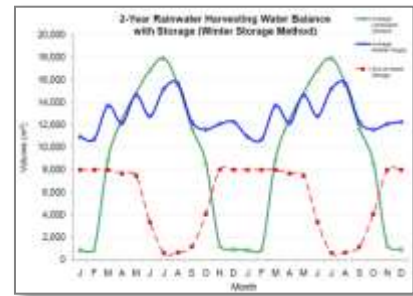
RELATED PROJECTS	RELATED TOOLS	RELATED SOURCES
<ul style="list-style-type: none"> <li>Water Point, Washington D.C.</li> <li>Vancouver BC, Views</li> <li>South Inland Lands, Canada</li> </ul>	<ul style="list-style-type: none"> <li>Water Story - Business</li> </ul>	<ul style="list-style-type: none"> <li>Power Institute - "Managing Water Demand: Price vs. Non-Price Conservation Options"</li> <li>U.S. DoE - Energy Efficiency and Renewable Energy - Federal Energy Mgmt. Program</li> <li>NJCOP Safe Drinking Water Act Regulations, (N.J.A.C. 7-21)</li> </ul>

**TOOL DEVELOPMENT SOURCE** ARUP New York

**KEY CONTACTS** Vincent Lee, Margaret Garcia, James DeMarco

**TOOL REVIEW AT ARUP**

ARUP			Project No. 208333	Client New York
Project Name Overall Water Management Strategy			Date 01/08/08	Rev 001
Design Element			Baseline Demand	Design Demand
Commercial Buildings	287,500	257,112		
Residential Buildings	24,875	27,342		
Governmental Buildings	46,250	55,593		
Healthcare Buildings	557,200	441,024		
Landscaping	622,214	68,224		
Water Treatment	27,281	27,287		
Other Demands (e.g. additional development)	0	0		
<b>Total Demand</b>	<b>1,414,269</b>	<b>882,581</b>		
Supply Resources			Baseline	Design
Reclaimed Water (for Non-Potable Uses)		52,332		
Reclaimed Water (for Potable Uses)		242,274		
Other (Stormwater, Harvested, etc.)		0		
<b>AWP Public Water Supply</b>		<b>882,581</b>		







# OvaRain

edited by Margaret Garcia  
Apr 6 2010

Design Rain Harvesting System and Estimates Water Usage for Building and Site Projects in Detailed Design

**APPL SCALE** Product Building Multi-Bldg Campus Highrise City Region

**APPL PHASE** Planning Concept Schematic Design/Dev. Genl. Dev. Const. Admin. Post-Const.

**APPL REGION** Americas Australia Europe East Asia **LIMITS** Internal External

**TOOL TYPE** Excel Excel+Maps Software Software Admin Database Web Interface Other

**TOPIC AREAS** Agr & Rng Carbon Economy Energy Land & Forest Group Comfort Materials Society Transport Waste Water

**APPROXIMATE USE TIME** **USER PROFILE** **QUALITY ASSURANCE PROCESS**



## SUMMARY

OvaRain is a tool to aid the design of rainwater harvesting systems. This tool is intended for use in the detailed design phase. The tool works with daily rainfall data and detailed demands to help the user size the rainwater harvesting system. The tool estimates runoff water quality based on the collection area land use to aid the user in treatment system design. Climate change scenarios gauge the system's resilience with changes in average temperature and precipitation. Cost analysis calculates annualized cost and payback period.

## PROCESS MAP

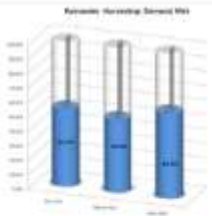


**INPUTS** Climate Data, Land Use, Master Plan Program, Landscape Demand, Conservation Measures, **OUTPUTS** Summary Sheet, Various Graphs and Charts

BENEFITS	ROOM FOR IMPROVEMENT	LIMITATIONS
Comprehensive water management tool	Incorporation of cost information	Requires specialist knowledge
Covers the schematic and detailed design phases	Link to reference material on landscape costs	Requires substantial setup time
Powerful visual output	Write users guide	
User-Friendly		

ARUP PROJECTS	RELATED TOOLS	RELATED SOURCES
East River Waterfront	<a href="#">Water Flow Analysis</a>	<a href="#">PowerPoint: "Managing Water Demand, Price"</a>
	<a href="#">Water Neutral Design</a>	<a href="#">U.S.G.P.A. Energy Efficiency and Demands</a>
	<a href="#">Water Demands for Masterplans</a>	<a href="#">ARUP's Sustainable Water Act Enactment</a>

TOOL DEVELOPMENT SOURCE	KEY CONTACTS	TOOL REVIEW AT ARUP
<b>ARUP</b> New York	<a href="#">Viewed Log</a> , <a href="#">Margaret Garcia</a> , <a href="#">Margaret Garcia</a>	



Collection Area = 114,321 sq ft  
Weighted CM = 92.0  
Storage Vol = 2,500 gallons  
Storage Weight = 2,025.0 lbs  
First year of data = 1990

**Year of Data** 20 Years

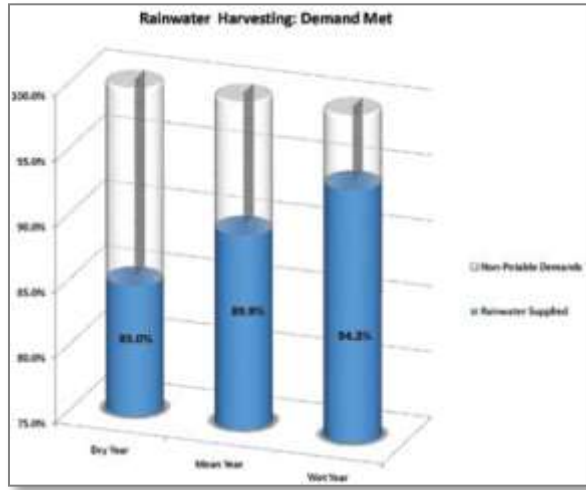
Year	Total Precip	Year	Total Precip
1990	55.1	2000	62.2
1991	42.9	2001	76.3
1992	46.3	2002	46.8
1993	56.3	2003	70.3
1994	53.7	2004	91.6
1995	38.8	2005	46.2
1996	57.8	2006	42.5
1997	37.2	2007	56.9
1998	44.5	2008	46.2
1999	41.2	2009	45.5

**Summary of Results**

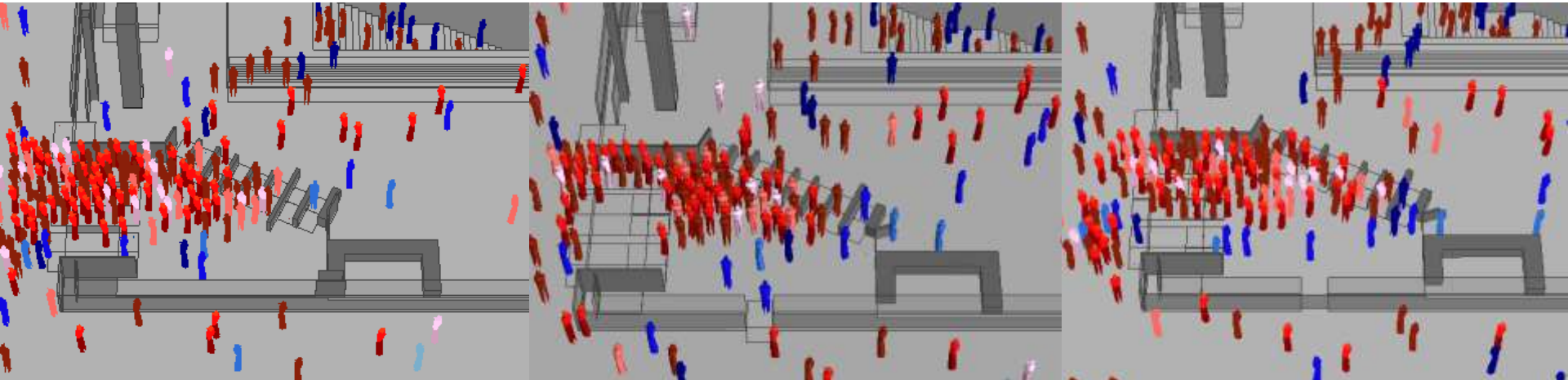
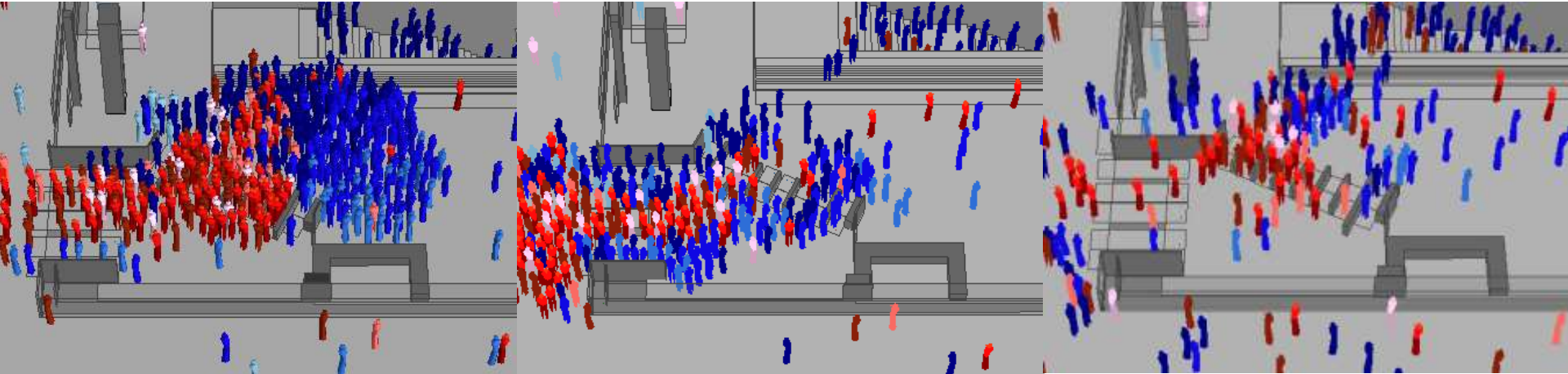
	% Demand Met	% Dry Days	% Overline Days	% Unmet Demand
Select Dry Year: 2001	81.0%	15.2%	12.9%	0.3%
Select Mean Year: 1990	89.9%	11.1%	12.5%	0.3%
Select Wet Year: 1991	94.2%	6.0%	12.7%	0.0%

**NOTES:**  
1) Go to NOAA for data, see user's guide for instructions.  
2) Use data input button to select and import historical data.  
3) Select a dry, mean and wet year based on inspection.  
4) Use Auto-Sizing so for generate the tank size that will meet a given percentage of demand in the mean year.  
5) **0.00** = values to be entered

Dry Year					Mean Year					Wet Year				
Precip	Runoff	Vol	Demand	Storage	Precip	Runoff	Vol	Demand	Storage	Precip	Runoff	Vol	Demand	Storage
0.00	0.00	0.0	48	1494.3	0.00	0.00	0.0	48	3000.0	0.00	0.00	0.0	48	1000.0
0.02	0.02	6.6	49	1445.7	0.00	0.00	0.0	49	3452.3	0.00	0.00	0.0	49	1920.0
0.02	0.02	42.5	389	19266.5	0.01	0.01	300.6	300	3483.5	0.01	0.01	300.6	300	1811.2
0.5	0.01	340.1	389	18365.3	0.12	0.02	1077.5	389	3000.0	0.37	0.23	1440.4	389	3000.0
0.04	0.18	703.7	389	3800.0	0.00	0.00	0.0	389	3218.7	0.00	0.00	0.0	389	3218.7
0.02	0.02	8.8	389	3210.7	0.15	0.04	2121.3	389	3000.0	0.00	0.00	0.0	389	3000.0
0.07	0.08	288.2	389	3661.6	0.04	0.00	0.0	389	3218.0	0.00	0.00	0.0	389	3218.0
0.43	0.26	1010.1	49	3500.0	0.04	0.00	0.0	49	3162.3	0.02	0.00	100.5	49	2551.9
0.00	0.00	0.0	46	3591.4	0.04	0.00	0.0	46	3144.3	0.00	0.00	0.0	46	2591.4
0.00	0.00	0.0	389	3162.0	0.05	0.00	2540.7	389	3400.0	0.00	0.00	0.0	389	2142.1
0.00	0.00	0.0	389	2772.7	0.00	0.00	24832.9	389	3600.0	0.00	0.00	0.0	389	1752.8
0.04	0.00	0.0	389	2383.6	0.00	0.00	0.0	389	3218.7	0.00	0.00	0.0	389	1003.4
0.00	0.00	0.0	389	1994.3	0.00	0.00	0.0	389	3023.3	0.00	0.00	0.0	389	374.1
0.00	0.00	0.0	389	1634.9	0.00	0.00	308.8	389	3522.9	0.12	0.00	1077.5	389	2162.1
0.14	0.04	2211.5	49	3000.0	0.01	0.01	360.8	49	3164.5	0.04	0.04	4636.9	49	3000.0
0.21	0.16	10913.4	389	3000.0	0.00	0.00	0.0	389	3117.1	0.00	0.00	0.0	389	3218.7
0.00	0.00	0.0	389	3210.7	0.00	0.00	0.0	389	3218.7	0.00	0.00	0.0	389	3218.7
0.07	0.08	288.2	389	2681.5	0.06	0.07	5409.5	389	3600.0	0.00	0.00	0.0	389	3000.0
0.21	0.08	5464.4	389	3600.0	0.00	0.00	0.0	389	3218.7	0.00	0.00	0.0	389	2642.7
0.00	0.00	0.0	389	3210.7	0.00	0.00	0.0	389	2623.2	0.00	0.00	440.6	389	2303.1
0.00	0.00	0.0	49	3162.0	0.00	0.00	0.0	49	2722.9	0.00	0.00	0.0	49	3254.5
1.19	0.08	98443.2	49	3000.0	0.00	0.00	0.0	49	2724.1	0.01	0.00	6000.6	49	3000.0
0.04	0.00	0.0	389	3210.0	0.00	0.00	0.0	389	2324.8	1.09	1.07	11873.6	389	3600.0
0.00	0.00	0.0	389	2421.8	0.00	0.00	0.0	389	1945.6	0.00	0.00	0.0	389	3218.7



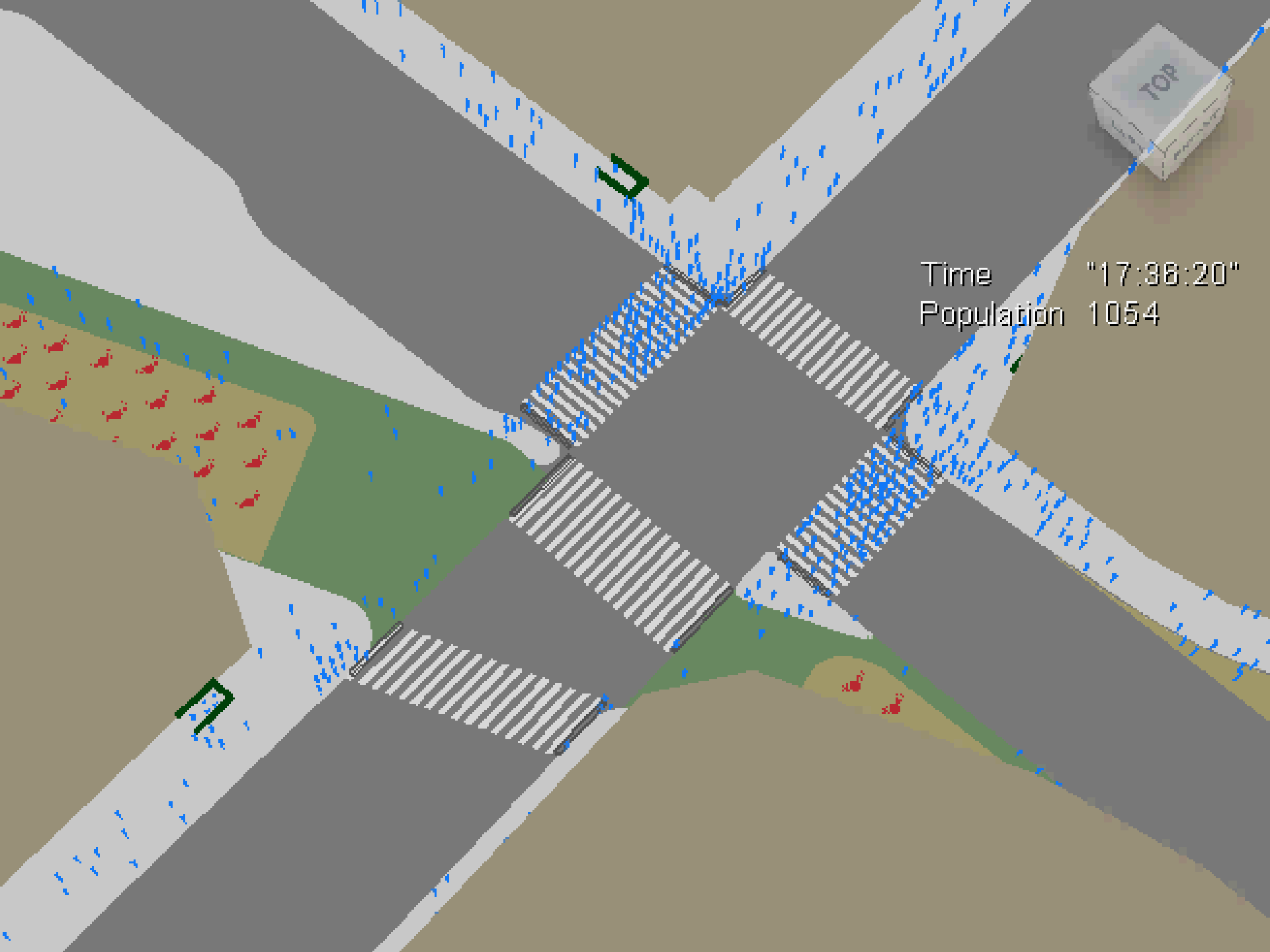
# Pedestrian Planning in the Urban Realm



# Pedestrian Planning in the Urban Realm



34<sup>th</sup> Street Herald Square, New York City



TOP

Time "17:38:20"  
Population 1054

# Pedestrian Planning in the Urban Realm



# Pedestrian Planning in the Urban Realm

Time "11:35:20"  
Population 44



Result