Sustainability drivers for hydropower design and operation

Richard Taylor, IHA Executive Director

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1. Background context
2. Appropriate scales
3. Extending powerplant life
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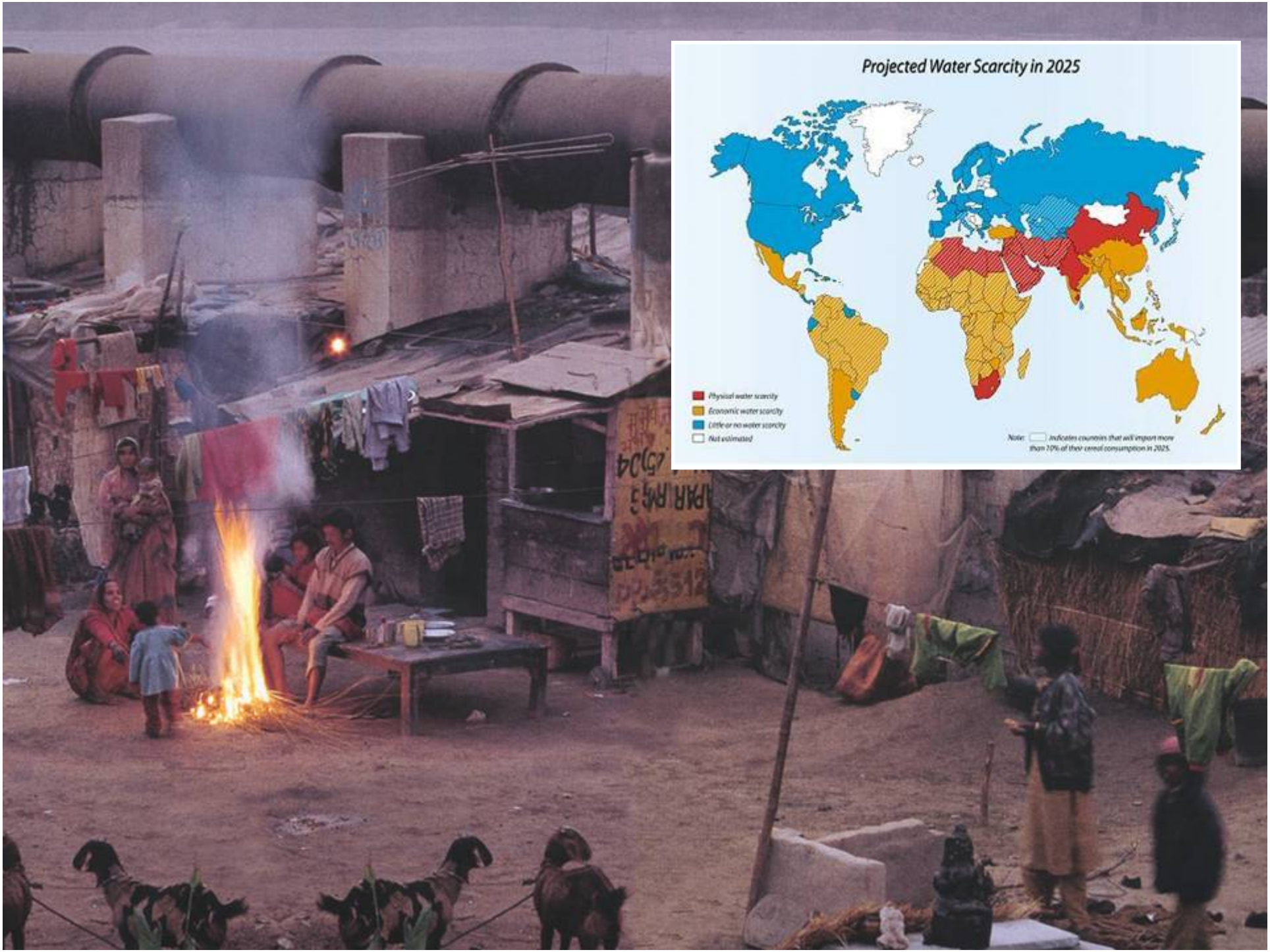
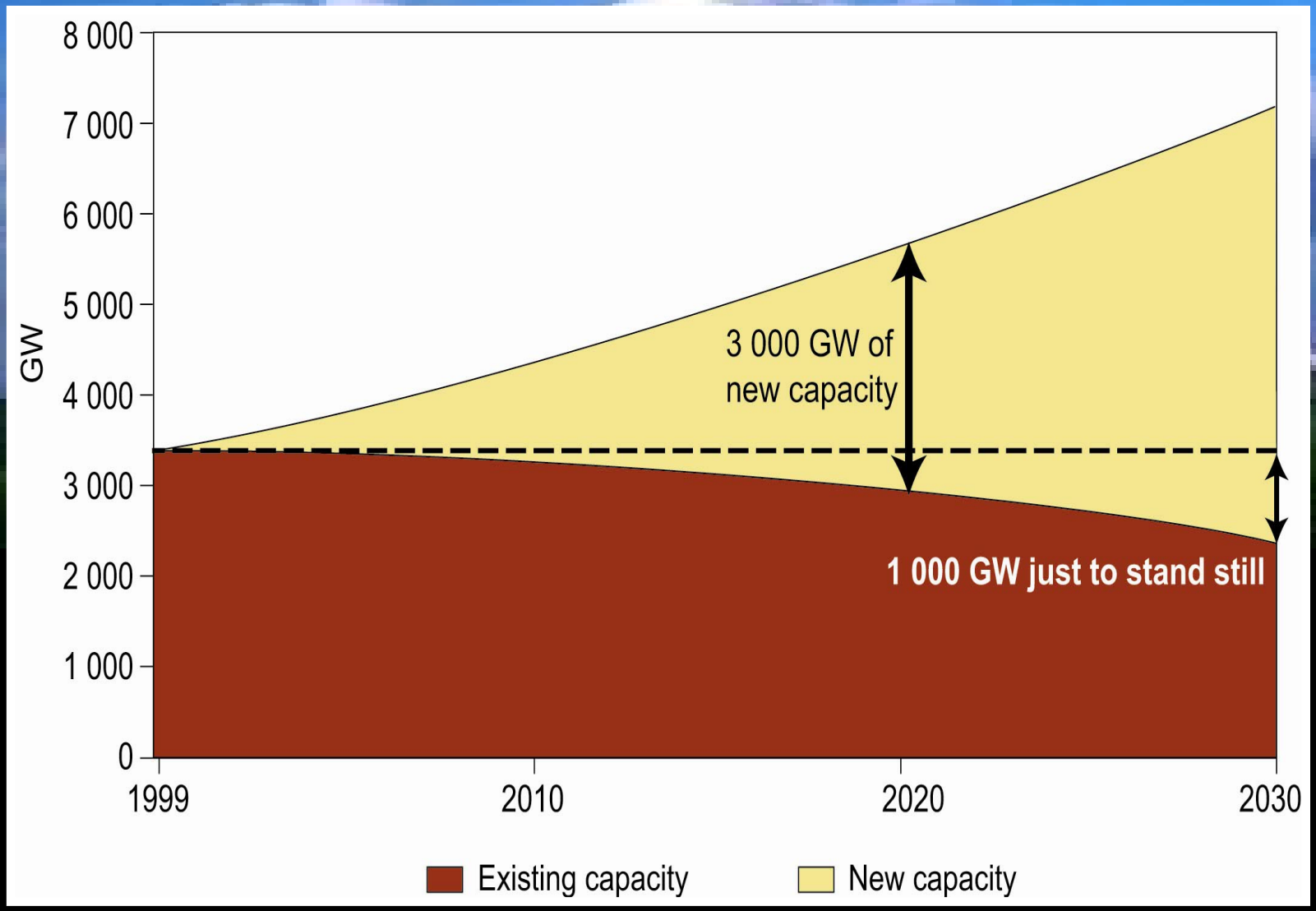
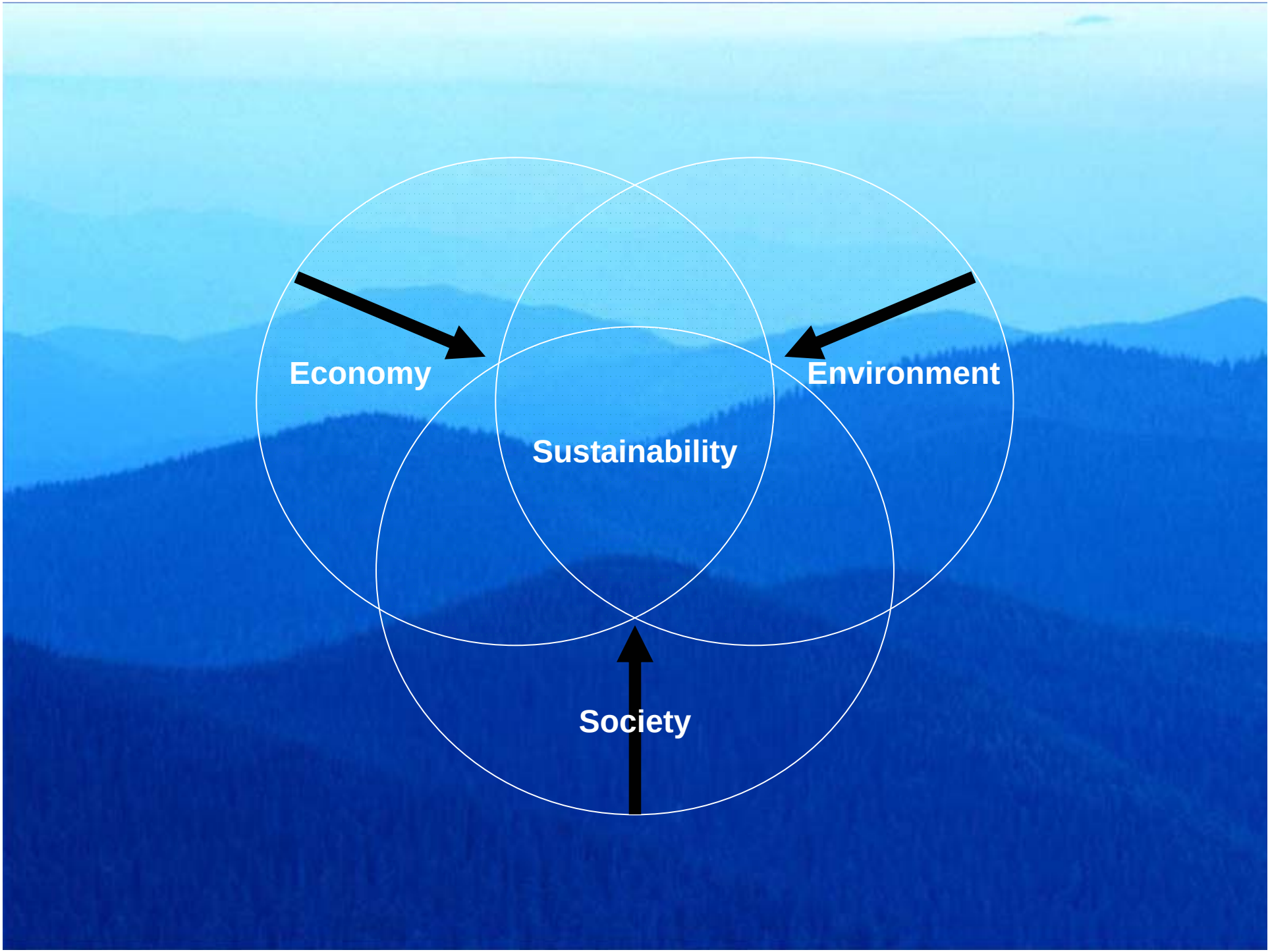
Water security
Energy security


Projected Water Scarcity in 2025
Physical water scarcity
Economic water scarcity
Little or no water scarcity
Not estimated
Note: Indicates countries that will import more than 10% of their cereal consumption in 2025.


8 000
7 000
6 000
5 000
4 000
3 000
2 000
1 000
0
GW
3 000 GW of
new capacity
1 000 GW just to stand still
1999
2010
2020
2030
Existing capacity
New capacity


Economy
Environment
Sustainability
Society

Plan of Implementation, World Summit on Sustainable Development, September 2002

Item 19e “Diversify energy supply by developing advanced, cleaner, more efficient, affordable and cost-effective energy technologies, including fossil fuel technologies and renewable energy technologies, **hydropower included**, and their transfer to developing countries on concessional terms as mutually agreed. With a sense of urgency, substantially increase the global share of renewable energy sources with the objective of increasing its contribution to total energy supply, recognizing the role of national and voluntary regional targets as well as initiatives, where they exist, and ensuring that energy policies are supportive to developing countries’ efforts to eradicate poverty, and regularly evaluate available data to review progress to this end.”

World Water Forum, March 2003 - Ministerial Declaration:

Item 15: “We recognize the role of hydropower as one of the renewable and clean energy sources, and that its potential should be realized in an environmentally sustainable and socially equitable manner.”

Ratified by Ministers and Heads of Delegation from 170 countries

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“Helping people to help themselves”
H. Hoover, 1932

“Small is beautiful”
E. F. Schumacher
1973


Photo by Peter Lynch

A large power plant is geometrically more environmentally responsible than a series of small projects

(for an equal amount of energy generated and all other things being equal)

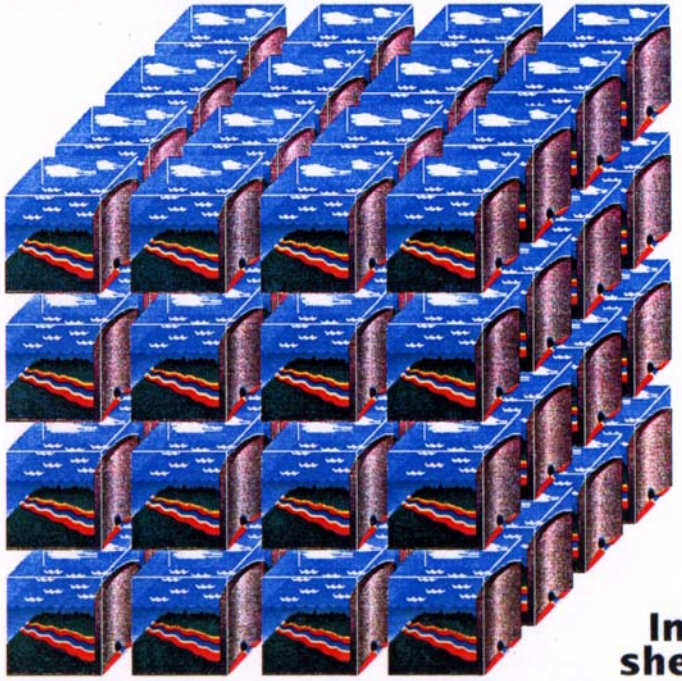
As the diagram shows, a small object has more surface in proportion to its volume than a large object that is similar in shape. This simple geometrical relationship, of fundamental importance in biology, must also be recognized by environmental sciences and sustainable development management.

Mega power plant option

Info sheet

Volume of water retained:	1 x
Generating capacity in tWh and power in MW:	1 x
Area flooded:	1 x
Length of original riverbanks lost:	1 x
Lenght of new banks spoiled by counter-seasonal water level fluctuations	1 x
Number of one-time impacts (access roads, dams, dikes, electric lines, construction sites, impact studies to be conducted)	1 x

Mini generating station option

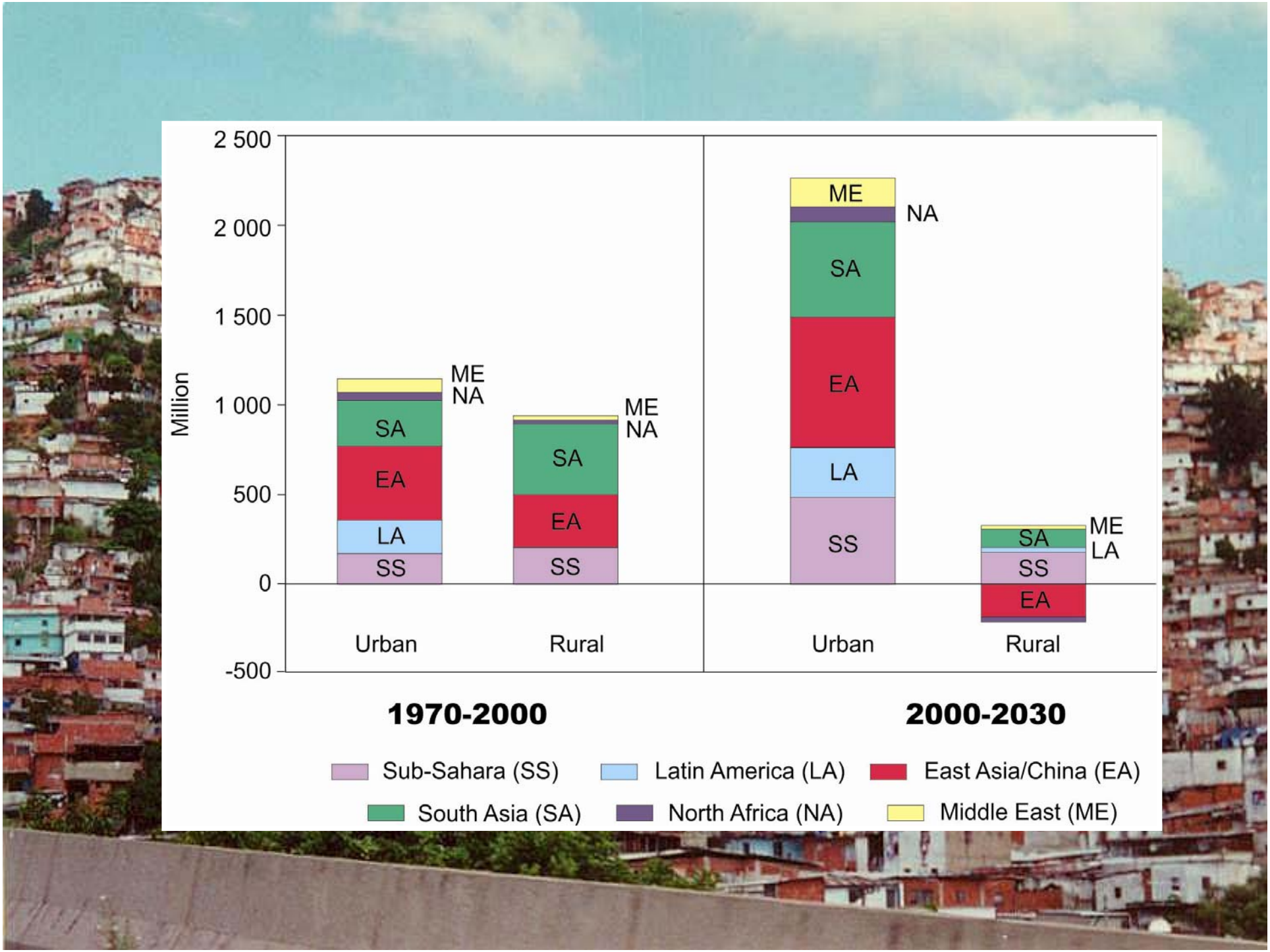


Info sheet

Volume of water retained:	1 x
Generating capacity in tWh and power in MW:	1 x
Area flooded:	4x
Length of original riverbanks lost:	16x
Lenght of new banks spoiled by counter-seasonal water level fluctuations	16x
Number of one-time impacts (access roads, dams, dikes, electric lines, construction sites, impact studies to be conducted)	64x


Natrel
ULTRA LAIT
Lait 2%
Partiellement écrémé
DU MONDE DE NATREL
1L


Photo by Peter Lynch


2 500
2 000
1 500
1 000
500
0
-500
Million
ME
NA
SA
EA
LA
SS
Urban
Rural
1970-2000
2000-2030
Sub-Sahara (SS)
Latin America (LA)
East Asia/China (EA)
South Asia (SA)
North Africa (NA)
Middle East (ME)

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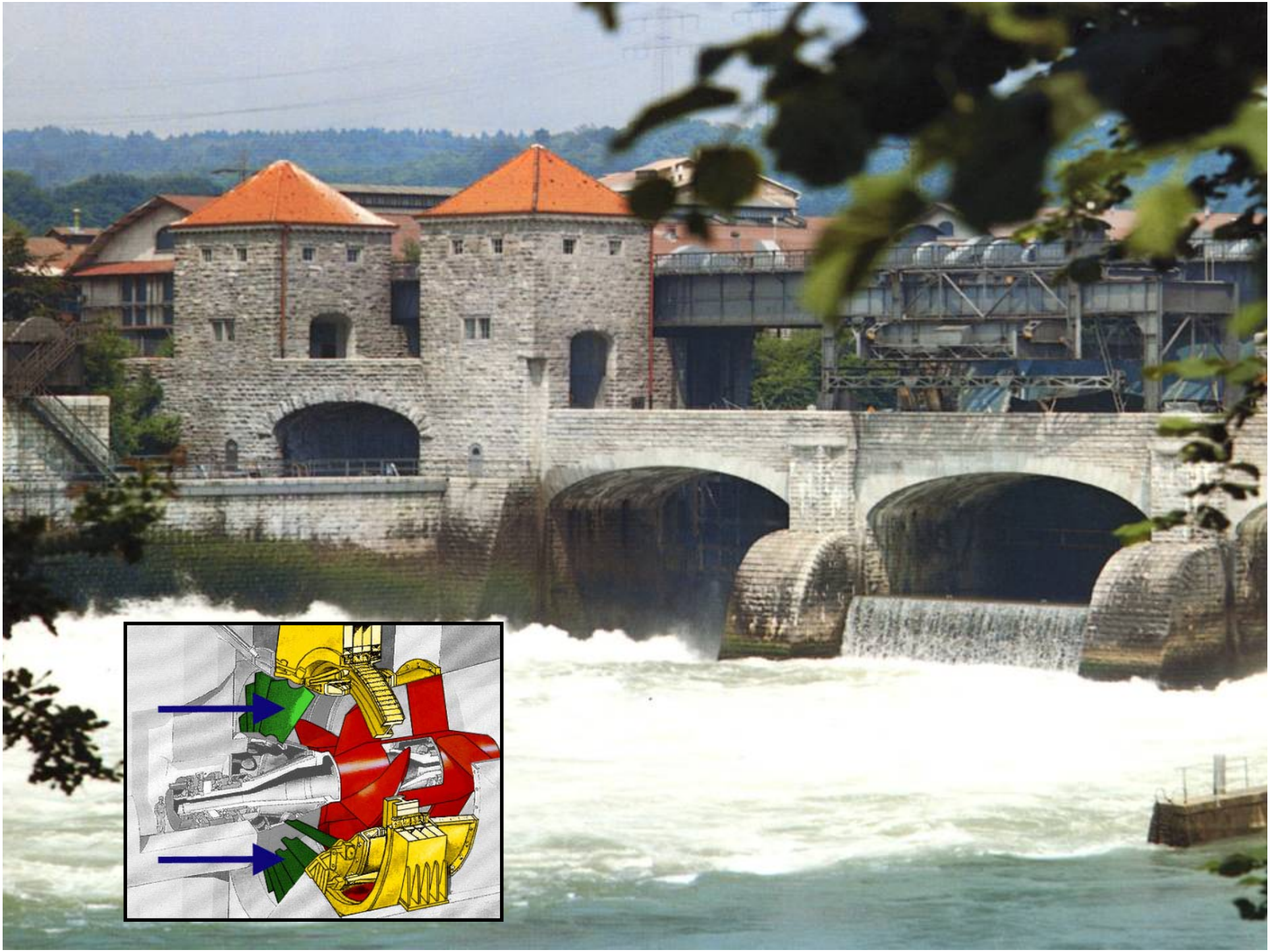
S.W.L. 500kg
M/C 1
SWL-250kg



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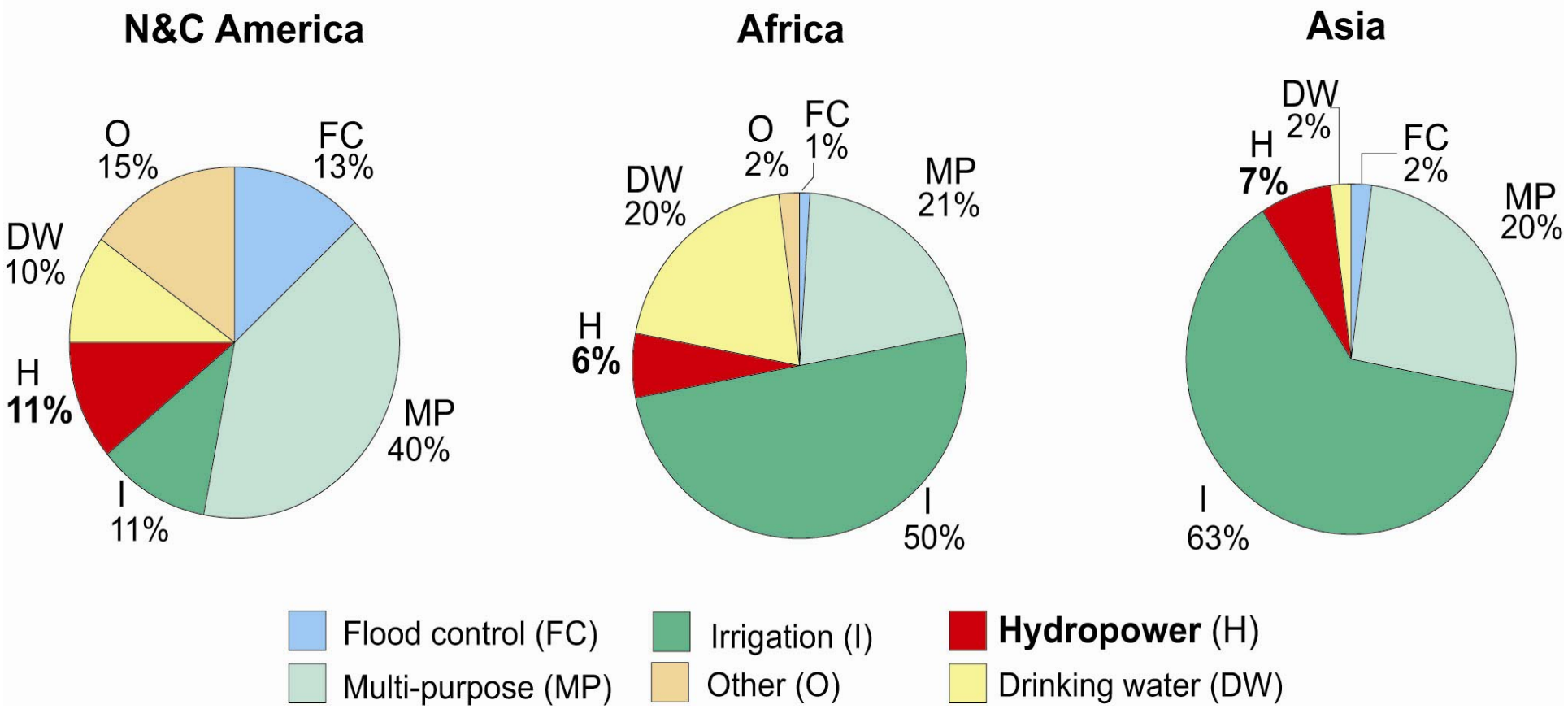
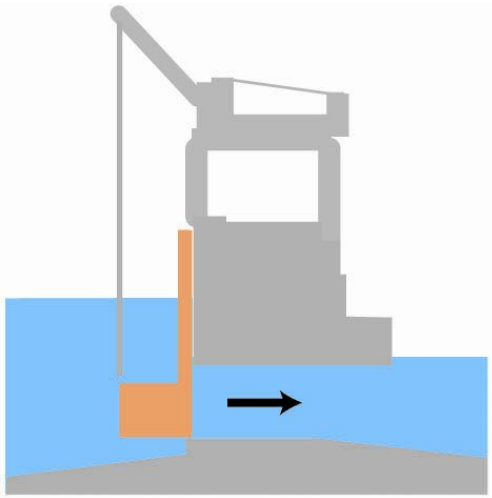
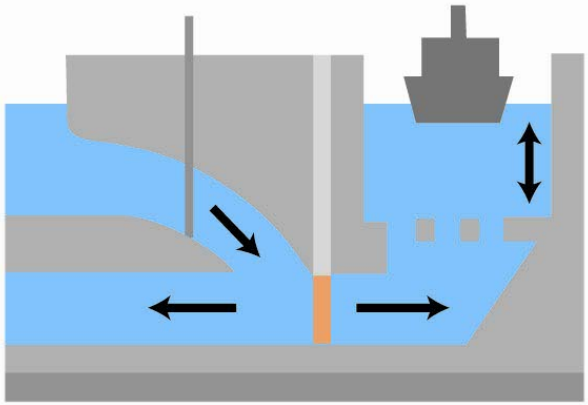
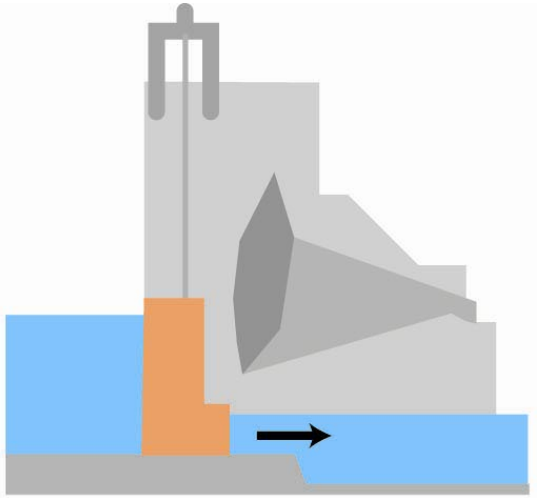
Main uses of dams, by region

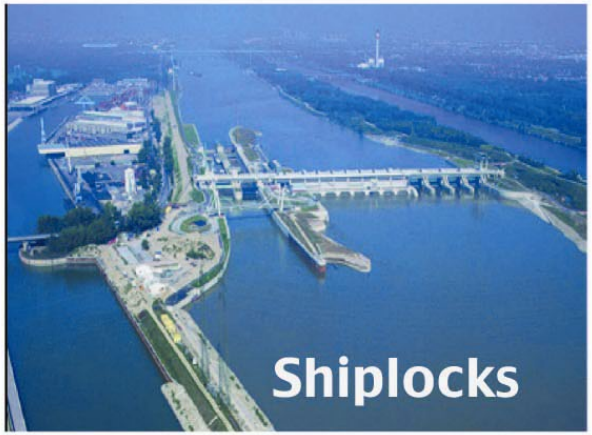




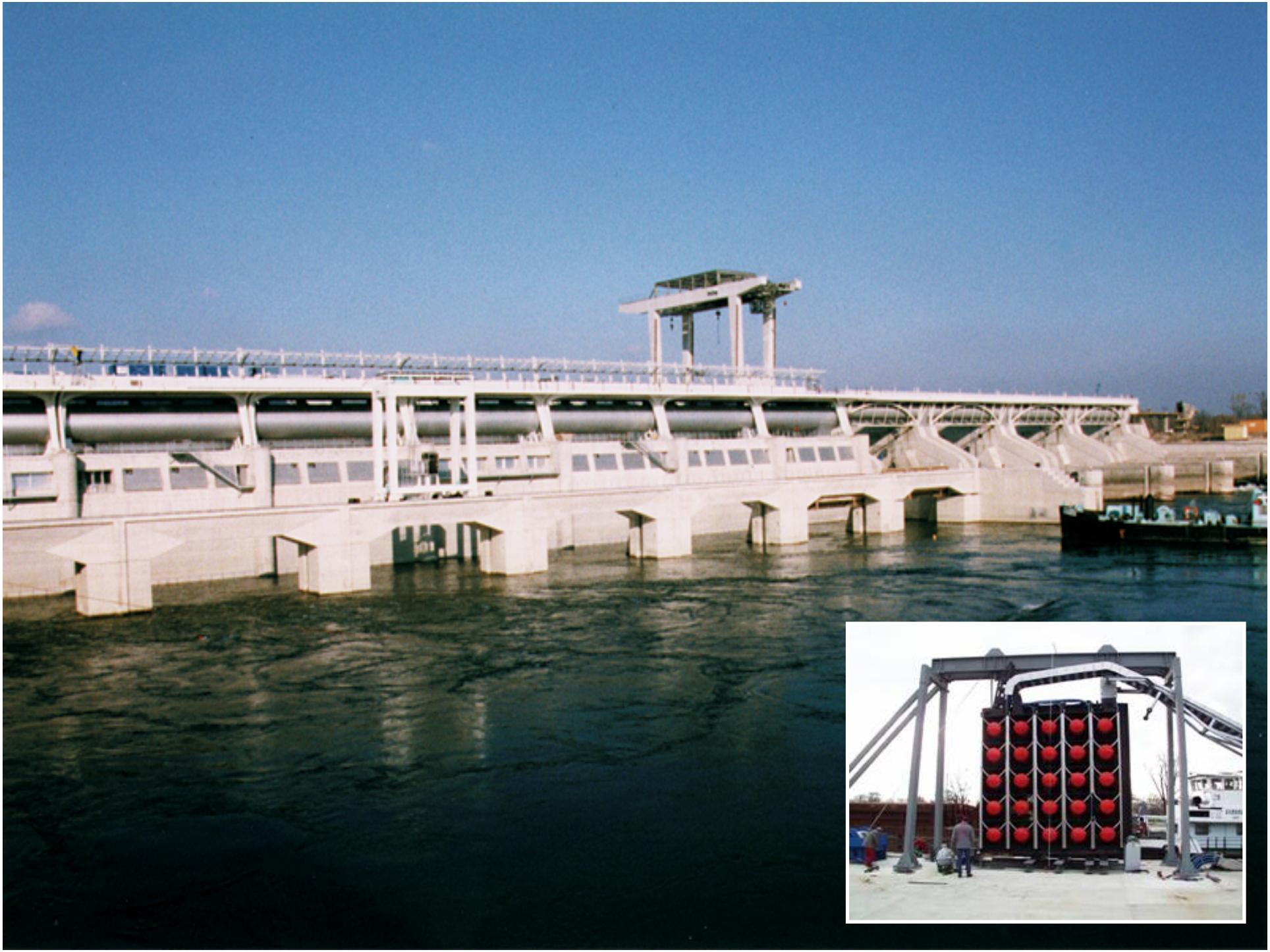





Irrigation dams


Shiplocks


Weirs



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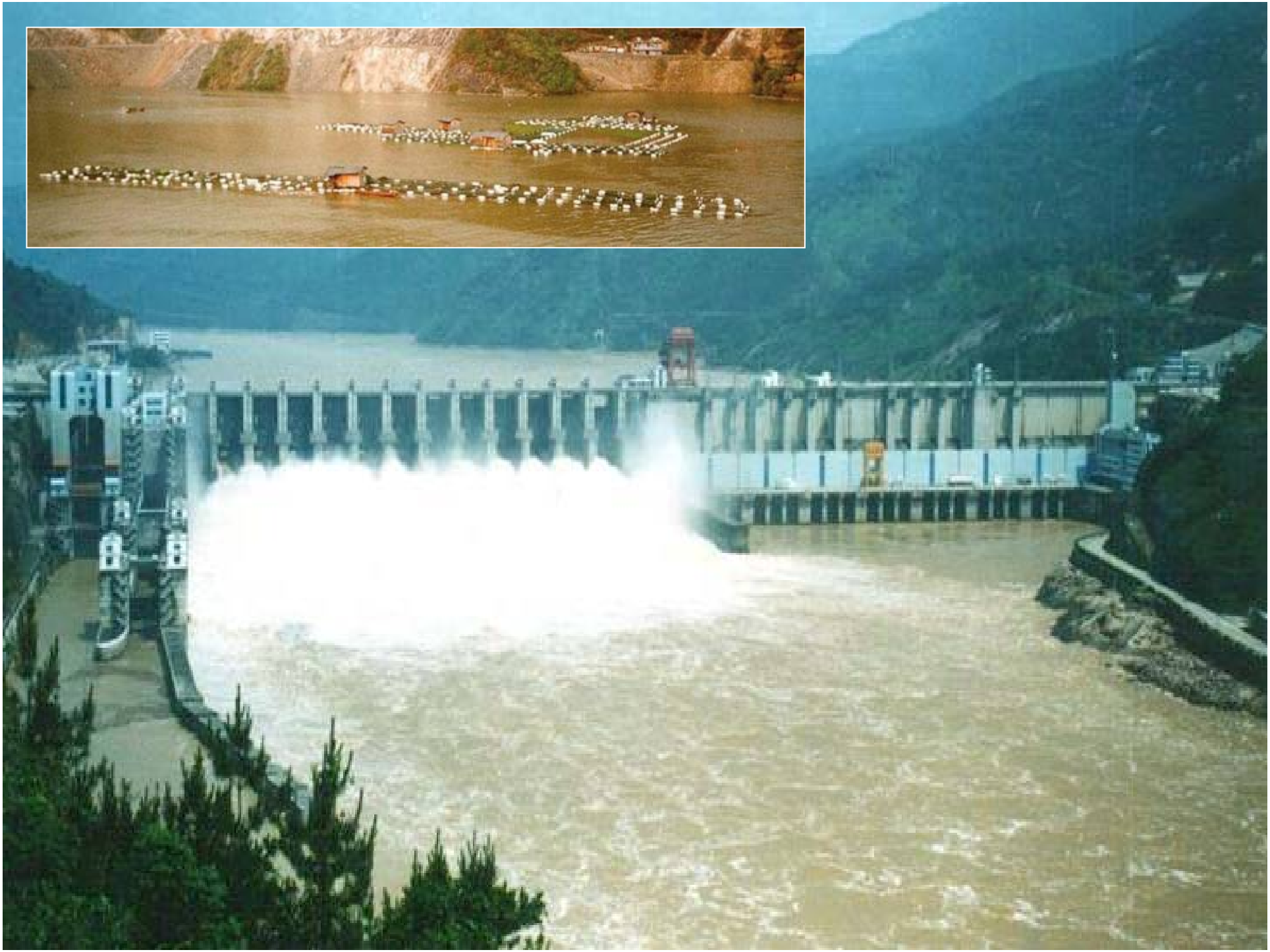
ON PAPER, dams may seem like a good idea. The truth is dams kill a river's ecosystem by cutting off its flow. But that's after the locals have lost their homes. Spare a thought too, for those downstream of the dam where there's less water to irrigate crops and catch fish. Then there are the green-house gas emissions due to vegetation rotting in the reservoir. Not good. But let's talk money. The projected financial cost is rarely accurate. The World Commission on Dams found that, on average, large dams go over budget by 56%. They are high-risk investments. So how can you navigate this moral and economic minefield? By getting hold of WWF's Investor's Guide to Dams. It outlines good dam practice and alternatives for supplying water and energy. That way you can go into any project with your eyes wide open. DAMS. THINK AGAIN.

www.panda.org/dams WWF



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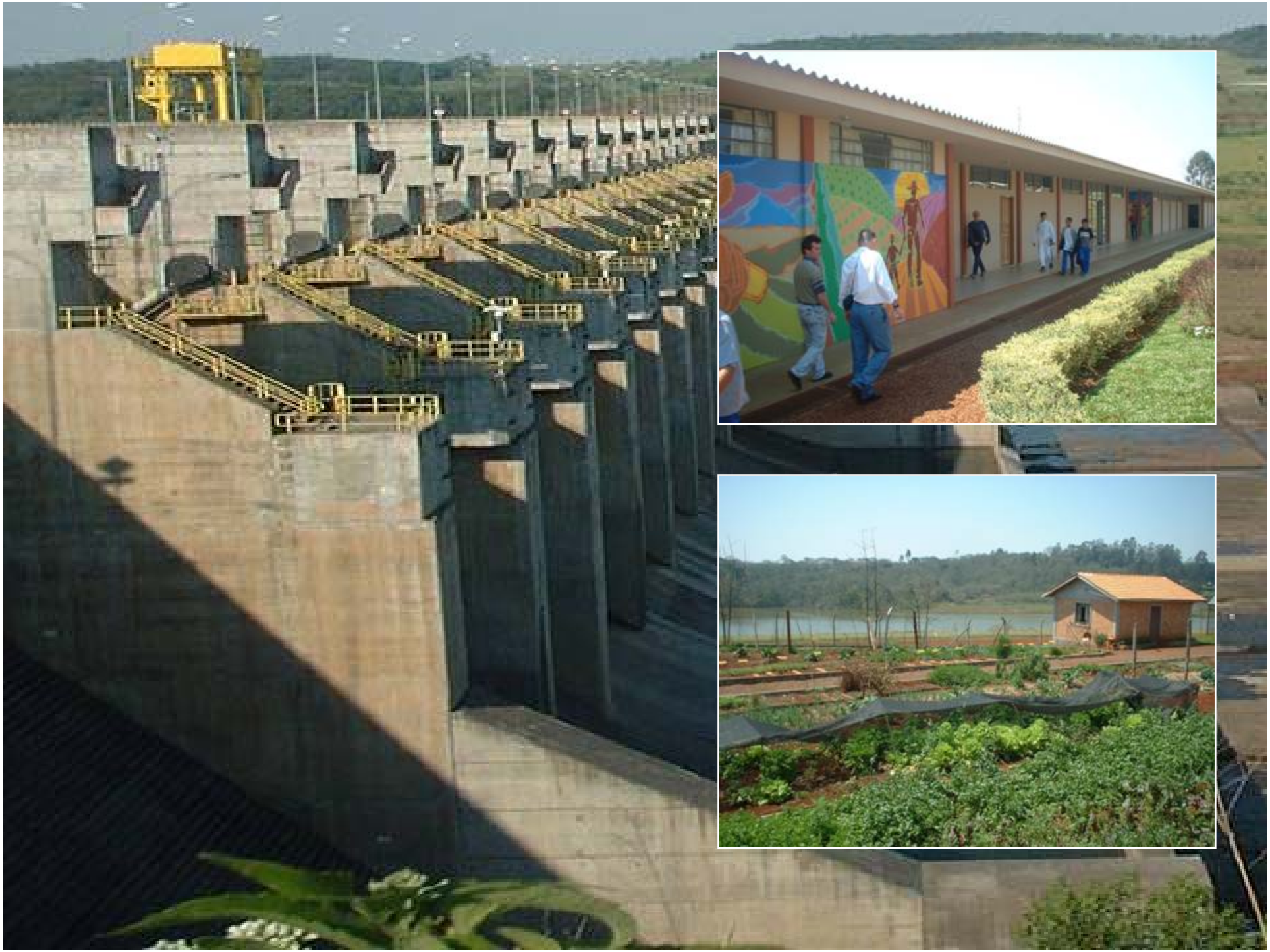

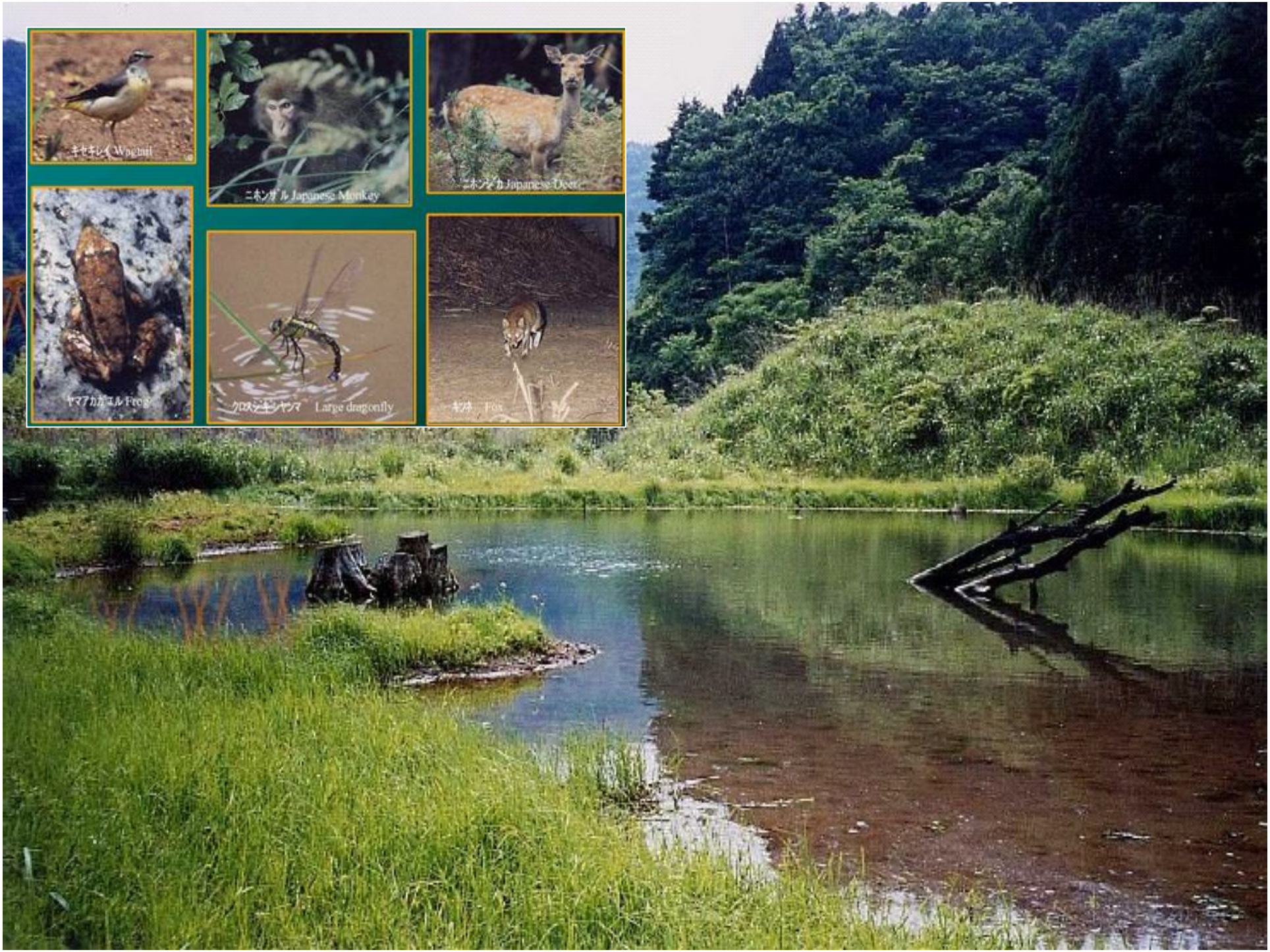
キセキレイ Wagtail
ニホンザル Japanese Monkey
ニホンジカ Japanese Deer
ヤマアカガエル Frog
クロスジギンヤンマ Large dragonfly
キツネ Fox

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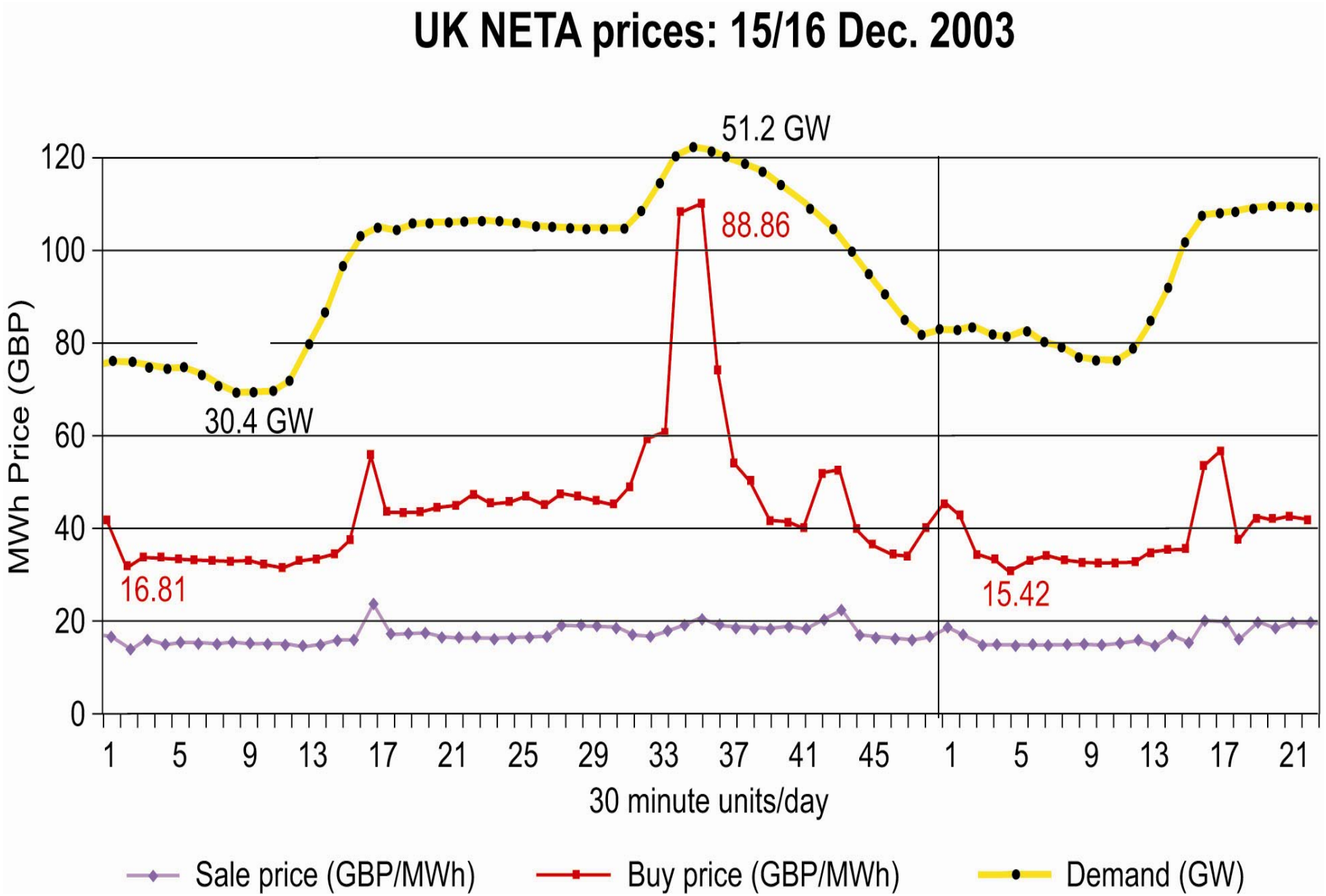
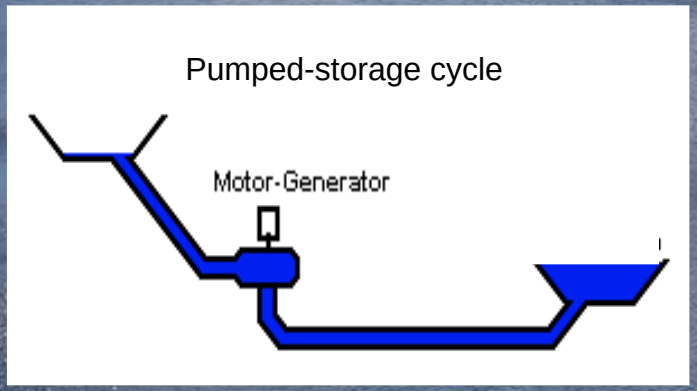

UK NETA prices: 15/16 Dec. 2003
51.2 GW
88.86
30.4 GW
16.81
15.42
MWh Price (GBP)
120
100
80
60
40
20
0
1
5
9
13
17
21
25
29
33
37
41
45
1
5
9
13
17
21
30 minute units/day
Sale price (GBP/MWh)
Buy price (GBP/MWh)
Demand (GW)


Pumped-storage cycle
Motor-Generator

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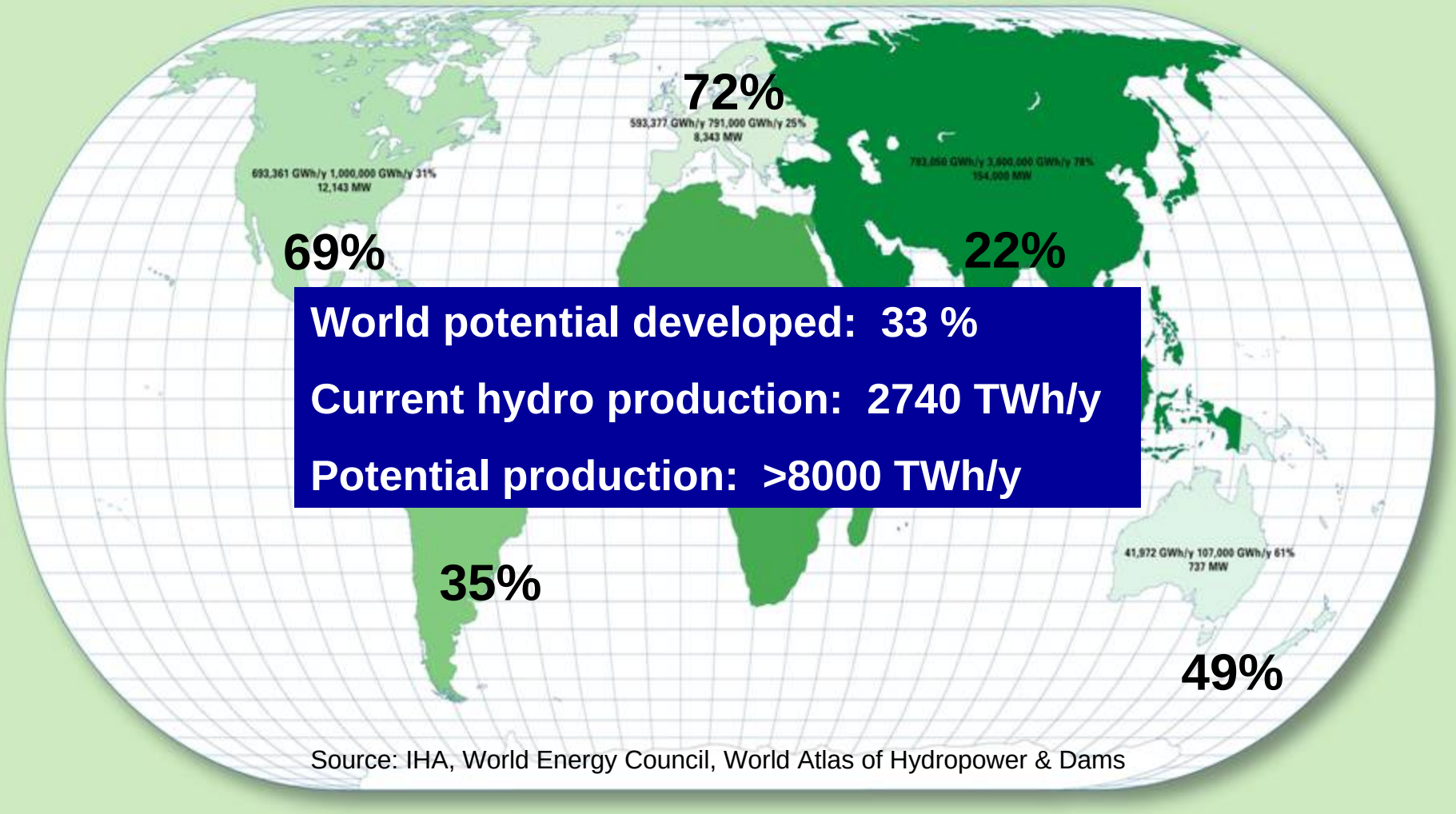
Hydro Tasmania

Hydropower potential, by continent



World potential developed: 33 %

Current hydro production: 2740 TWh/y

Potential production: >8000 TWh/y

Source: IHA, World Energy Council, World Atlas of Hydropower & Dams

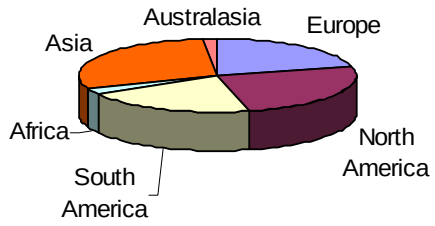
Current hydro generation: Africa = 80 Asia = 800 Australasia = 43
Europe = 570 N/C America = 700 S America = 550 (TWh/y)

Region	Current output (TWh/y)	Part of potential (%)	Total potential (TWh/y)	Realistic contribution (TWh/y)	New-build contribution (TWh/y)
Europe	570	72	792	633	63
North America	700	69	1014	812	112
South America	550	35	1571	1257	707
Africa	80	7	1143	914	834
Asia	800	22	3636	2909	2109
Australasia	43	49	88	70	27
Total	2743	~	8245	6596	3853

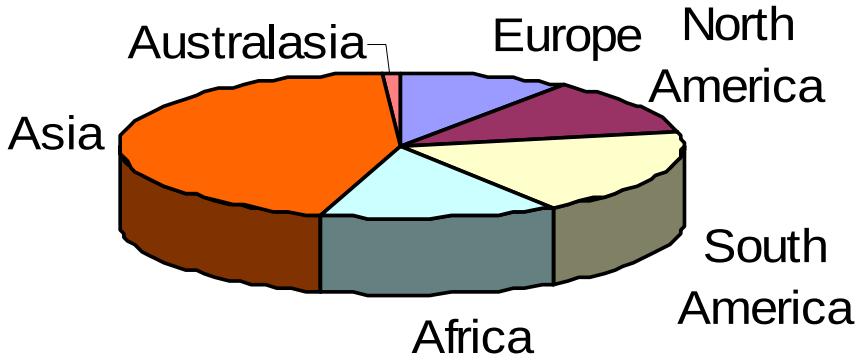
Priorities: Plant-life extension / incremental power + New-build hydro development

Hydro in the second half of the 21st Century

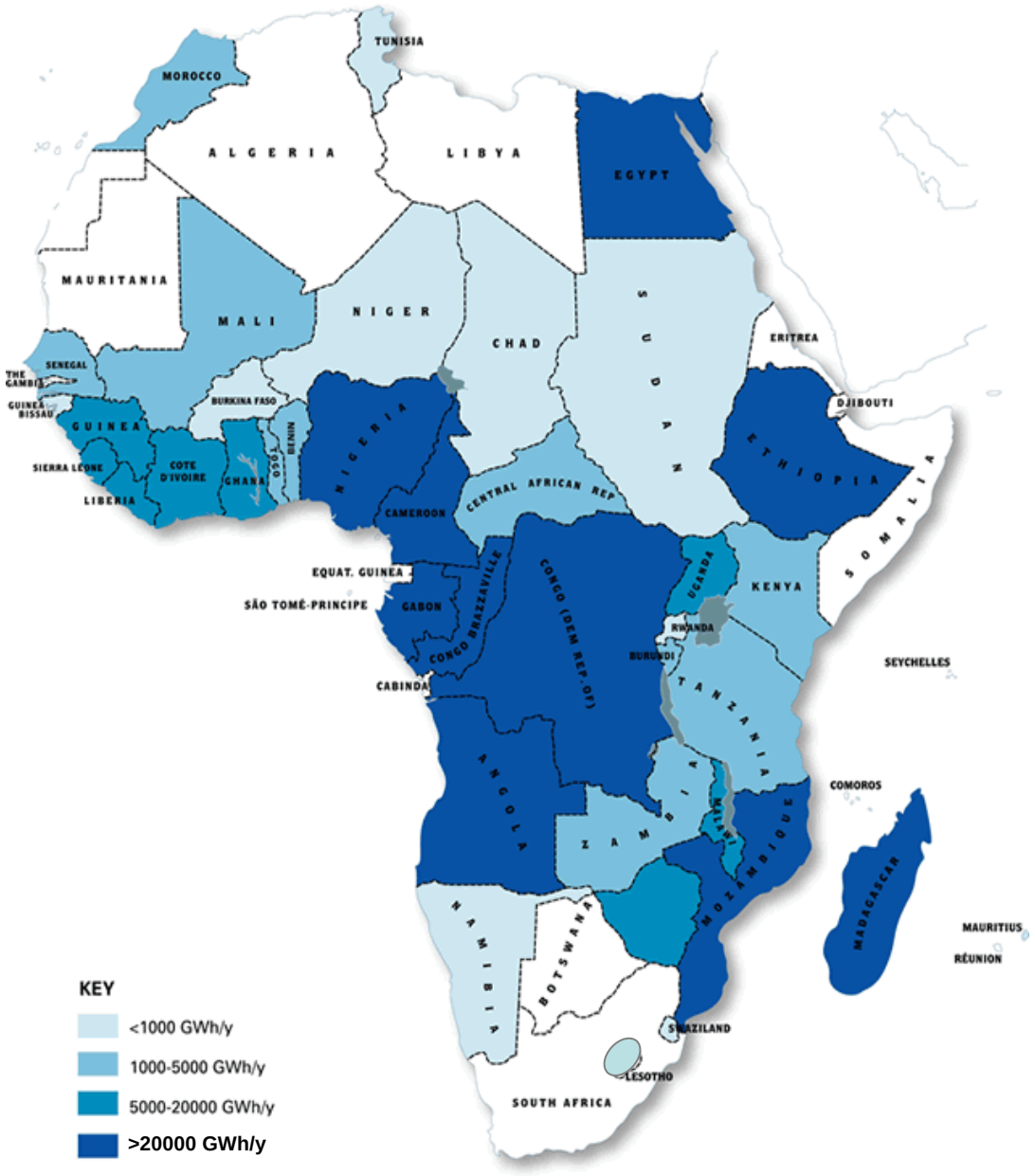
Current contribution, 2004
2743 TWh/y



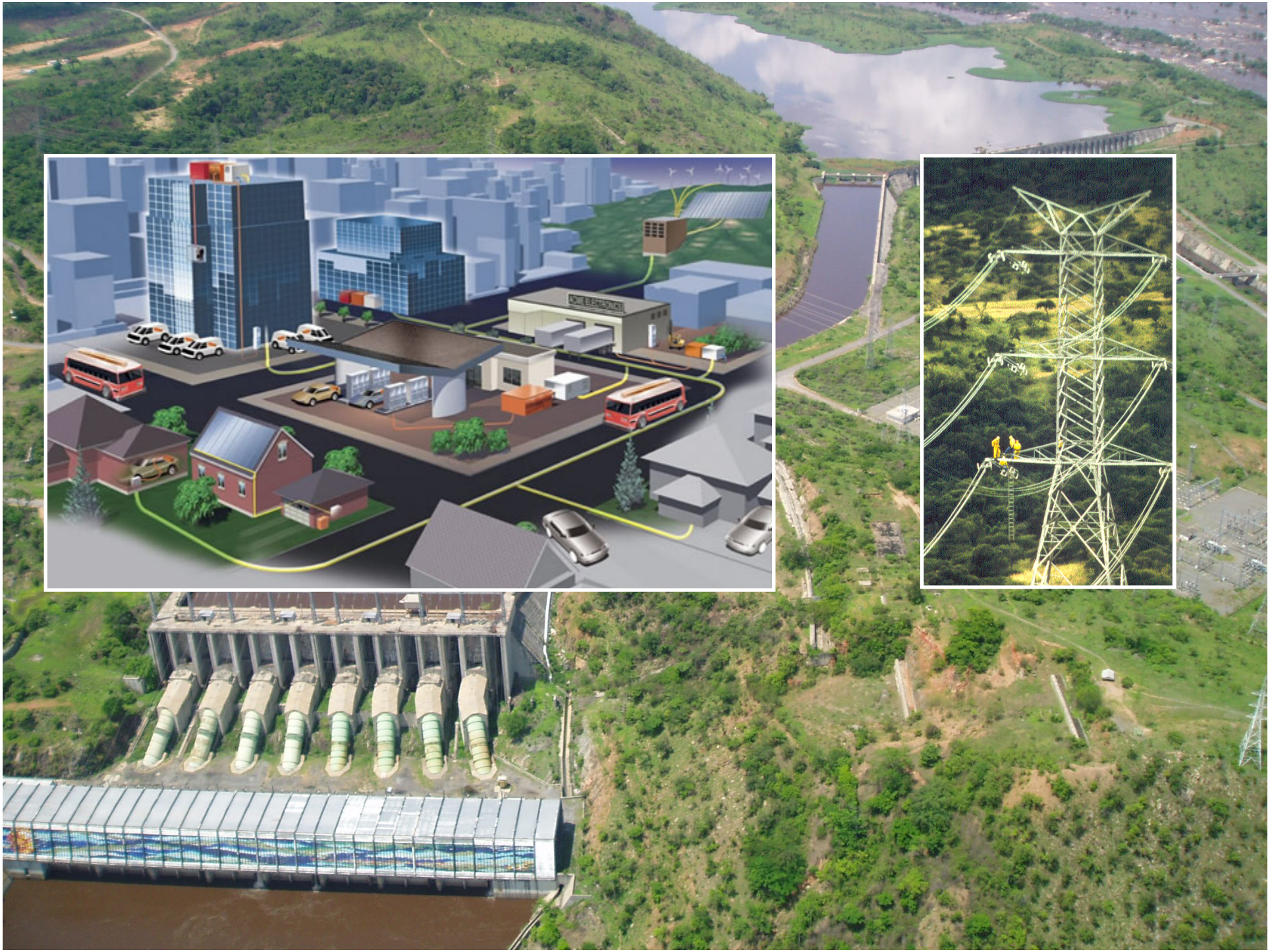
Future contribution, >2050
6600 TWh/y

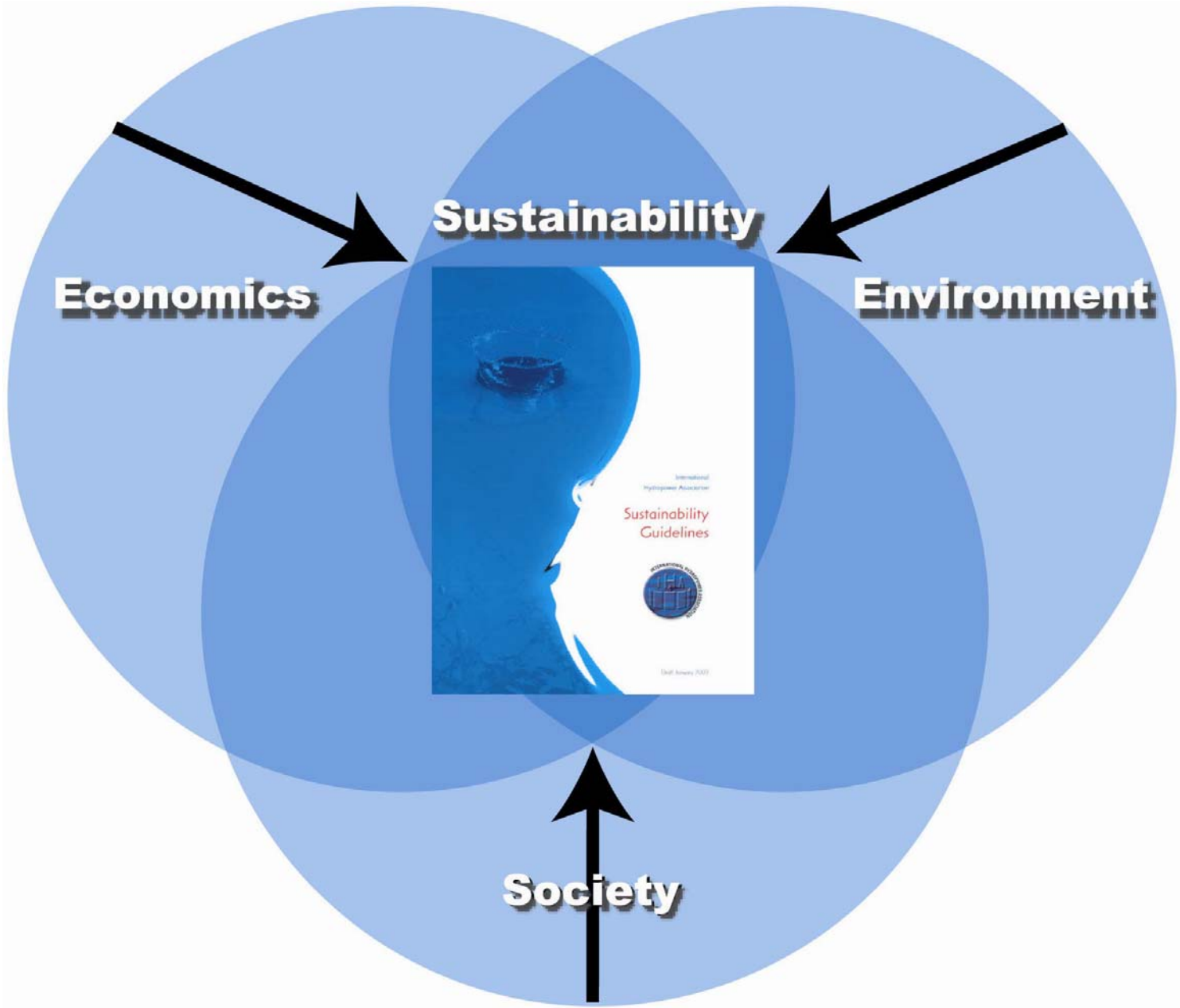


Africa, past:
Dependent
Unbalanced
Unhealthy
and Poor



Africa, future?
Self-sustained
Integrated
Prosperous
and Healthy




Sustainability
Economics
Environment
Society
International
Hydropower Association
Sustainability
Guidelines

Thank you for your attention

www.hydropower.org
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